Atlantic Coastal Fish Habitat Partnership

Steering Committee Meeting

October 28 – 29, 2019
Wentworth by the Sea
588 Wentworth Road
New Castle, NH

Webinar: https://global.gotomeeting.com/join/603819661
Phone number: 1-888-585-9008, room number: 508-421-182

Please remember to save outside work (including cell phone calls, emails, etc.) for the technology breaks, when at all possible.

Agenda

The times listed are approximate; the order in which these items will be taken is subject to change; other items may be added as necessary.

Day 1: Monday, October 28th

1. Welcome and Introductions (*K. Smith*)	1:00 pm
• Reminder on vice-chair nominations	
• SC DNR application to join Steering Committee	
2. Committee Consent (*K. Smith*)	1:10
• Approval of Agenda	
3. Funding Update	1:15
• RepYourWater (*L. Havel*)	
• Donate to ACFHP!	
• FishAmerica funding (*L. Havel and K. Smith*)	
• 2019 + 2020 Operational funding (*P. Campfield*)	
• Regional business plan 2-pagers update (*L. Havel*)	
4. NFHP Update (*L. Havel*)	2:30
• AFS Film Festival	
• Waters to Watch	
• Fish Habitat Act status	
5. Technology Break	3:00
6. NFHAP Funding Update (*J. Devers)*	3:15
• FY2019 funding	
• FY2020 project rankings	
7. Whitewater to Bluewater update (*J. Thomas-Blate*)	4:00
8. Merrimack River Watershed Council Update (*J. Macone*)	4:05
9. Wrap up (*K. Smith*)	4:35
10. Adjourn Day 1	5:00

Day 2: Tuesday, October 29th

11. Reconvene	8:30 am
12. Current Action Plan Review (*L. Havel*)	8:40
13. Action Planning 2020 – 2021 (*K. Smith & L. Havel*)	9:10

14. Lunch (on your own) 12:30 pm
15. Update on Conservation Mapping (*L. Havel and E. Martin*) 2:00
    - SE Mapping
    - NE Mapping
    - Assessment of Existing Information
16. Communications Discussion (*L. Havel*) 3:00
    - 10-year ACFHP factsheet
    - WNTI trout challenge discussion (*B. Groskin*)
    - World Fish Migration Day: May 16th, 2020
17. SAV Monitoring Protocols Discussion (*A. Kornbluth*) 4:00
18. Other Business 4:45
    - New Vice Chair nominations
19. Adjourn Day 2 5:00

South Carolina Department of

Natural Resources

Robert H. Boyles, Jr
Interim Director
Philip P. Maier
Acting Deputy Director for
Marine Resources

September 12, 2019

Dear ACFHC Steering Committee,

The South Carolina Department of Natural Resources (SCDNR) would like to join the Atlantic Coastal Fish Habitat Partnership (ACFHP) Steering Committee. SCDNR was a founding member with Dr. Robert Van Dolah serving as our representative on the Steering Committee. Since Dr. Van Dolah's retirement, the SCDNR has not participated on the Steering Committee. We would like to re-engage and petition the committee for membership on the Steering Committee. If approved, then we have identified Dr. Andrew Tweel as our representative. Dr. Tweel has been with the agency for 5 years and is a member of our Environmental Research Section at the Marine Resources Research Institute. He has a wealth of experience in wetland and coastal landscape ecology. The agency and Dr. Tweel are very interested in participating in the partnership. I look forward to hearing of your decision regarding his participation.

Sincerely,

Robert H. Boyles, Jr.
Interim Director

In a Habitat Near YOU

RIVER HERRING

STATUS
Vulnerable

THREATS
Overfishing, Development

SIZE
10-12 inches

LIFESPAN
12 years

RANGE
Nova Scotia to Florida

FISHING
River herring have been commonly fished along the Atlantic coast for centuries. Crowds of people would watch their annual spring migration from the ocean to rivers and to catch their dinner. They are also critical prey for larger fish. However, stocks began to crash between 1960's and 1970's from overharvesting and human development of dams obstructing migration routes.

DID YOU KNOW?
River herring is an umbrella term for blueback herring and the alewife species. As juveniles, they prefer freshwater areas in the spring and summer until they migrate to the ocean to spend their adult years. Every year they travel to the freshwater location where they were born to spawn. This is called natal homing.

For more information visit:
https://www.iucnredlist.org/species/201946/2730890
http://www.asmfc.org/species/shad-river-herring

Free Flowing Water in New Hampshire

Water

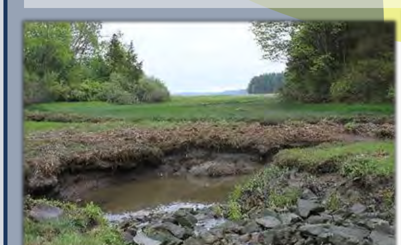
Water quality is essential for aquatic organisms to feed, grow, and reproduce. For species that migrate from saltwater to freshwater for spawning (anadromous), the streams and rivers must be clean and free-flowing. The laid eggs and larvae that hatch rely on nutrient-rich waters for food and health.

Blockades

The migration route from sea to streams has many obstacles including dams, bridges, and roads that prevent river herring from accessing safe habitat, leaving them unable to successfully reproduce. In New Hampshire, 33 of the 118 tidal stream crossing areas impede migration and require maintenance for water to flow. Also, 80% of them are highly restricting water movement. These barriers lead to risk of flooding and pollution from the buildup of sediments. 11 tidal crossings have already been submerged and more are likely to follow with climate change effects including sea level rise and increased storm intensity.

Successes

New Hampshire is working with the Nature Conservancy and assessed the maintenance required for all tidal crossings in 2018 and 2019. At Lubberland Creek of Newmarket, NH, a 36-inch culvert will be replaced with a 16-foot tunnel this year. The design plans have been awarded with the 'gold standard' for resiliency and capability of handling fish passage, sea level rise, and violent storm events. Support to this project by ACFHP will include community collaboration to identify the road crossings to replace, develop designs, habitat quality assessment, and apply these same goals to other fish passages in need of repair along the Atlantic coast. Designs are focused on fish migration, expansion of salt marsh, boosting plant growth, and infrastructure risk. The project requires $273,000 and $156,000 has already been raised! Each project will have the gold standard for future resiliency, clean water, and fish migrations.



WHAT IS A HEALTHY FISH HABITAT?

A healthy habitat is a home where all species have enough resources to survive and reproduce. Oxygen, food, and shelter are abundant. A thriving habitat allows many organisms to grow and increase the local diversity. These habitats clean our polluted waters, protect our coastlines from erosion and sea level rise, and combats climate change by absorbing carbon dioxide from the water in order to breathe.

Fundraising Goals

We need you!

Raise $117,000 for restoring fish passages and habitat quality assessments

DONATE FOR THE FUTURE OF OUR HERRING & CLEAN WATER

$54,600 – $68,250 = 1 SAFE CROSSING FOR THOUSANDS

Donate to Your Home

VALUE

Our work uses science, data, outreach, communication, and conservation projects to protect the Atlantic coast's vital habitats including: rivers, coastal waters, coral reefs, shellfish beds, and seagrasses.

STRENGTH

Our partners include scientists and managers at local, state, federal, and non-government organizations with expertise in various components of fish habitat conservation.

NETWORK

ACFHP has a total of 65 partners and counting that make the connection between the rivers and oceans, and mand and fish.

FUNDING

Between 2011 and 2017, ACFHP supported over *$5 million* worth of fish habitat restoration projects because of the gracious match contribution from their *local* partners.

ACFHP's Value + Strength + Network + Funding = Healthy Habitat

Want to be a supporter or contributor to ACFHP? Contact Dr. Lisa Havel, our Coordinator at lhavel@asmfc.org

We rely on people like *you*. With your help, our ever-expanding partnership can have an even greater impact on improving fish habitat, one that may be in your own backyard!

In a Habitat Near YOU

Seagrass Restoration in the Chesapeake Bay

BLUE CRABS

STATUS
Stable

THREATS
Habitat loss,
Overfishing,
Warming waters

SIZE
4-6 inches

LIFESPAN
1-3 years

RANGE
Nova Scotia to Gulf of Mexico

FISHING
The blue crab is the unofficial Chesapeake Bay mascot with 600 million crabs in the Bay as of 2019. 55 million pounds of blue crabs are prepared annually for steaming, frying, soups, crab cakes, and more. The blue crab supported the local economy with $78 million in 2009.

DID YOU KNOW?
In their early life stages, crabs molt 15-20 times before becoming a juvenile crab at 12-18 months. Seagrass beds are great for protecting crabs from predators during their molts. A study performed by the Virginia Institute of Marine Science discovered that the denser the seagrass bed, the more crabs there are!

For more information visit:
https://www.chesapeakebay.net/issues/blue_crabs

History

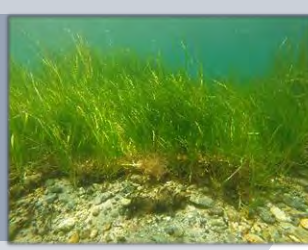
The Chesapeake Bay is home to seagrass beds and a multitude of fish and shellfish species including our famous blue crab. Maryland and Virginia have benefited from the Bay with 34,000 jobs and $3.39 billion in sales per year. The Bay's health is heavily affected by severe storms, poor water quality, and human interactions such as fishing, dredging, boating, and aquaculture. The Chesapeake Bay Program has initiated restoration programs including seagrasses, oysters, shoreline protection to absorb excess nutrients, and collaboration with farmers to reduce pollution runoff. With the Program's efforts and community participation, the Bay's water quality is at its best compared to the decline starting in the 1950's.

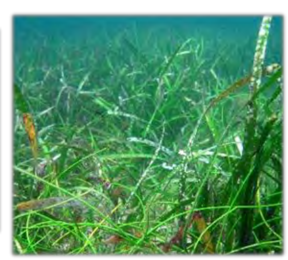
Why Seagrass?

Seagrasses release oxygen, act as food for aquatic birds, and function as shelter for juvenile blue crabs, striped bass, bay scallops, and many other species that are vital for the ecosystem and our economy. This habitat also reduces erosion of shorelines by absorbing the forces from crashing waves. Seagrasses are actually 250% more efficient than forests at absorbing carbon dioxide! Seagrasses provide us with the tools to adapt to climate change effects.

Successes

The improved water quality has promoted outstanding growth of seagrass beds (from 38,000 acres in 1984 to over 100,000 acres now), even in areas that have been barren for 45 years! The Maryland Department of Natural Resources and Anne Arundel Community College have collaborated to process seagrass seeds and disperse them throughout the Bay. ACFHP has helped rebuild seagrass projects in Florida, Massachusetts, New Jersey, and Rhode Island. We are aiding restoration with seed collection, processing, testing, dispersal, and long-term monitoring. With water quality at its best, NOW is the time for ACFHP and you to support Chesapeake Bay Program's success.





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Fundraising Goals

We need you!

- Restore **20 acres of seagrass annually for 5 years** or **100 acres by 2025**
- Contribute to Chesapeake Bay Program's goal of **185,000 acres** of restored seagrass habitat

EVERY DOLLAR HELPS RESTORE THE SEAGRASSES: OUR BAY'S LUNGS

$670,000 = 100 ACRES OF SEAGRASS

Donate to Your Home

VALUE

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In a Habitat Near YOU

Sponge Restoration in Florida Bay

Algae Bloom

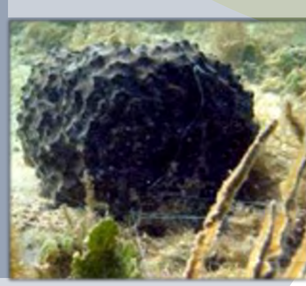
In the last 20 years, western Florida and the Florida Keys have experienced major changes in water quality because of algae blooms. Algae blooms are seasonal, and some are toxic while others are normal. Algae is an aquatic plant that requires oxygen to grow as well as decompose when they decay. In high quantity, an algae bloom forms and sucks the oxygen out of the water. Without oxygen, habitats and fish cannot survive.

Sponges

In the Florida Keys, algae blooms have caused a massive die-off of sponges. Sponges provide habitat to tons of organisms including our spiny lobster. Without sponges, our marine friends do not have a safe home and end up vulnerable to predators. Floridian sponges affect fish population growth and, in the end, affect marine communities and fishing.

Successes

To combat against habitat degradation and declines in fish populations, the Florida Fish and Wildlife Conservation Commission have grown thousands of sponges in indoor aquaculture facilities. They are then planted onto the seafloor, where sponges once inhabited, and the results are prolific! The sponges reproduce (called budding) and attract tenants of all kinds. Grey snapper, spiny lobster, and other fish show sustainable growth in their new healthy fish habitat.



SPINY LOBSTERS

Status
Unknown due to lack of data

Threats
Overfishing, Disease

Size
18 inches
15 pounds

Lifespan
15 years

Range
NC to TX and the Caribbean Sea

Fishing
A seafood delicacy in the South with an annual value of $20 million, constituting it to be the largest commercial fishery in Florida. 98% of the legal sized population is harvested annually from the Keys.

Did You Know?
In the first development stage, the spiny lobsters (called phylosome larva at this time) look like spiders and float in the water column for 9-12 months. When they settle on the seafloor, they molt and become juvenile lobsters. The juveniles rely on sponges for protection against predators. The crevices within the sponges act as a den while they grow to adult size and develop a strong exoskeleton (outer shell).

For more information visit:
https://www.iucnredlist.org/species/169976/6697254
https://myfwc.com/research/saltwater/crustaceans/lobster/facts/

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Fundraising Goals

We need you!

- Grow **10,000 sponges** annually in an indoor aquaculture facility
- Donations of **$50,000 per year** or **$500,000 within 10 years**

DONATE $5 TODAY AND YOU CAN PLANT A SPONGE IN FLORIDA BAY!

$5,000 = 1 ACRE OF SPONGE HABITAT

Donate to Your Home

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National Fish Habitat Conservation Through Partnerships Act of 2019
(S. 754 and H.R. 1747)
Highlights and Talking Points

- The National Fish Habitat Conservation Through Partnerships Act (NFHCTPA) was modeled after two of the most successful conservation endeavors in our nation's history – the state- and locally-led collaborative Joint Venture (JVs) model for implementing voluntary conservation actions on the ground to conserve birds and their habitats; and the North American Wetlands Conservation Act (NAWCA) Program which for 30 years has proven to be one of the most successful conservation programs in the U.S. by utilizing a state-led collaborative process for identifying and funding the highest priority and best wetland conservation projects that support the North American Waterfowl Management Plan.

- NFHCTPA codifies the National Fish Habitat Partnership (NFHP) - a program established through a state-led public-private partnership and housed in 2006 within the U.S. Fish and Wildlife Service.

- NFHCTPA allows Congress to further refine how the NFHP program operates. For example, this legislation adds more diverse representation onto the current NFHP Board, broadening the input of stakeholders. The Board, which recommends local projects implemented through Fish Habitat Partnerships to the Secretary of the Interior for funding approval, will be led permanently by state fish and wildlife agencies with clarified federal agency representation and more diverse NGO representation including organizations from the agricultural and private industry sectors.

- Currently, National Fish Habitat Action Plan Funding is administered by the U.S. Fish and Wildlife Service (USFWS), based on Fish Habitat Partnership recommendations. The USFWS provides various forms of support to some, though not all, of the Fish Habitat Partnerships. Several Fish Habitat Partnerships benefit from a variety of services from the USFWS using NFHP funding, including but not limited to technical, on-the-ground restoration, and monitoring support; grant administration, compliance, report tracking, and budget management; project site visits; strategic planning; maximizing coordination and communication across Fish Habitat Partnerships; providing infrastructure and staff; and participating on Fish Habitat Partnership committees. Other Fish Habitat Partnerships have minimal engagement with the U.S. Fish and Wildlife Service.

- The Fish Habitat bill will codify and support a purely voluntary, non-regulatory, from "the-ground-up" fish habitat conservation program. This program has been and will continue to be driven by local and regionally-based Fish Habitat Partnerships. The partnerships are comprised of representatives of federal, state and local agencies, conservation and sportsmen's organizations, private landowners and the business sector. These partnerships have already led to over 840 successful conservation projects in 50 states benefitting fish habitat and anglers throughout the country. New Jersey waters and their habitats are included in three Fish Habitat Partnerships: the Atlantic Coastal Fish Habitat Partnership, Eastern Brook Trout Joint Venture, and Reservoirs Fish Habitat Partnership.

- Currently, the Fish Habitat Partnerships are promoting ground-up conservation with project ideas that emanate from the local and state level. This legislation ensures on-the-ground programs will continue focusing on ideas that come from the local and state levels.

- NFHCTPA has very broad support from the sportsmen and conservation communities. The American Sportfishing Association, American Fisheries Society, Association of Fish & Wildlife Agencies, Coastal Conservation Association, Congressional Sportsmen's Foundation, Trout Unlimited, The Nature Conservancy, and Theodore Roosevelt Conservation Partnership are among the leading national organizations who have made support of this legislation a top priority.

- The NFHP we are codifying and supporting in this legislation leverages limited federal dollars, involves multiple partners, and places federal agencies in a technical assistance/grant management role in order to advance public-private partnerships for fish habitat conservation.

- In addition to broad support from current stakeholders, this legislation has been crafted in direct consultation with private landowner groups and farming and ranching organizations. Significant changes were made to the bill to be absolutely crystal clear about matters such as the scope of fish habitat projects; protection of private property rights; approval of projects by the state of jurisdiction; and the necessary and enhanced role of states, industry and private landowners on the National Fish Habitat Board charged with providing the Secretary with recommendations for project selection.

- The Senate bill, (S.754), was introduced by Senator Mike Crapo (R-ID) and Sen. Ben Cardin (D-MD) on March 12. The House bill, (H.R. 1747), was introduced by Rep. Rob Wittman (R-VA-1) and Rep. Marc Veasey (D-TX-33) on March 13.

ATLANTIC COASTAL FISH HABITAT PARTNERSHIP

Conservation Strategic Plan

2017-2021

For more information please contact:

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www.atlanticfishhabitat.org

This plan is a product of the Atlantic Coastal Fish Habitat Partnership with funding from the National Fish Habitat Partnership (Award Number F16AC01131) and the Multistate Conservation Grant Program with funds from the Wildlife and Sport Fish Restoration Program of the U.S. Fish and Wildlife Service.

COVER PHOTO: Istockphoto.com/jocrebbin

Table of Contents

Introduction

Our Mission

Healthy, thriving habitats of sufficient quantity and quality to support all life stages of Atlantic coastal, estuarine-dependent, and diadromous fishes

Our Vision

To accelerate the conservation, protection, restoration, and enhancement of habitat for native Atlantic coastal, estuarine-dependent, and diadromous fishes through partnerships between federal, tribal, state, local and other entities

The Atlantic Coastal Fish Habitat Partnership (ACFHP – see Appendix A for all acronyms) is an assembly of public and private entities interested in the conservation of habitat for Atlantic coast diadromous, estuarine-dependent, and coastal fish species (see Appendix B for select definitions). ACFHP was formed in 2006 under the auspices of the National Fish Habitat Action Plan and operates within the National Fish Habitat Partnership framework. The NFHAP is a non-regulatory, voluntary plan designed to protect, restore, and enhance the nation's fish and aquatic communities through regional Fish Habitat Partnerships. The NFHAP is a strategy to identify restoration projects and other activities to help maximize the impact of on-the-ground conservation dollars appropriated by Congress to the United States Fish and Wildlife Service.

Every five years the ACFHP Steering Committee and partners re-evaluate and update their Conservation Strategic Plan (CSP), focused on broad coastwide strategies for determining and addressing the threats affecting habitats important for all life stages of Atlantic diadromous, estuarine-dependent, and coastal species. The CSP is used as a guidance document for the ACFHP Steering Committee, the Partnership-At-Large, state and federal agencies, and restoration practitioners. The Plan is designed to address goals, objectives, and strategies that the Partnership will focus on over the next five years to improve the condition of Atlantic coastal fish habitat. When appropriate, our goals and objectives have been aligned with those of our partners. Action Plans will be developed every two years and will include steps towards achieving objectives identified in this CSP.

The issues that ACFHP will address are complex, and tackling them is important for the conservation of Atlantic coastal habitats. This Partnership is designed to bring diverse groups together to identify the causes of habitat declines, implement strategic corrective action, and measure and communicate progress made through its efforts. The end result of ACFHP actions will benefit not only a great number of species, from diadromous to marine, but a large population of resource users as well. Covering a densely populated region in close proximity to some of the country's most productive and unique fish habitats, ACFHP's role in making the connection between headwater and continental shelf habitats; non-governmental organizations (NGOs), state, federal, tribal, and various stakeholders; and people and fish habitat is vital to maintaining healthy fish habitat.

Habitat is the physical space that an organism uses to fulfill its basic requirements for life, such as food, water, oxygen, and shelter. Put simply, habitat is where something lives. Sustainable recreational and commercial fisheries are dependent upon healthy habitat. The ACFHP region has a range of fish habitats that are critical to coastal fisheries. These habitats represent areas where coastal fishery species forage, seek refuge, grow, or spawn. The protection and restoration of these areas is critical to the protection and sustainability of coastwide fishery resources and the ways of life they support.

Habitat loss and degradation impair fish productivity and can impact fishery sustainability and recovery rates, even after management actions have successfully reduced fishing pressures. The relationship between habitat condition and fish populations is

Accomplishments 2012 – 2016

- Published the Species-Habitat Matrix, a tool for evaluating the relative importance of a specific habitat type to a given life history stage for an individual species
- Coordinated the development of the estuarine and diadromous portions of the Fish Habitat Decision Support Tool, a visualization and ranking tool to assess fish habitat spatially
- Wrote a paper on river herring habitat restoration needs in six Atlantic coast watersheds
- Welcomed three new partners: Merrimack River Watershed Council, International Federation of Fly Fishers, and North Carolina Coastal Federation
- Opened 75 river miles[1]
- Restored 0.5 acres of riverine spawning habitat, 2.95 acres of oyster reefs, 2.4 acres of salt marsh and mangroves, and 19 acres of seagrass beds[2]
- Increased communication and collaboration among over 60 different federal, state, county, local, academic, tribal, non-profit, private interest, and conservation entities
- Completed the Conservation Mooring Project, using advanced technology to replace traditional boat moorings and conserve surrounding seagrass
- Contributed over $400,000 directly to conservation projects, leveraging $4 for each ACFHP restoration dollar
- Added an annual estimated $41 million in economic value to the Atlantic coast[2]

Making the Connection

- From the headwaters to the continental shelf
- Among non-governmental, state, federal, tribal, and various stakeholders
- Between people and fish habitat

The ACFHP region includes:

- Over 25% of the U.S. population (approximately 87 million people)
- Nine of the ten most densely populated states
- The largest city in the U.S. (New York City)
- The most urban estuary in the U.S. (New York Harbor)
- The largest estuary in the world (Chesapeake Bay)
- The only barrier coral reef in the continental U.S. (off of South Florida)
- The largest cruise ship port in the world (Miami, Florida)
- The only U.S. city bordered by two National Parks (Miami: Everglades and Biscayne Bay NPs)
- Fish communities residing in climates ranging from cold temperate to tropical Atlantic
- Four National Marine Sanctuaries and one National Monument
- The largest number of diadromous species in the world (ACFHP's North Atlantic subregion)
- The most marine habitat of any Fish Habitat Partnership
- One of the most rapidly warming areas in the world (Gulf of Maine, warming 3x faster than the global average)

complex. In the past, the decline of a particular fish stock was often attributed to overfishing. Weakfish, river herring, and Atlantic sturgeon are examples of fish species that have not recovered even after having lengthy fishing moratoriums imposed on the stocks. This being said, the status of specific fish species can be an indicator of declining fish habitats and the need to take action to restore and protect the significant habitats to those fish populations.

Thriving, healthy waterways and robust fish populations are vital to the well-being of our society. They provide clean water and sustainable fisheries. They also are essential for less tangible reasons, as anyone who has fished wild waters or canoed a tranquil stream can attest. Unfortunately, in many waters around the country, fish and the habitats on which they depend are in decline. A substantial amount of work has been undertaken to protect, restore, and enhance these aquatic habitats. Although significant gains have been made, they have not kept pace with impacts resulting from population growth and land-use changes. Given the diverse array of federal, state, tribal, local, and private jurisdictions, the need has never been greater for increased action and improved coordination of fisheries conservation measures across boundaries and jurisdictions.[3]

Habitats like seagrass beds, coral reefs, and wetlands of sufficient quantity and quality supporting all life stages are critical for healthy fish communities. However, many of these habitats are being threatened. In fact, the National Fish Habitat Partnership reports that 89% of Mid-Atlantic estuaries are at high or very high risk of habitat degradation, and rank overall as the poorest quality marine habitat in the country.[4]

Seagrasses are one of the most rapidly declining habitats around the world, with up to 7% loss in area annually associated with human activities like sewage discharge, shoreline hardening, coastal development, and deforestation.[5] The 150-mile long Indian River Lagoon estuary in Florida has lost 70% of the system's historic 70,000 acres of seagrass due to prolonged algae blooms attributed in part to nutrient additions to the system.[6]

Recreational Fishing along the Atlantic Coast (NOAA 2015)

Location	Number of Anglers	Number of Fishing Trips	Value Added Impact	Number of Jobs Created	Durable Goods Expenditures
New England	1.0 million	5.0 million	$1.2 billion	17,016	$1.4 billion
Mid-Atlantic	2.0 million	12.4 million	$2.6 billion	37,170	$2.8 billion
South Atlantic	2.2 million	16.5 million	$3.8 billion	58,019	$4.3 billion
TOTAL	5.2 million	33.9 million	$7.6 billion	112,205	$8.5 billion

Commercial Fishing along the Atlantic Coast (NOAA 2015)

Location	Pounds Landed	Landing Revenue	Value Added Impact	Number of Jobs Created
New England	599 million	$1.2 billion	$4.9 billion	139,712
Mid-Atlantic	649 million	$512 milllion	$5.1 billion	100,954
South Atlantic	106 million	$182 million	$6.9 billion	101,024
TOTAL	1.354 billion	$1.894 billion	$16.9 billion	341,690

The coral reef tract in southeast Florida contributes $5.7 billion annually to the regional economy and is responsible for supporting over 61,000 full and part-time jobs.[7] Unfortunately, these reefs are dissolving at a faster rate than previously thought.[8]

According to the Status and Trends of Wetlands in the Coastal Watersheds of the Conterminous United States 2004 to 2009, 15.9 million acres of Atlantic coast watershed is covered by wetlands, but from 2004 to 2009 this region experienced a net wetland loss of 111,960 acres (0.7% loss; though South Carolina, Georgia, and parts of Florida experienced a net gain of coastal wetlands). Overwhelmingly, this loss was freshwater wetlands. Oyster reefs are also on the decline – 85% have been lost globally,[9] and Chesapeake Bay coverage is less than 1% of historic mass.

[1]*http://www.atlanticfishhabitat.org/projects/fundedprojects/, http://www.atlanticfishhabitat.org/projects/endorsedprojects/*
[2]Calculation based on economic valuations from Charbonneau and Caudill, 2010. Conserving America's Fisheries: An Assessment of Economic Contributions from Fisheries and Aquatic Resource Conservation. U.S. Fish and Wildlife Service. Arlington, VA. *https://www.fws.gov/home/feature/2011/pdf/fisherieseconomicreport.pdf*
[3]Association of Fish and Wildlife Agencies. 2006. National Fish Habitat Action Plan. *http://www.fishhabitat.org/files/uploads/National_Fish_Habitat_Action_Plan_2006.pdf.*
[4]Crawford, S., Whelan, G., Infante, D.M., Blackhart, K., Daniel, W.M., Fuller, P. L., Birdsong, T., Wieferich, D.J., McClees-Funinan, R., Stedman, S. M., Herreman, K., and P. Ruhl. 2016. Through a Fish's Eye: The Status of Fish Habitats in the United States 2015. National Fish Habitat Partnership. *http://assessment.fishhabitat.org/.*
[5]Waycott, M., Duarte, C.M., Carruthers, T.J.B., Orth, R.J., Dennison, W.C., Olyarnik, S., Calladine, A., Fourqurean, J.W., Heck Jr., K.L., Hughes, A.R., Kendrick, G.A., Kenworthy, W.J., Short, F.T, and S.L. Williams. 2009. Accelerating loss of seagrasses across the globe threatens coastal ecosystems. Proceedings of the National Academy of Sciences of the United States of America 106(30): 12377-12381.
[6]Charles Jacoby, St. Johns Water Management District, personal communication.
[7]Giliam, D. 2013. A Quick Guide to SE Florida's Coral Reefs. Southeast Coral Reef Initiative. NOAA. *http://www.dep.state.fl.us/coastal/programs/coral/reports/LBSP/SEFCRI_Quick_Guide.pdf*
[8] *Muehllehner, N., Langdon, C., Venti, A. and D. Kadko, 2016. Dynamics of carbonate chemistry, production, and calcification of the Florida Reef Tract (2009-2010): evidence for seasonal dissolution. Global Biogeochemical Cycles 30: 661-688.*
[9]*http://www.nature.org/science-in-action/science-features/oyster-reef-interactive-graphic.xml*

ACFHP Partners

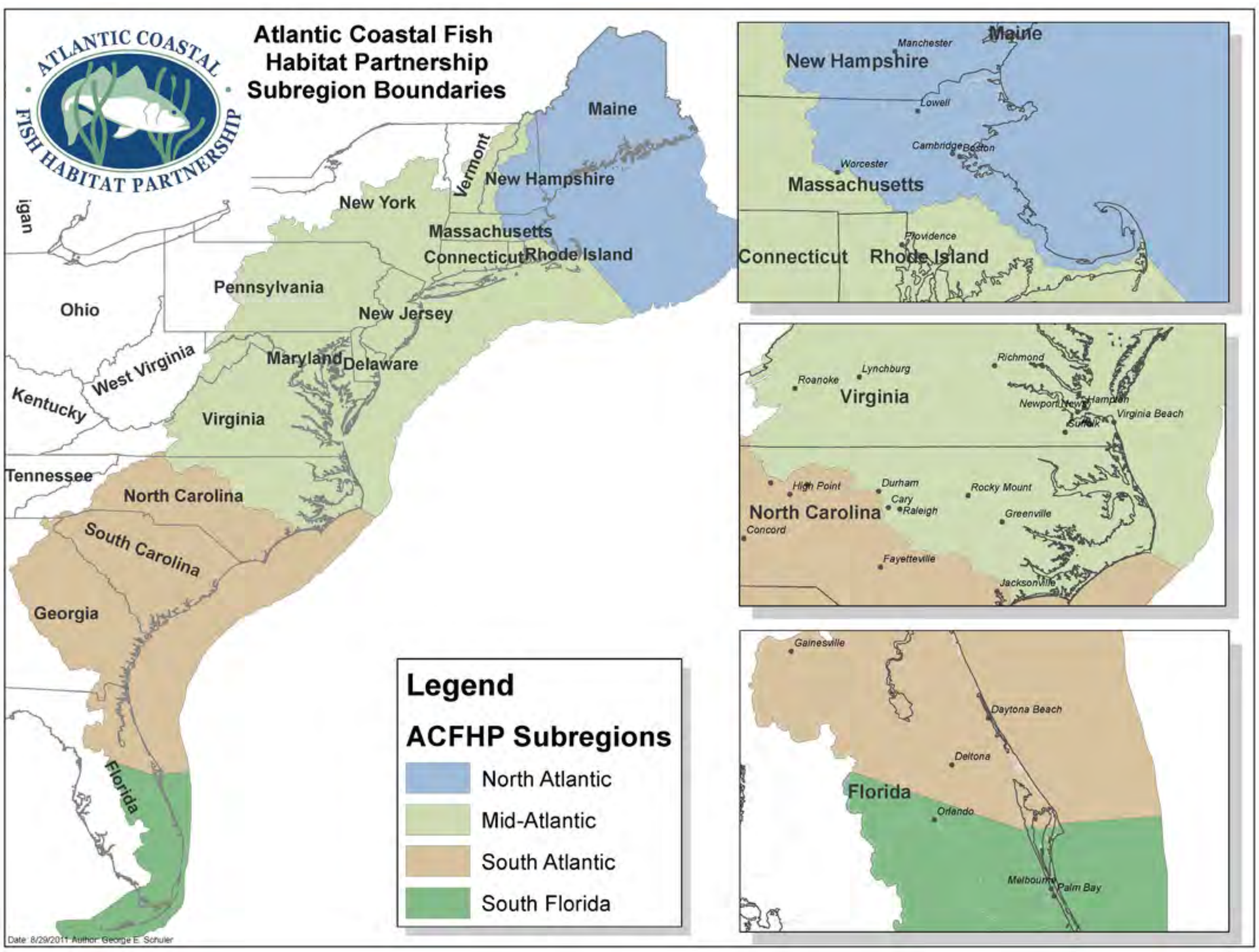
To address Atlantic coast fish habitat issues, ACFHP created a Memorandum of Understanding. It affirms the commitment of the 33 signatories to develop local, regional, state, tribal, federal, and private partnerships that extend beyond the traditional boundaries of resource management agencies and non-governmental organization responsibilities for the benefit of their shared aquatic resources. The Partnership hopes to bring in additional organizations committed to conserving fish habitat along the Atlantic coast in the future. ACFHP's Charter and By-Laws can be found at: *http://www.atlanticfishhabitat.org/Documents/ACFHP-Charter-and-Bylaws.pdf*

- Albemarle-Pamlico National Estuary Partnership
- American Littoral Society
- American Rivers
- Atlantic States Marine Fisheries Commission
- Chesapeake Bay Foundation
- Connecticut Department of Environmental Protection
- Delaware Department of Natural Resources and Environmental Control
- Environmental Defense Fund
- Florida Fish and Wildlife Conservation Commission
- Georgia Department of Natural Resources
- Houlton Band of Maliseet Indians
- International Federation of Fly Fishers
- Maine Department of Marine Resources
- Maryland Department of Natural Resources
- Massachusetts Division of Marine Fisheries
- Merrimack River Watershed Council
- National Oceanic and Atmospheric Administration
- New Hampshire Fish and Game Department
- New Jersey Division of Fish and Wildlife
- New York Department of Environmental Conservation
- North Carolina Coastal Federation
- North Carolina Department of Environmental Quality
- Oyster Recovery Partnership
- Partnership for the Delaware Estuary
- Pennsylvania Fish and Boat Commission
- Rhode Island Division of Fish and Wildlife
- South Carolina Department of Natural Resources
- The Nature Conservancy
- United States Fish and Wildlife Service
- United States Geological Survey
- Vermont Fish and Wildlife Department
- Virginia Marine Resources Commission
- Wells National Estuarine Research Reserve

Scope

ACFHP utilizes subregional boundaries for the purposes of habitat prioritization. These subregions represent ecologically distinct units and were derived from Marine Ecoregions of the World[10] as established by the World Wildlife Fund and The Nature Conservancy. These include the Gulf of Maine, Virginian, Carolinian, and Floridian ecoregions which correspond to ACFHP subregions North Atlantic, Mid-Atlantic, South Atlantic, and South Florida, respectively.

ACFHP plans to work throughout the defined subregions, however, less emphasis will be placed on upstream headwaters and offshore marine ecosystems and more on the approximately 29,000 miles of shoreline and



coastal waters. ACFHP will seek to ensure contiguous watershed coverage with adjacent Fish Habitat Partnerships while minimizing overlap or duplication of effort. As ACFHP develops on-the-ground projects, it will work with these partnerships to identify where cooperation should occur, as well as new avenues for collaboration. This will ensure that ACFHP is not working in competition, but in concert with existing partnerships towards fish habitat conservation.

In this CSP and our work, ACFHP acknowledges the importance and severity of global and regional climate change effects on fish habitat. The impacts and severity of climate change on fish habitats throughout the ACFHP region will vary. For example, the Gulf of Maine is a climate change hotspot, with temperatures predicted to rise three times more rapidly than the global average.[11] Sea level rise; ocean acidification; increased water temperatures; increased storm frequency and severity; habitat expansion, contraction, and fragmentation; species geographic shifts; and eutrophication are all factors that will lead to fish habitat modifications in pending climate change effects. The full impacts and timeline of those impacts are uncertain. However, climate change is likely to influence all habitats and species along the Atlantic coast in some way, including people. For instance, sea level rise in south Florida currently causes coastal flooding during peak lunar tides, and may cause marginal wetland habitats (mangroves and fringing seagrass meadows) to be lost by squeezing them against developed shorelines. Climate change has the potential to strongly influence how we plan and execute habitat protection and restoration projects. The ways in which climate change influences projects will likely evolve over time as we learn more about how the atmosphere and oceans are changing. The CSP will not specifically address climate change; however, ACFHP will develop, recommend, and implement restorative and adaptive solutions (e.g. living shorelines) to fish habitat conservation to address this significant threat.

[10]*http://www.worldwildlife.org/publications/marine-ecoregions-of-the-world-a-bioregionalization-of-coastal-and-shelf-areas*
[11]Saba, V.S., Griffies, S.M., Anderson, W.G., Winton, M., Alexander, M.A., Delworth, T.L., Hare, J.A., Harrison, M.J., Rosati, A., Vecchi, G.A., and R. Zhang. 2016. Enhanced warming of the northwest Atlantic Ocean under climate change. Journal of Geophysical Research: Oceans 121(1): 118-132.


Shorey's Brook (NY) before and after dam removal. Photos courtesy of Great Works Regional Land Trust.

Habitats

The full list of ACFHP Habitats to the right has been excerpted from the ACFHP Species-Habitat Matrix. This list should not be considered a comprehensive index of all habitats along the Atlantic coast; however, these habitats were determined to best represent the range of habitats supporting Atlantic coastal, estuarine-dependent, and diadromous fishes at a coast-wide level.

This table illustrates the 25 habitat types organized within seven habitat categories (see Appendix C Habitat Characterizations for more detailed descriptions). The habitat types are examples of particular habitat characterizations that fall within a broader habitat category.

ACFHP Habitats by Category and Type

Habitat Category	Habitat Type
Marine and Estaurine Shellfish Beds	Oyster aggregations/reef Scallop beds Hard clam beds Shell accumulations
Coral and Live/Hard Bottom	Coral reefs Patch reef, soft corals, or anemones Live rock
Macroalgae	*Fucus* spp., *Laminaria* spp., *Ulva lactuca*
Submerged Aquatic Vegetation	Tidal fresh & oligohaline plant species Mesohaline & polyhaline plant species
Tidal Vegetation	Estuarine emergent marsh Tidal freshwater marsh Mangrove
Unvegetated Coastal Bottom	Loose fine bottom Loose coarse bottom Firm hard bottom Structured sand habitat
Riverine Bottom	Higher gradient headwater tributaries Lower gradient tributaries Higher gradient large mainstem river Lower gradient large mainstem river Low order coastal streams Non-tidal freshwater mussel beds Coastal headwater pond Non-tidal freshwater marsh

Subregional Priority Habitats

ACFHP has selected three to four priority habitats within each subregion using the results of the Species-Habitat Matrix as a guide, and professional judgment to consider threats facing each habitat. Given limited resources, projects addressing the Priority Habitats appropriate for the given subregion will receive heightened consideration and ACFHP support and implementation during the next five years (2017-2021). With this in mind, ACFHP will support efforts to accelerate the conservation, protection, restoration, and enhancement of all habitats listed on the previous page. Note that the priority habitats selected for each subregion are not ranked or prioritized within the subregion.

ACFHP PRIORITY HABITATS BY SUBREGION

NORTH ATLANTIC
- Riverine Bottom
- Submerged Aquatic Vegetation
- Marine and Estuarine Shellfish Beds

MID-ATLANTIC
- Riverine Bottom
- Submerged Aquatic Vegetation
- Marine and Estuarine Shellfish Beds
- Tidal Vegetation

SOUTH ATLANTIC
- Riverine Bottom
- Submerged Aquatic Vegetation
- Marine and Estuarine Shellfish Beds
- Tidal Vegetation

SOUTH FLORIDA
- Submerged Aquatic Vegetation
- Coral and Live/Hardbottom
- Tidal Vegetation (mangrove)

Partnership for the Delaware Estuary

FL Keys Reef Restoration, FL FWCC

Priority Threats

Habitat destruction and degradation in the Atlantic coastal drainage systems, which provide critical habitats for diadromous, estuarine-dependent, and coastal fish species, must be reversed. Threats that impact important spawning and nursery habitats are of particular concern. ACFHP has identified Priority Threats that are currently impacting habitats along the Atlantic coast that it has the capacity to address as a Partnership, recognizing the Partnership is limited in its ability to reduce the impact of some threats. Since climate change was addressed earlier in this document, it will not be discussed here. It is a major threat the Partnership will seek to adaptively manage.

In the first CSP, ACFHP Priority Threats were informed by the results of the Partnership's 2009 Assessment of Existing Information. The Assessment is a database of over 500 documents, datasets, and information portals on Atlantic coastal habitats which were collected and analyzed for indicator, threat, and action information. In 2016, the ACFHP Steering Committee re-evaluated these Priority Threats and supported using those originally identified in 2009.

LIST OF PRIORITY THREATS IMPACTING ACFHP HABITATS ON A COASTWIDE SCALE

Obstructions to Fish Passage/Habitat Connectivity

Examples: Dams; hydropower facilities; hurricane and storm barriers; road crossings and culverts; thermal barriers; reduced stream flow and low flow areas caused by diversions, withdrawals, legacy effects, and reduced base flow; jetties and breakwater; tidal turbines; and beaver dams or debris jams

Importance: Hurricane and storm barriers are an emerging concern as new activities to protect coastal populations from storm damage are considered. Dams, culverts, tide gates, sedimentation, and other water quality or flow impediments to fish passage can impact and limit the survivability of fish populations and lead to local extinctions in rivers, streams, and estuaries along the Atlantic coast. Obstructions to fish passage can adversely affect life history stages of diadromous and important estuarine fish populations.

--continued

Doug Clark

Dredging and Coastal Maintenance

Examples: Dredging; blasting; port expansion and maintenance; dredge spoil disposal; and beach maintenance (including beach fill, mining of sand, bulldozing, sand bypass, sand bags, and shoreline stabilization)

Importance: Human activities around marinas, ports, and residential docks can have major impacts on fish habitat. The direct impacts of this threat are the removal, degradation, or smothering of habitat. Indirect impacts involve the blockage of sunlight or are linked with other threats noted in this section (e.g. water quality degradation and eutrophication). This threat is serious and persistent given its on-going and reoccurring nature. Once habitat is allowed to re-establish in impacted areas, it is often impacted again. The areas of greatest impact are nursery and spawning areas; protection of these areas is vitally important to ensure sustainability of critical life stages of many species.

Water Quality Degradation and Eutrophication

Examples: Surface water and groundwater quality and quantity; point/non-point source pollution; nutrient loading; atmospheric deposition; and dissolved oxygen concerns

Importance: This threat can occur in all aquatic habitats. Water quality decline and eutrophication are among the most common causes of aquatic habitat degradation. For example, nutrients promoting excessive algal blooms, such as nitrogen and phosphorus, can decrease oxygen levels in the water column and cause die-off of fish and other marine species. This threat is one of the most pervasive and difficult to target and reverse. Often the causes of this threat must be addressed in order for habitat restoration to be successful over the long-term.

Consumptive Water Withdrawal

Examples: Withdrawals for industrial, agricultural, residential, and recreational uses, such as irrigation, desalinization, and energy generation; flow concerns; and freshwater withdrawal in the salt front

Importance: Consumptive water withdrawal can reduce water quantity or flow for fish and their habitats, degrade water quality, and alter the location of fresh-salt water interfaces. This is a particularly challenging threat to address because of the inherent difficulties of balancing conflicting water needs of fish and humans from a particular water body. Impacts to habitat can result from groundwater as well as surface water removals.

Sedimentation

Examples: Suspended and deposited solids; construction of impervious surfaces in the watershed (e.g. parking lots, roads, buildings); point and non-point source runoff; and development of shorelines and riparian areas

Importance: While movement of the natural sediment load is important in aquatic ecosystems; excess, contaminated, or polluted sedimentation is a particularly important threat to consider when dealing with riverine or estuarine habitats. Watersheds with a high percentage of impervious surfaces and erosion often have detrimental sedimentation impacts on aquatic habitats. Sediment runoff can smother fish eggs, impact physiological and behavioral responses in fish, vegetation, shellfish beds, submerged aquatic vegetation (SAV), dislodge plants, decrease light penetration, and increase susceptibility to disease.

Vessel Operation Impacts

Examples: Recreational and commercial vessel operation; prop washing; anchoring; grounding; and discharge

Importance: Vessel impacts are most prevalent in shallow water estuarine and marine habitats. Vessel operation can lead to propeller scarring, localized siltation issues, shoreline erosion due to wakes and grounding, and shading from boats and associated docks.

Lisa Havel, ASMFC

Contamination of Water (ground and surface) and Sediments

Examples: Heavy metal accumulation; acid precipitation; pesticides and herbicides; petrochemical spills; and pharmaceuticals

Importance: Contamination can degrade the health of both habitats and species, especially for elements that easily bioaccumulate in tissues and sediments. Identifying the sources of and avenues to address contamination issues can be particularly challenging. An emerging concern involves the prevalence of pharmaceuticals in water supplies that affect humans and fish alike. Contamination is a major concern because it can cause lethal and sub-lethal effects, disease, locomotor impairment, abnormal mating and other behaviors, incomplete or abnormal development, inadequate nutrient balance, susceptibility to parasites, and other problems.

Invasive Species

Examples: Introduction of invasive species, including plants, invertebrates, and vertebrates, and lack of invasive species eradication

Importance: Demonstrated many times over, invasive species can have a major impact on fish and their habitats. Native habitat types may be outcompeted, smothered, or displaced by invasive plants (such as common reed *Phragmites australis* or water lettuce *Pistia stratiotes*) and animals (such as zebra mussel *Dreissena polymorpha*, mitten crab *Eriocheir sinensis*, and pink barnacle *Tetraclita rubescens*). The best way to address this threat is to try to prevent introductions through public education and encouraging the use of best management practices (BMPs) (e.g. in vessel transport). Once an invasive species is introduced, it is difficult or impossible to eradicate.

Other Threats

Other threats to Atlantic coast fish habitat were identified. However, those threats were determined not to be as high of a priority for ACFHP, or were of a nature that could not be effectively addressed by ACFHP. Those threats included:

- **Fishing gear impacts** (including hydraulic clamming, bottom-tending gears, and recreational and commercial fishing impacts on habitat)
- **Aquaculture** (including pathogen transfer, entanglement, nutrient issues, and genetic sustainability)
- **Inadequate development and implementation of regulatory systems** (including permitting, zoning, land-use planning, sewage treatment, floodplain management, and fishery management)
- **Physical impacts to fish** (including entrainment, impingement, propeller strikes, prop wash, and turbines)

All of these threats can be cumulative, which can possibly cause irreversible changes to the ecosystem.

Jerry Prezioso, NOAA Fisheries

Kevin Kalasz, DE DNREC

The Major Threats within Each Subregion to ACFHP's Priority Habitats[12]		
Submerged Aquatic Vegetation	Dredging and Coastal Maintenance	NA, MA, SA, SF
	Water Quality Degradation and Eutrophication	NA, MA, SA, SF
	Vessel Operation Impacts	NA, MA, SA, SF
	Sedimentation	NA, SA, SF
	Contamination of Water and Sediments	SA, SF
	Invasive Species/Disease	SA, SF
Riverine Bottom	Obstruction to Fish Passage/Habitat Connectivity	NA, MA, SA
	Dredging and Coastal Maintenance	NA, MA, SA
	Water Quality Degradation and Eutrophication	NA, MA, SA
	Consumptive Water Withdrawal	NA, MA, SA
	Sedimentation	NA, MA, SA
	Contamination of Water and Sediments	MA, SA
	Invasive Species/Disease	MA, SA
Marine and Estaurine Shellfish Beds	Water Quality Degradation and Eutrophication	NA, MA, SA
	Sedimentation	NA, MA, SA
	Dredging and Coastal Maintenance	MA, SA
	Consumptive Water Withdrawal	MA, SA
	Invasive Species/Disease	NA, SA
	Vessel Operation Impacts	SA
	Contamination of Water and Sediments	SA
Tidal Vegetation	Dredging and Coastal Maintenance	MA, SA, SF
	Water Quality Degradation and Eutrophication	MA, SA, SF
	Sedimentation	MA, SA, SF
	Vessel Operation Impacts	MA, SF
	Invasive Species/Disease	MA, SF
	Contamination of Water and Sediments	SA
Coral and Live/Hardbottom	Dredging and Coastal Maintenance	SF
	Water Quality Degradation and Eutrophication	SF
	Vessel Operation Impacts	SF
	Contamination of Water and Sediments	SF
	Invasive Species/Disease	SF

ACFHP Ecological Subregions: NA = North Atlantic, MA = Mid-Atlantic, SA = South Atlantic, SF = South Florida

[12]Climate change is affecting all habitats in each region to varying degrees and is not included in this table.

A. Conservation Objectives

CONSERVATION OBJECTIVE 1: Work with partners to protect, restore, or maintain resilient Subregional Priority Habitats (using strategies outside of fish passage) to optimize ecosystem functions and services to benefit fish and wildlife.

Strategy A.1.1: Support on-the-ground conservation projects that protect, restore, or maintain Subregional Priority Habitats (outside of fish passage).

Strategy A.1.2: Minimize or reduce adverse impacts to Subregional Priority Habitats associated with coastal development and water-dependent uses.

Strategy A.1.3: Promote the use of best management practices (BMPs) for protection and restoration of Subregional Priority Habitats.

Strategy A.1.4: Work with partners to identify and conserve intact coastal habitats and buffers in need of protection.

CONSERVATION OBJECTIVE 2: Work with partners to support the maintenance of water quality and hydrology standards for functional priority habitats and improvement of water quality in degraded priority habitat areas.

Strategy A.2.1: Coordinate with partners to assess and identify critical watersheds for water quality improvement that are having a major impact on Subregional Priority Habitats.

Strategy A.2.2: Support on-the-ground projects that improve water quality within Subregional Priority Habitats.

CONSERVATION OBJECTIVE 3: Coordinate with partners to restore, enhance, and maintain adequate and effective fish passage to ensure connectivity within and among required Subregional Priority Habitats.

Strategy A.3.1: Coordinate with partners to identify and prioritize watersheds for conservation where fragmentation of, or barriers to, fish passage are a potentially critical threat to be addressed.

Strategy A.3.2: Coordinate with partners to disseminate a “standardized toolbox” of fish passage technologies and guidance to assist the public in the development and implementation of effective fish passage protocols.

Strategy A.3.3: Work with partners to increase habitat connectivity within and among Subregional Priority Habitats by directly addressing physical barriers.

B. Science and Data Objectives

SCIENCE AND DATA OBJECTIVE 1: Work to achieve ACFHP Science and Data needs and fulfill science and data responsibilities established by NFHAP.

Strategy B.1.1: Develop an online searchable database of the Species-Habitat Matrix.

Strategy B.1.2: Produce a fine scale ACFHP region-wide GIS map, using existing data, that shows areas for priority habitat protection and restoration which can be used to better target our actions.

Strategy B.1.3: Develop project tracking capabilities for the purpose of capturing and reporting conservation results to stakeholders.

Strategy B.1.4: Analyze monitoring data to assess success of fish habitat restoration projects.

SCIENCE AND DATA OBJECTIVE 2: Support ongoing research related to identifying or assessing fish habitat conservation activities and the threats to fish habitats.

Strategy B.2.1: Identify and communicate pertinent challenges affecting fish habitat management and create a prioritized list of data gaps that would help ACFHP achieve its goals (i.e. spatial data for various life stages of priority fish species and/or habitat maps of subregional priority habitats).

Strategy B.2.2: Seek funding or endorse applied science/research projects aimed at (1) monitoring the impacts of Priority Threats on ACFHP habitats, (2) evaluating the effectiveness of fish habitat conservation techniques or methodologies, (3) identifying causes of habitat loss and the resulting effects on ACFHP species, and (4) collecting data to fill gaps identified in Science and Data Objective B.2.1.

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C. Outreach and Communication Objectives

OUTREACH AND COMMUNICATION OBJECTIVE 1: Develop new and update current printed and digital content for communicating information that supports ACFHP's goals to target audiences: scientists, resource managers, state and federal legislatures, non-governmental organizations, stakeholders, media, and others as identified.

Strategy C.1.1: Determine which communications platforms maximize ACFHP's ability to deliver its messaging to target audiences.

Strategy C.1.2: Upgrade and seek improvements to content/organization of the ACFHP website to make better use of available technology and enhance accessibility/usability by target audiences.

Strategy C.1.3: Redesign outreach materials for consistency to optimize our messaging.

Strategy C.1.4: Disseminate communication materials via social media platforms, the website, and participation at professional conferences/tradeshows to extend our coverage.

OUTREACH AND COMMUNICATION OBJECTIVE 2: Promote and broadly disseminate information about the products, projects, and services of ACFHP.

Strategy C.2.1: Share the successes of the on-the-ground conservation projects that ACFHP supports with target audiences.

Strategy C.2.2: Seek opportunities to expand media coverage of ACFHP products, projects, and services.

Strategy C.2.3: Facilitate the dissemination of BMPs and other fish habitat conservation information from partners to our targeted audiences.

OUTREACH AND COMMUNICATION OBJECTIVE 3: Maintain relations with the National Fish Habitat Partnership Board, fellow Fish Habitat Partnerships, and Beyond the Pond.

Strategy C.3.1: Promote the mission and accomplishments of ACFHP and exchange lessons learned with the National Fish Habitat Partnership Board.

Strategy C.3.2: Enhance fish habitat improvement through cooperation with fellow Fish Habitat Partnerships.

OUTREACH AND COMMUNICATION OBJECTIVE 4: Seek avenues to promote the activities and products of partners.

Strategy C.4.1: Publicize partners' actions and products via various communication platforms.

Strategy C.4.2: Distribute and publicize the Atlantic States Marine Fisheries Commission's (ASMFC) Habitat Committee actions and products, including a link in ACFHP's website to ASMFC's website.

Partnership for the Delaware Estuary, courtesy of The Milford Beacon

D. Finance Objectives

FINANCE OBJECTIVE 1: Maintain infrastructure and mechanisms for managing ACFHP finances.

Strategy D.1.1: Coordinate with ASMFC to maintain ACFHP operations.

Strategy D.1.2: Coordinate with Beyond the Pond staff and partners to establish financial capacities for managing grant proposals and awards.

FINANCE OBJECTIVE 2: Utilize NFHAP funding to achieve the greatest overall benefits for on the ground conservation and Partnership productivity.

Strategy D.2.1: Solicit and select high quality conservation projects through an annual request for proposals process.

Strategy D.2.2: Enhance ACFHP's performance score in the annual NFHAP funding determinations.

Strategy D.2.3: Support federal legislation for NFHAP.

FINANCE OBJECTIVE 3: Leverage new funding for restoration projects and ACFHP operations.

Strategy D.3.1: Adopt a working Business Plan.

Strategy D.3.2: Implement the Business Plan and pursue private donors for funding.

Strategy D.3.3: Continue to pursue additional conservation project funding and endorsement opportunities.

Strategy D.3.4: Identify and pursue new sources of operational funding.

FINANCE OBJECTIVE 4: Fund projects for Science and Data and Outreach and Communications.

Strategy D.4.1: Secure funding or in-kind support to develop Science and Data and Outreach and Communication priority materials and products.

Appendix A
ACRONYMS

ACFHP	Atlantic Coastal Fish Habitat Partnership
ASMFC	Atlantic States Marine Fisheries Commission
BMP	Best management practice
CSP	Conservation Strategic Plan
GIS	Geographic information system
NFHAP	National Fish Habitat Action Plan
NGOs	Non-governmental organizations
NOAA	National Oceanic and Atmospheric Administration
SAV	Submerged aquatic vegetation

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Appendix B
GLOSSARY

Bioaccumulate	The concentration of substances within an organism
Coastal resiliency	Building the ability of a community to 'bounce back' after hazardous events rather than simply reacting to impacts (modified from National Ocean Service, NOAA)
Cobble	Rocks 64 – 256 mm in diameter
Connectivity	The degree to which streams and rivers facilitate or inhibit movement among resources[13]
Consumptive water withdrawal	The permanent removal of water from its source, through natural or anthropogenic processes
Desalination	Salt and mineral removal from a substance
Diadromous	Fish that spend part of their life cycle in fresh water and part of their life cycle in salt water
Dredge	The removal of sediment, plants, etc. to maintain a desired depth and width within a waterway
Embayment	A bay or conformation resembling a bay
Emergent	Rising above the water
Entrainment	Entrapment
Estuarine-dependent	Fish that reside in the estuary for at least part of their life cycle
Eutrophication	Excessive nutrients in a body of water, causing an increase in primary producers, leading to a decrease in oxygen upon their decay
Fragmentation	When continuous habitat divides into smaller, separated habitats, usually due to habitat loss
Headwaters	The tributaries or streams closest to its source
Hydrology	The science of the distribution, movement, and quality of the water on Earth
Impingement	Collision or violent contact
Intertidal	The area between high and low tide
Lagoon	Shallow water bodies separated from larger water bodies, usually with little tidal or freshwater flow

Locomotor	Influencing the ability of moving from one location to another
Moratorium	Delay or suspension of an activity or law
Primary production	Converting energy into organic substances by organisms (autotrophs)
Riparian	Areas adjacent to rivers and streams
Shoreline hardening	The use of groins, jetties, offshore breakwaters, sea walls, tombolos, or other hardened beach structures on the shore (www.coastalcare.org)
Spawn	To deposit eggs or sperm directly into the water
Supratidal	Area above high tide that is regularly splashed with seawater, but is not under water
Spatial data	Data elements with a spatial component i.e. associated with a location
Symbiosis	An interaction between two different organisms in close proximity. Usually the interaction is mutually beneficial.
Threat	A thing likely to cause damage
Unicellular	Consisting of one cell
Vascular	The plant tissue that transports water, sap, and nutrients

[13]Modified from Taylor, P.D., Fahrig, L, Henein, K. and G. Merriam. 1993. Connectivity is a vital element of landscape structures. Oikos 68: 571-573.

FL FWCC

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Appendix C
HABITAT CHARACTERIZATIONS

MARINE AND ESTUARINE SHELLFISH BEDS

Oyster aggregations/reef

Structures formed by the Eastern oyster (*Crassostrea virginica*) that provide the dominant structural component of the benthos (bottom), and whose accumulated mass provides significant vertical relief (> 0.5 m).

Scallop beds

Areas of dense aggregations of scallops on the ocean floor. Common Atlantic coast species include: (1) the large Atlantic sea scallop (*Placopecten magellanicus*), which ranges from Newfoundland to North Carolina; (2) the medium-sized Atlantic calico scallop (*Argopecten gibbus*), which is found in waters south of Delaware; and (3) the bay scallop (*Argopecten irradians*), which occurs from Cape Cod to Florida, as well as in the Gulf of Mexico.

Hard clam beds

Dense aggregations of the hard clam (*Mercenaria mercenaria)* found in the subtidal regions of bays and estuaries to approximately 15 m in depth. Clams are generally found in mud flats and firm bottom areas consisting of sand or shell fragments.

Shell accumulations

Shells of dead mollusks sometimes accumulate in sufficient quantities to provide important habitat. Accumulations of Eastern oyster shells are a common feature in the intertidal zone of many southern estuaries.

CORAL AND LIVE/HARD BOTTOM

Coral reefs

Reef-building corals are of the order Scleractinia, in the class Anthozoa, of the phylum Cnidaria. Coral accumulations are restricted to warmer water regions, where the average monthly temperature exceeds 18°C (64°F) throughout the year. Through symbiosis with unicellular algae, reef- building corals are the source of primary production in reef communities.

Patch reef, soft corals, or anemones

A patch reef is an isolated, often circular, coral reef usually found within a lagoon or embayment. Soft corals are species of the anthozoan order Alcyonacea, of the subclass Octocorallia. In contrast to the hard or stony corals, most soft corals do not possess a massive external skeleton (e.g. sea pens and sea fans). Anemones are cnidarians of the class Anthozoa that possess a flexible cylindrical body and a central mouth surrounded by tentacles found in soft sediments.

Live rock

Calcareous rock that is removed from the vicinity of a coral reef with some of the life forms still living on it. These may include bacteria, coralline algae, sponges, worms, crustaceans, and other invertebrates.

Macroalgae

Large marine multi-cellular macroscopic algae (seaweeds). There are three types of macroalgae: green, brown, and red.

Examples of macroalgae species found along the Atlantic coast include:

Chlorophyta (green algae)

Ulva lactuca, sea lettuce

Phaeophyta (brown algae)

Fucus vesiculosus, bladderwrack; *Laminaria* spp.; *Sargassum* spp.

Rhodophyta (red algae)

Chondrus crispus, Irish moss

SUBMERGED AQUATIC VEGETATION (SAV)

SAV refers to rooted, vascular plants that live below the water surface in large meadows or small patches in coastal and estuarine waters. SAV can be further classified by the range of salinity of the waters in which they are found.

Tidal fresh and oligohaline plant species

Generally found in areas where salinity ranges from 0.5 to 5.0 ppt.

Examples include: *Vallisneria americana*, wild celery
Ceratophyllum demersum, coontail

Mesohaline and polyhaline plant species

Generally found in areas where salinity ranges from 5 ppt up to 30 ppt.

Examples include: *Zostera marina*, eelgrass
Ruppia maritime, widgeon grass

Natural eelgrass meadow in the Peconic Estuary, by Kimberly Manzo, Cornell Cooperative Extension Marine Program.

TIDAL VEGETATION

Estuarine emergent marsh

Salt marsh is an environment in the coastal intertidal zone between land and brackish water. The low marsh zone floods twice daily, while the high marsh floods only during storms and unusually high tides. Smooth cordgrass (*Spartina alterniflora*) dominates the regularly flooded low marsh along much of the Atlantic coast. In addition, salt meadow cordgrass (*Spartina patens*), saltgrass (*Distichlis spicata*), and needle rush (*Juncus* spp.) species comprise much of the vegetative community of the mid to upper salt marsh and brackish marsh.

Tidal freshwater marsh

Tidal freshwater marsh occurs where the average annual salinity is below 0.5 ppt. It is found along free-flowing coastal rivers, and is influenced twice daily by the incoming tides. Tidal freshwater marsh can be located just upstream of the salt front, where the river essentially backs up as it meets resistance from high tides. Tidal freshwater marsh is characterized by salt intolerant plant species. These include: giant cordgrass (*Spartina cynosuroides*), sawgrass (*Cladium jamaicense*), cattails (*Typha* spp.), arrow arum (*Peltandra virginica*), pickerelweed (*Pontedaria cordata*), blue flag (*Iris virginica*), and soft stem bulrush (*Scirpus validus*).

Mangrove

The mangrove ecological community includes four tree species collectively called mangroves. This swamp system occurs along intertidal and supratidal shorelines in southern Florida. The four species found in Florida mangrove swamps are:

Rhizophora mangle, red mangrove
Avicennia germinans, black mangrove
Laguncularia racemosa, white mangrove
Conocarpus erectus, buttonwood

UNVEGETATED COASTAL BOTTOM

Loose fine bottom

Submerged underwater bottom habitat in estuaries and oceans where the dominant sediment type is mud, silt, or sand.

Loose coarse bottom

Submerged underwater bottom habitat in estuaries and oceans where the dominant sediment type ranges from gravel to cobble.

Firm hard bottom

Submerged underwater bottom habitat in estuaries and oceans where embedded rock or boulders are the dominate sediment types.

Structured sand habitat

Linear, narrow sand features that develop where a stream or ocean current promotes deposition of sand.

RIVERINE BOTTOM

Higher gradient headwater tributaries

Streams in which the dominant substrate is comprised of gravel and cobble. The stream slope is greater than 2%. This characterization includes 1st to 3rd order streams.[14]

Lower gradient tributaries

Streams in which the dominant substrate is comprised of sand, gravel, and small cobble. The stream slope is between 0.51% and 2.0%. This characterization includes 1st to 3rd order streams.

Higher gradient large mainstem river

Rivers in which the dominant substrate is sand, gravel, and cobble. The stream slope is between 0.51% and 2%. This characterization includes 4th order rivers and above.

Lower gradient large mainstem river

Rivers in which the dominant substrate is fine sediments (silt, mud, sand). The stream slope is between 0.51% and 2%. This characterization includes 4th order rivers and above.

Laura Leach, ASMFC

Low order coastal streams

Generally low gradient 0% to 0.05% in slope. This characterization includes 1st to 3rd order streams located along the coast.

Non-tidal freshwater mussel beds

Freshwater mussel beds, located above tidal influence.

Coastal headwater pond

A pond connected to coastal streams and rivers, generally located near the headwaters.

Non-tidal freshwater marsh

A marsh that occurs in the non-tidal section along a river. The main feature of a freshwater marsh is its openness, with only low-growing or "emergent" plants. It may include grasses, rushes, reeds, typhas, sedges, and other herbaceous plants (possibly with low-growing woody plants) in a context of shallow water.

[14]Strahler Stream Order is a hierarchical classification of streams. Headwaters are the first order, and two first order streams combine to form a second order stream. Two second order streams form a third order stream, and so on.

Appendix D

WEBSITES AND DOCUMENT LINKS

4 National Fish Habitat Action Plan
www.fishhabitat.org/files/uploads/National_Fish_Habitat_Action_Plan_2006.pdf

4 Restoration practitioners
www.atlanticfishhabitat.org/wp-content/uploads/2012/10/Aligning-the-ACFHP-Efforts-with-Restoration-Practitioners.pdf

5 Species-Habitat Matrix
https://academic.oup.com/bioscience/article/66/4/274/2464081/The-Importance-of-Benthic-Habitats-for-Coastal

5 Fish Habitat Decision Support Tool
www.fishhabitattool.org

5 River Herring Habitat Restoration Needs
www.atlanticfishhabitat.org/wp-content/uploads/2012/10/RIVER-HERRING-RESTORATION-NEEDS-final-edited.pdf

7 NOAA Fisheries Economics of the Unites States, 2015
www.st.nmfs.noaa.gov/economics/publications/feus/fisheries_economics_2015/index

8 Memorandum of Understanding
www.atlanticfishhabitat.org/wp-content/uploads/2012/10/ACFHP-MOU-2015-with-signatures-1.pdf

8 ACFHP Charter and By-Laws
www.atlanticfishhabitat.org/Documents/ACFHP-Charter-and-Bylaws.pdf

8 ACFHP Partners

Albemarle-Pamlico National Estuary Partnership
www.apnep.org/web/apnep

American Littoral Society
www.littoralsociety.org

American Rivers
www.americanrivers.org

Atlantic States Marine Fisheries Commission
www.asmfc.org

Chesapeake Bay Foundation
www.cbf.org

Connecticut Department of Environmental Protection
www.ct.gov

Delaware Department of Natural Resources and Environmental Control
www.dnrec.delaware.gov

Environmental Defense Fund
www.edf.org

Florida Fish and Wildlife Conservation Commission
www.myfwc.com

Georgia Department of Natural Resources
www.gadnr.org

Houlton Band of Maliseet Indians
www.maliseets.com

International Federation of Fly Fishers
www.flyfishersinternational.org

Maine Department of Marine Resources
www.maine.gov

Maryland Department of Natural Resources
www.dnr.maryland.gov

Massachusetts Division of Marine Fisheries
www.mass.gov/eea/agencies/dfg/dmf

Merrimack River Watershed Council
www.merrimack.org

National Oceanic and Atmospheric Administration
www.noaa.gov

New Hampshire Fish and Game Department
www.wildlife.state.nh.us

New Jersey Division of Fish and Wildlife
www.state.nj.us

New York Department of Environmental Conservation
www.dec.ny.gov

North Carolina Coastal Federation
www.nccoast.org

North Carolina Department of Environmental Quality
www.deq.nc.gov

Oyster Recovery Partnership
www.oysterrecovery.org

Partnership for the Delaware Estuary
www.delawareestuary.org

Pennsylvania Fish and Boat Commission
www.fish.state.pa.us

Rhode Island Division of Fish and Wildlife
www.dem.ri.gov

South Carolina Department of Natural Resources
www.dnr.sc.gov

The Nature Conservancy
www.nature.org

United States Fish and Wildlife Service
www.fws.gov

United States Geological Survey
www.usgs.gov

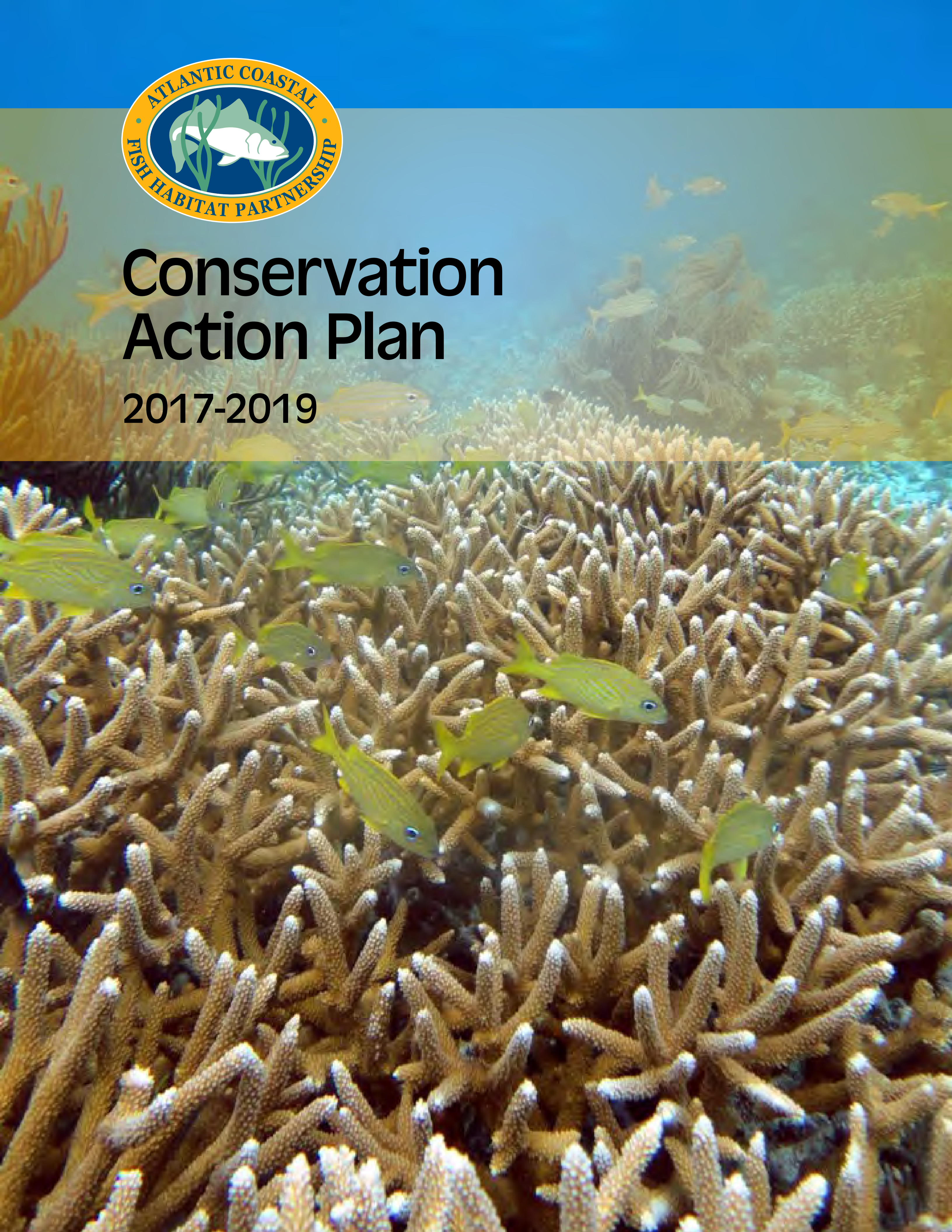
Vermont Fish and Wildlife Department
www.vtfishandwildlife.com

Virginia Marine Resources Commission
www.mrc.state.va.us

Wells National Estuarine Research Reserve
www.wellsreserve.org

13 2009 Assessment of Existing Information
http://www.atlanticfishhabitat.org/Documents/ACFHP%20Assessment%20of%20Existing%20Information%20Final%20Report.pdf


ATLANTIC COASTAL
FISH HABITAT PARTNERSHIP



ATLANTIC COASTAL FISH HABITAT PARTNERSHIP

Conservation Action Plan

2017-2019

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This plan is a product of the Atlantic Coastal Fish Habitat Partnership with funding from the National Fish Habitat Partnership (Award Number F16AC01131) and the Multistate Conservation Grant Program with funds from the Wildlife and Sport Fish Restoration Program of the U.S. Fish and Wildlife Service.

COVER PHOTO: FL Keys Reef Restoration, FL FWCC

2017-2019 Action Plan

The Atlantic Coastal Fish Habitat Partnership (ACFHP) 2017 – 2019 Action Plan is a subset of the 2017 – 2021 ACFHP Conservation Strategic Plan. It contains a set of objectives, strategies, and related actions that can be accomplished over the course of a two year period. These actions will be carried out by the ACFHP Coordinator or Action Lead, with the help of subgroups as necessary.

ASMFC Habitat

A. Conservation Objectives

CONSERVATION OBJECTIVE 1: Work with partners to protect, restore, or maintain resilient Subregional Priority Habitats (using strategies outside of fish passage) to optimize ecosystem functions and services to benefit fish and wildlife.

Strategy A.1.1: **Support on-the-ground conservation projects that protect, restore, or maintain Subregional Priority Habitats (outside of fish passage).**

Action 1: Allocate U.S. Fish and Wildlife Service (Service) funding to annually support a minimum of one project that promotes/supports restoration, protection, and resiliency of Subregional Priority Habitats.

Action 2: Submit a minimum of one funding proposal annually outside of Service-National Fish Habitat Action Plan (NFHAP) funding (e.g. National Oceanic and Atmospheric Administration [NOAA]) to support projects that increase the resiliency of Subregional Priority Habitats.

Action 3: Support four on-the-ground conservation projects annually through endorsement by ACFHP.

Strategy A.1.4: **Work with partners to identify and conserve intact coastal habitats and buffers in need of protection.**

Action 1: Promote the use of the Species-Habitat Matrix and Northeast-Southeast Fish Habitat Mapping Projects to protect high quality fish habitats through at least one webinar or presentation at a professional conference.

CONSERVATION OBJECTIVE 3: Coordinate with partners to restore, enhance, and maintain adequate and effective fish passage to ensure connectivity within and among required Subregional Priority Habitats.

Strategy A.3.3: **Work with partners to increase habitat connectivity within and among Subregional Priority Habitats by directly addressing physical barriers.**

Action 1: Allocate Service funding to annually support a minimum of one on-the-ground project that aims to remove barriers in areas identified as a priority for fish passage restoration by an ACFHP partner.

B. Science & Data Objectives

SCIENCE AND DATA OBJECTIVE 1: Work to achieve ACFHP Science and Data needs and fulfill science and data responsibilities established by NFHAP.

Strategy B.1.1: Develop an online searchable database of the Species-Habitat Matrix.

Action 1: Identify a partner who can develop a searchable database of the Matrix andwork with them to publish it online.

Strategy B.1.2: Produce a fine scale ACFHP region-wide GIS map, using existing data, that shows areas for priority habitat protection and restoration which can be used to better target our actions.

Action 1: Establish a timeline and calculate metrics for the Southeast Fish Habitat Mapping Project initiated by Merrimack River Watershed Council using the data layers provided, and the metrics defined.

Action 2: Determine data gaps in the Southeast Fish Habitat Mapping Project.

Action 3: Initiate the Northeast Fish Habitat Mapping Project by compiling all of the necessary data layers.

Strategy B.1.3: Develop project tracking capabilities for the purpose of capturing and reporting conservation results to stakeholders.

Action 1: Develop coordination with the Service Fish and Aquatic Conservation and Wildlife and Sport Fisheries Restoration divisions (which administers Tracking and Reporting Actions for the Conservation of Species [TRACS]) to get all of the NFHAP-funded reports (progress and final) into an online database and/or provide them to ACFHP.

C. Outreach & Communication Objectives

Outreach and Communication Objective 1: Develop new and update current printed and digital content for communicating information that supports ACFHP's goals to target audiences: scientists, resource managers, state and federal legislatures, non-governmental organizations, stakeholders, media, and others as identified.

Strategy C.1.2: **Upgrade and seek improvements to content/organization of the ACFHP website to make better use of available technology and enhance accessibility/usability by target audiences.**

Action 1: Hire a contractor and complete the ACFHP website redesign within one year.

Strategy C.1.3: **Redesign outreach materials for consistency to optimize our messaging.**

Action 1: Develop a PowerPoint presentation that can be used by partners to explain what ACFHP is, what we do, etc.

Action 2: Develop a one-page ACFHP fact sheet specifically for primary target audience(s).

Strategy C.1.4: **Disseminate communication materials via social media platforms, the website, and participation at professional conferences/tradeshows to extend our coverage.**

Action 1: Update contact information for ACFHP partners and followers outside of the Steering Committee and find out how we can increase their involvement in the Partnership.

Action 2: Attend and present a poster or talk at least once per year at a national conference.

Outreach and Communication Objective 2: Promote and broadly disseminate information about the products, projects, and services of ACFHP.

Strategy C.2.1: **Share the successes of the on-the-ground conservation projects that ACFHP supports with target audiences.**

Action 3: Submit a newsletter article to Rhode Island Marine Trades Association on the benefits of conservation moorings.

Strategy C.2.3: Facilitate the dissemination of best management practices (BMPs) and other fish habitat conservation information from partners to our targeted audiences.

Action 2: Provide Science and Data-approved links on ACFHP's website on topics of interest to target audiences, such as water quality parameters needed to maintain a healthy ecosystem, fish passage tools, riparian buffer BMPs, etc.

Outreach and Communication Objective 3: Maintain relations with the National Fish Habitat Partnership (NFHP) Board, fellow Fish Habitat Partnerships (FHPs), and Beyond the Pond.

Strategy C.3.1: Promote the mission and accomplishments of ACFHP and exchange lessons learned with the National Fish Habitat Partnership Board.

Action 1: Participate in at least three NFHP Board meetings per year and present as opportunities allow.

Action 2: Participate on the NFHP Partnership Committee and in NFHP workshops as needed, and report highlights to ACFHP Steering Committee annually.

Strategy C.3.2: Enhance fish habitat improvement through cooperation with fellow FHPs.

Action 1: Produce three quarterly Coastal FHP articles for the newsletter in coordination with other FHPs.

Action 2: Work closely with Eastern Brook Trout Joint Venture and Southeast Aquatic Resources Partnership on Whitewater to Bluewater efforts, and report to ACFHP Steering Committee on progress biannually.

D. Finance Objectives

Finance Objective 1: Maintain infrastructure and mechanisms for managing ACFHP finances.

Strategy D.1.1: **Work with the Atlantic States Marine Fisheries Commission (ASMFC) to maintain ACFHP operations.**

Action 1: Coordinate with the Service and NOAA to establish grant/cooperative agreements with ASMFC for ACFHP operational funding annually.

Action 2: Work with ASMFC and NFHP to apply for Multistate Conservation Grant funding annually.

Action 3: Work with ASMFC to apply for Wallop Breaux funding annually.

Strategy D.1.2: **Coordinate with Beyond the Pond staff and partners to establish financial capacities for managing grant proposals and awards.**

Action 1: Provide assistance and input into the development of Beyond the Pond infrastructure by attending at least 75% of FHP calls and quarterly Board meetings.

Finance Objective 2: Utilize NFHAP funding to achieve the greatest overall benefits for on the ground conservation and Partnership productivity.

Strategy D.2.1: **Solicit and select high quality conservation projects through an annual request for proposals process.**

Action 1: Convene the NFHAP project review subcommittee annually to evaluate proposals.

Action 2: Evaluate the success of the previous request for proposals cycle and provide the Steering Committee with recommended changes.

Strategy D.2.2: **Enhance ACFHP's performance score in the annual NFHAP funding determinations.**

Action 1: Complete the annual report to the Service and develop recommendations to enhance or maintain ACFHP's performance score for the Steering Committee.

Finance Objective 3: Leverage new funding for restoration projects and ACFHP operations.

Strategy D.3.1: Adopt a working Business Plan.

Action 1: Present a Business Plan to the Steering Committee for adoption within one year.

Action 2: Prioritize actions in the Business Plan in Year 2.

Finance Objective 4: Fund projects for Science and Data and Outreach and Communication.

Strategy D.4.1: Secure funding or in-kind support to develop Science and Data and Outreach and Communication priority materials and products.

Action 1: Secure funding for an online searchable database of the Species-Habitat Matrix if in-kind support is not feasible.

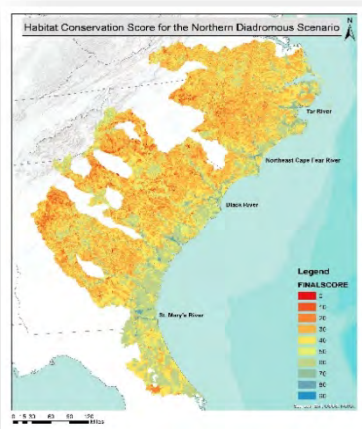
Action 4: Secure funding to maintain and update the content and organization of the ACFHP website.

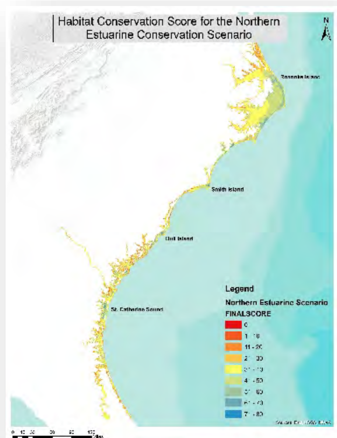

ATLANTIC COASTAL
FISH HABITAT PARTNERSHIP

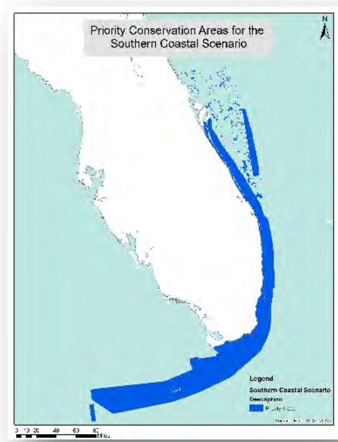
Atlantic Coastal Fish Habitat Partnership

Southeast Habitat Protection Mapping Project

Kat Hoenke, Southeast Aquatic Resources Partnership
Jessica Graham, Southeast Aquatic Resources Partnership
Lisa Havel, Atlantic Coastal Fish Habitat Partnership







Prepared for the NOAA Fisheries Southeast Regional Office

July 26, 2019

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Background

For this project, the Atlantic Coastal Fish Habitat Partnership (ACFHP) worked with the Southeast Aquatic Resources Partnership (SARP) to spatially prioritize fish habitat protection and restoration sites through GIS mapping and analyses for the southeast region of the U.S. from North Carolina to Florida. This effort was designed to be a pilot project with desire for expanding this analytical framework to the entire ACFHP geography.

As part of the National Fish Habitat Partnership (NFHP), ACFHP is expected to prioritize habitats for both protection and restoration. Habitat prioritization is an essential element of ACFHP's Conservation Strategic Plan, which covers the 2017 - 2021 timeframe. Additionally, habitat prioritization is needed for ACFHP to objectively evaluate on-the-ground restoration project proposals. Results will help ACFHP, its partners, and various stakeholders better identify locations in need of habitat restoration – both 'pristine' sites that could benefit from land and watershed protection and expanded by restoring adjacent areas, and minimally to moderately degraded habitat that would most benefit from restoration. It is not intended to be used as guidance for regulatory purposes (see 'Discussion and Caveats' for more details). This project focused on the southern portion of the ACFHP geography to spatially determine which locations are optimal for diadromous, estuarine, and coastal fish habitat conservation based on the guidance provided by the ACFHP Steering Committee and Science and Data Committee (Table 1). If the Steering Committee finds the results of this project acceptable, the methods will be used to expand the project to ACFHP's northern boundary.

Table 1: Timeline of Science and Data Committee and Steering Committee project engagement.

Committee Engagement	Date
Science and data committee webinar to introduce the project	June 12, 2017
Science and data committee in-person meeting to select variables and metrics for analyses	September 27 - 28, 2017
Steering committee in-person meeting to provide project update and solicit feedback	October 16 - 17, 2017
Steering committee in-person meeting to provide project update and solicit feedback	May 17 - 18, 2018
Science and data committee webinar to provide project update and solicit feedback	June 15, 2018
Steering committee in-person meeting to provide the final product	November 15 - 16, 2018

Project Scope

The southeast region of the United States includes three of ACFHP's subregions: the Mid-Atlantic (Virginia watersheds that drain into North Carolina waters south to Cape Lookout, NC), the South Atlantic (from Cape Lookout, NC to Cape Canaveral, FL), and South Florida (from Cape Canaveral, FL to the Dry Tortugas, FL) (Figure 1). These subregions correspond to the Virginian, Carolinian, and Floridian marine ecoregions (Spalding et al. 2007). ACFHP's priority fish habitats in the Mid-Atlantic and South Atlantic subregions include submerged riverine bottom, submerged aquatic vegetation (SAV), tidal vegetation, and marine and estuarine shellfish beds. Coral and live/hard bottom, tidal vegetation, and SAV are ACFHP's priority habitats in South Florida.

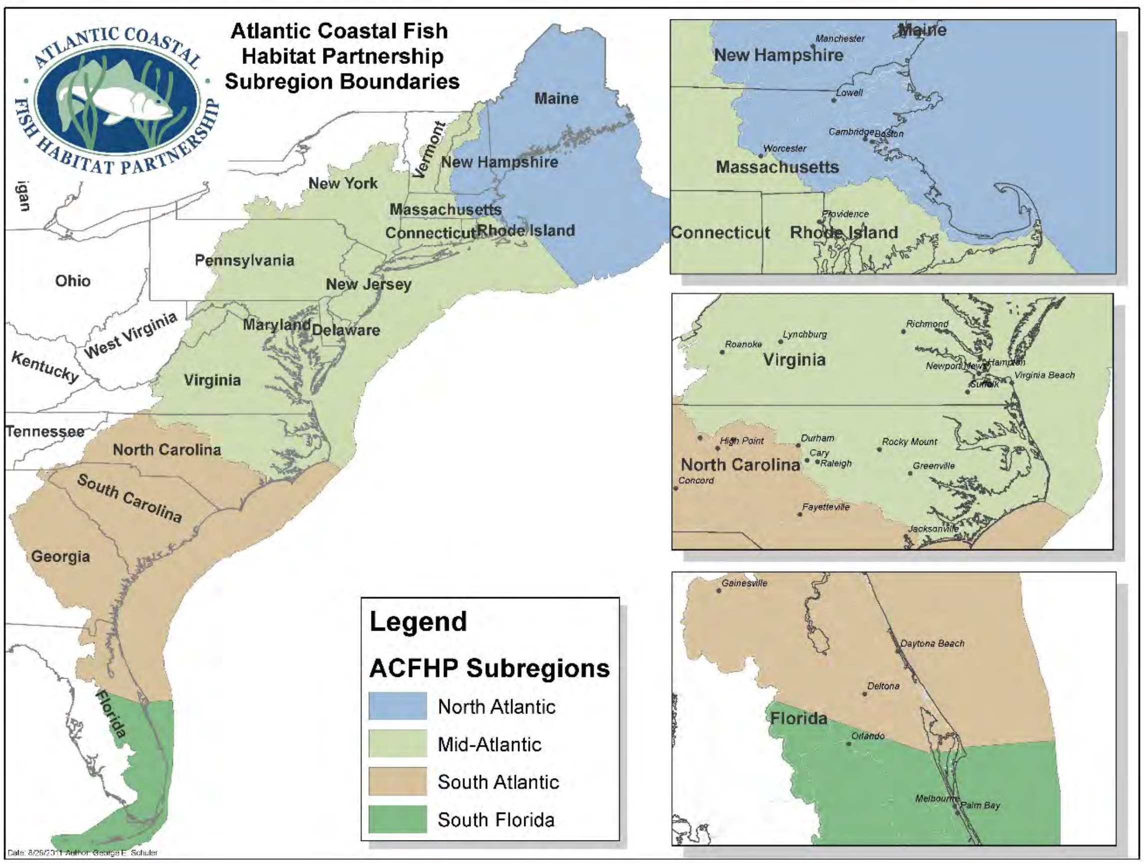

Figure 1. ACFHP subregional boundaries.

Four separate analyses were conducted to cover all of ACFHP's priority habitats in the southeastern United States: the 'Northern Diadromous Conservation Scenario' addressed the riverine bottom priority habitat in the Mid- and South Atlantic ('northern' for this project refers to the area north of Cape Canaveral, FL); the 'Northern Estuarine Conservation Scenario' addressed the SAV, tidal vegetation, and marine and estuarine shellfish beds priority habitats north of Cape Canaveral; the 'Southern Estuarine Conservation Scenario' addressed SAV and tidal vegetation priority habitats south of Cape Canaveral; and the 'Southern Coastal Conservation Scenario' addressed the coral and live/hard bottom priority habitat south of Cape Canaveral (Table 2). We only included a 'Northern Diadromous' scenario because our riverine priority habitat does not extend into South Florida. For this reason we also did not include a 'Northern Coastal' scenario – our coral and live/hard bottom habitat is only a priority in South Florida.

Table 2: Geographic regions and ACFHP priority habitats covered by the four spatial analyses.

Project Subregion*	ACFHP Subregion	ACFHP Priority Habitat	Conservation Scenario
Northern	Mid- and South Atlantic	Riverine bottom	Northern Diadromous
		SAV	Northern Estuarine
		Tidal vegetation	
		Shellfish beds	
Southern	South Florida	SAV	Southern Estuarine
		Tidal vegetation	
		Coral and live/hard bottom	Southern Coastal

*The Northern Project Subregion = north of Cape Canaveral, the Southern Project Subregion = south of Cape Canaveral.

The following sections outline the three main scenarios (diadromous, estuarine, and coastal) that were mapped and prioritized through the compilation of existing resources and subsequent analyses. The specific variables and measurements in each analysis were chosen because they covered the entire Conservation Scenario area and were limited in redundancy (e.g. if impervious surface was included, urban development was not).

Northern Diadromous Conservation Scenario

The boundary for the analysis was determined based on the extent of diadromous fish habitat. The Northern Diadromous Conservation Scenario targeted all NHD catchments located within watersheds that harbored diadromous fishes based on The Nature Conservancy (TNC)'s Fish Habitat Decision Support Tool Alosine Prioritization results, the Southeast Aquatic Connectivity Assessment Project results, as well as expert knowledge from the ACFHP Steering Committee (Figure 2). The NHD catchments as well as all variable data were then clipped to the project boundary (the pink area in Figure 2). This scenario aimed at identifying those catchments that were the most pristine and also had access to the ocean for diadromous fish migration. All variables and metrics are outlined in Table 3.

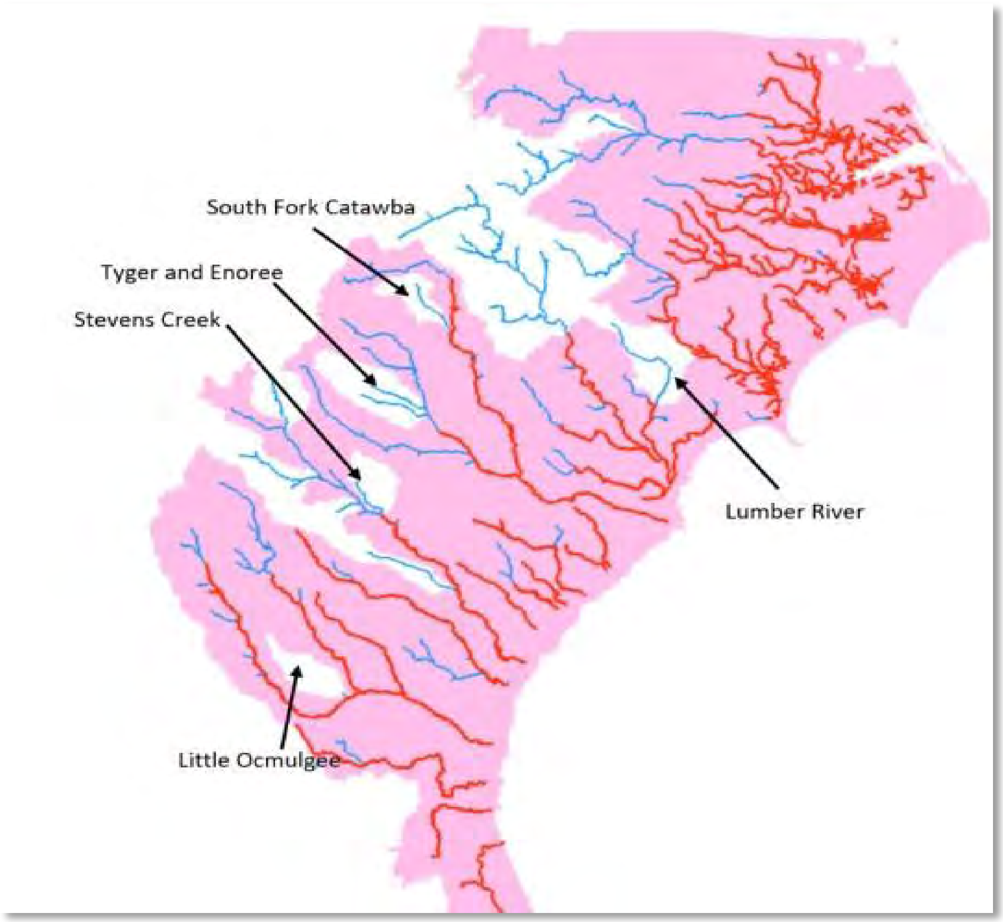

Figure 2. Areas considered for the Northern Diadromous Conservation Scenario. Red represents diadromous data from SEACAP, pink represents alosine extent based on TNC's prioritization, and experts were asked about the reaches labeled in black. This prioritization ended up using the pink area for its scope.

Table 3: Variables, measurements and metrics for the Northern Diadromous Conservation Scenario.

Variable	Measurement	Metric
Impervious surface	area above the catchment that is impervious surface	10 points if <5% cumulative impervious surface
Point source pollution	Density of sites in catchment	10 points if catchment is ranked in the lowest 25% for pollution (least polluted)
Non-point source pollution	% of catchment covered by agriculture	10 points if the catchment is ranked in the lowest 25% for pollution (least polluted)
Riparian buffers	% of floodplain area with natural land cover	10 points if the catchment is ranked in the top 25% for natural coverage
Potential for species access	Anadromous species presence + ocean access	10 points if catchment had an anadromous species present AND was on a network with zero dams downstream to the ocean
Flow alteration	Volume of all reservoirs per unit area of watershed	10 points if the catchment is ranks in the lowest 25% for volume
Fragmentation	Density of road crossings + dams in catchment	Ten points for those catchments that ranked lowest 25% for fragmentation (least amount of dams and crossings)
Sturgeon Critical Habitat	Sturgeon Critical Habitat designation	10 points if the catchment is designated Atlantic sturgeon Critical Habitat

Methods

Impervious Surface

Data for percent impervious surface above the catchment were pre-calculated by the Environmental Protection Agency (EPA) within their EPA StreamCat dataset (see Appendix I). To calculate this variable, EPA used the National Land Cover Dataset from 2011, and accumulated the amount of impervious surface using each catchment as a pourpoint, resulting in the attributes titled 'PctUrbHi2011Ws,' 'PctUrbMd2011Ws', 'PctUrbLo2011WS.' These three attributes were added to capture both high, medium, and low densities of urban land use. Therefore, the cumulative percentage of impervious surface above each catchment was calculated. Once these data were obtained, they were joined onto the catchment dataset via the NHD FeatureID. Once joined, a new field was calculated by sequentially ranking the data from 1 to 133,216 (with the highest number being the best value). Then, these ranks were binned into 5% tiers, and those catchments in the top 5% tier were given 10 points, all else were scored zero points.

Point Source Pollution

Like the impervious surface variable, data for point source pollution were obtained from EPA StreamCAT data, which combined toxic release inventory (TRI) site density (attribute titled 'TRIDensCat'); comprehensive environmental response, compensation, and liability information system site density (attribute titled 'NPDESDensCat'); and permit compliance system site density from the year 2014 (units were sites/km^2). Once this variable was joined to the catchments via 'feature id' and sequentially ranked and binned, those catchments falling in the top 25%, or having the lowest density of toxic release sites, were given 10 points and all others were given zero.

Non-Point Source Pollution

To create a variable for non-point source pollution, the USDA Cropscape raster from 2017 (30 x 30 m resolution) was used to determine the percentage of land cover within each catchment that was a type of agriculture (crops, pasture/hay). For this analysis, the tabulate area tool was used to identify the area of each land cover type present within each catchment, using the catchments as zones. Then, the areas of these landcover types containing agriculture were summed and divided by the total area to come up with a percentage of agriculture per catchment. Once this metric was calculated, it was sequentially ranked and binned in the same way as the above metrics, and those catchments in the top 25% for the least amount of agriculture were given 10 points.

Riparian Buffers

In addition to identifying those areas that had low impervious surface, agriculture, and point source pollution, a metric for riparian buffer coverage was calculated. Modified floodplain boundaries were used to assess riparian buffer health, rather than applying a uniform buffer width from an NHD line, in order to capture the buffers of large rivers. To calculate this metric, a 100-year floodplain boundary was used to quantify the percentage of natural land cover within each catchment to identify those catchments that had healthy floodplains. A raster dataset delineating each stream's 100-year floodplain boundary was obtained from FATHOM (see Appendix I). Because this dataset was of lower resolution than some of the 1:100,000 resolution NHD streams and catchments, a floodplain boundary for these smaller streams needed to be delineated. To delineate this boundary, the NHD streams were converted to a raster and expanded by 90 meters using 'raster calculator,' and then the 'raster to mosaic' tool was used to merge the expanded streams onto the floodplain boundary dataset. This process resulted in a contiguous floodplain boundary dataset that encompassed all

Figure 3. An example of a floodplain boundary within a catchment, used to quantify riparian buffer health.

catchments in the analysis. This floodplain boundary dataset then was split at each catchment boundary using the 'Con' tool in GIS, so that each catchment had a floodplain boundary associated with it via the catchment FeatureID (Figure 3). Finally, these floodplain boundaries were used as zones within the 'tabulate area' tool to calculate the percentage of natural land cover (from the National Land Cover Database, 2011) within each floodplain boundary. Those catchments falling in the top 25% for highest percent natural land cover within their floodplains were given 10 points and all others were given zero points.

Potential for Species Access

To target catchments that had the most benefit to anadromous fishes if conserved, potential for species access was considered. Anadromous species presence in each NHD stream was recorded in the SEACAP project (see Appendix I). In addition to species present, the SEACAP project identified stream reaches/catchments with zero downstream dams: those with open access to the ocean. In order for a catchment to be given 10 points, a catchment had to have at least one species present and have open access to the ocean.

Flow Alteration

In order to identify those catchments with the least amount of flow alteration accumulating from upstream, the StreamCat dataset was used. Within this dataset, EPA calculated the cumulative volume of all reservoirs from large dams ('NID_STORA' in NID) per unit area of watershed (m^3/km^2), resulting in the attribute titled 'DamNIDStorWs.' Those catchments in the top 25% for lowest volume of storage were given 10 points and all others were given zero points.

Fragmentation

Habitat fragmentation resulting from dams and road crossings were also added to the analysis. In addition to large dams, off-stream dams and road crossings can have an impact on diadromous habitat. SARP's Southeast Aquatic Barrier Inventory was used to identify those higher resolution dams and road crossings within each catchment. The number of barriers per square mile was calculated, and those in the top 25% for fewest barriers were given 10 points, all others were given zero points.

Sturgeon Habitat

Whether or not Atlantic sturgeon Critical Habitat was located in a catchment was included in the analysis. Sturgeon Critical Habitat data were obtained from NOAA, and the 'select by location' tool was used to identify those catchments that intersected Atlantic sturgeon Critical Habitat. Those catchments that intersected sturgeon habitat were given 10 points and all others were given zero points.

Results

Once all of the metrics were calculated, they were added together to produce a final score, highlighting those catchments on 'pristine' streams harboring diadromous fish species. A higher score, identified as blue in Figure 4, indicates more 'pristine' areas better suited for protection, and medium scores – those in yellow or green – are areas likely better suited for restoration, based on the variables in our analysis.

The results of the Northern Diadromous Conservation Scenario show that larger mainstem rivers having little development, and often times protected lands, are best suited for conservation. One example of this is in the catchment titled 'Northeast Cape Fear River' (Figure 5). This stretch of river was listed as having five species downstream, and the top score for the Northern Diadromous Conservation Scenario. The Angola Bay Game Land is also present within the catchment. However, not all of the catchment is protected, providing restoration and protection opportunities are still possible in the area.

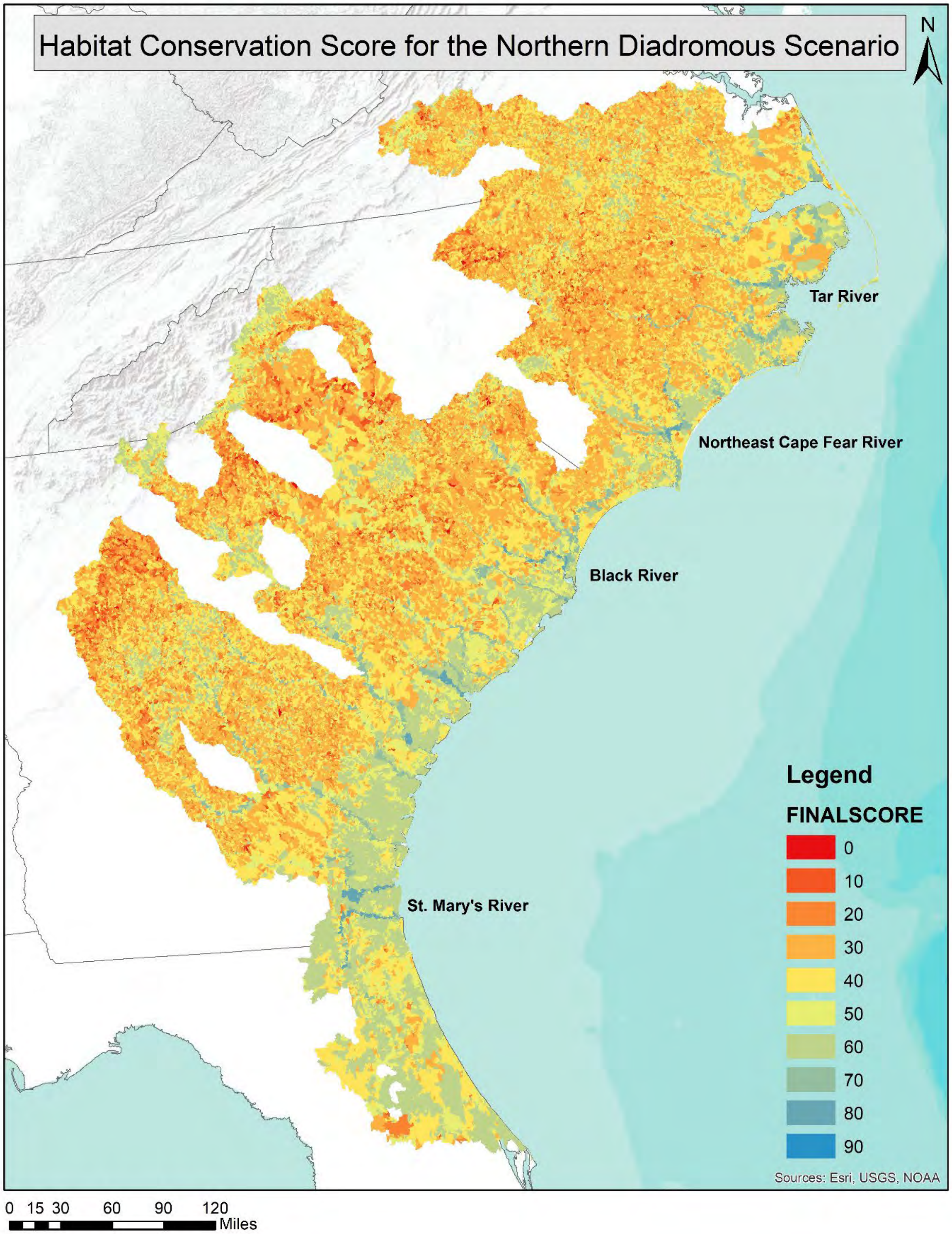

Figure 4. Results of the Northern Diadromous Conservation Scenario. Higher scores (blue) are likely areas better suited for protection, whereas medium scores – those yellow or green, are likely better suited for restoration. Locations with the highest scores are labelled

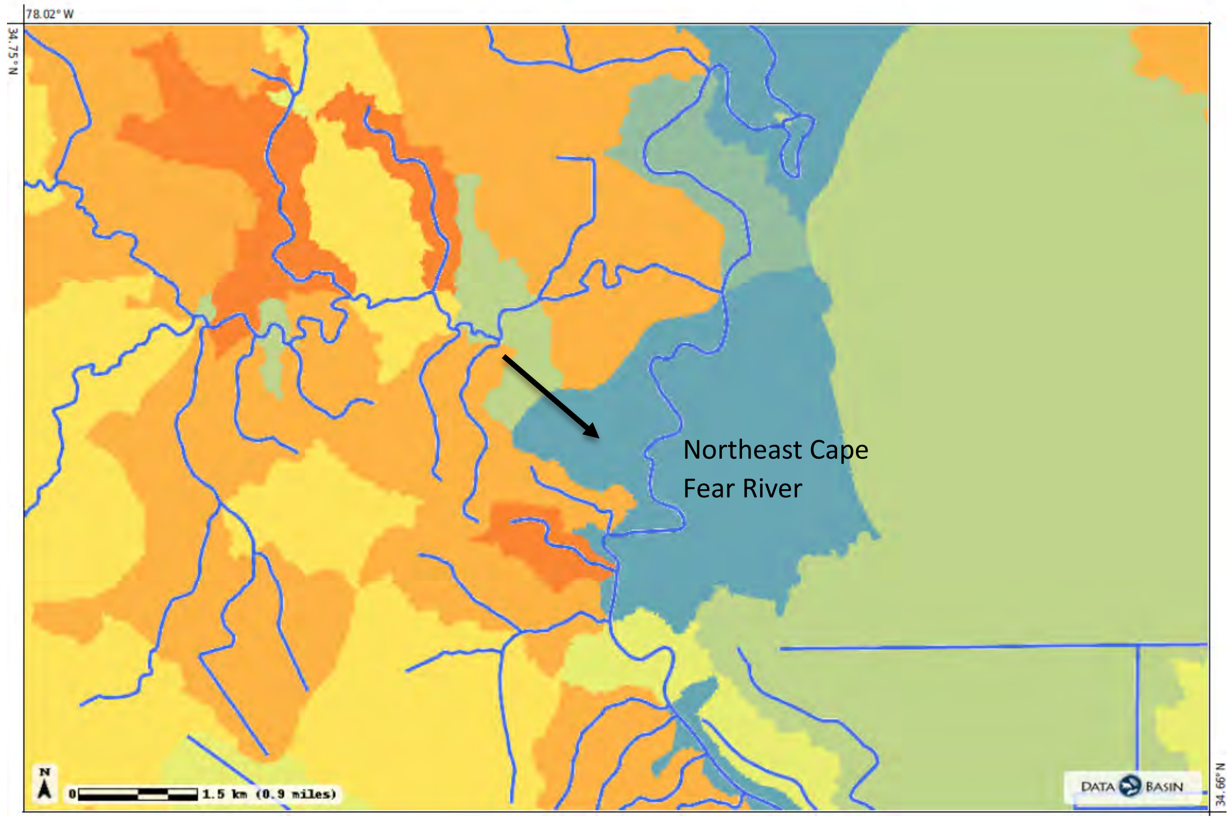

Figure 5. The Northeast Cape Fear River Catchment (black arrow in this figure and labeled in Figure 4) in North Carolina, scored as one of the highest priorities in the Northern Diadromous Conservation Scenario. Part of the catchment is secured lands (Angola Bay Game Land), but not all.

Estuarine Conservation Scenarios

Estuarine Conservation Scenarios were split into a northern and a southern scenario at the border of Cape Canaveral, based on the ACFHP priority habitat subregional designations. However, all methods for metric calculation and scoring were identical for each, except for the 'Water-Vegetation Edge' variable, which was available for the northern portion only. All variables and associated metrics are outlined in Table 4.

Table 4: Variables, measurements and metrics for the Northern and Southern Estuarine Conservation Scenarios.

Variable	Measurement	Metric
Seagrass and oyster reef habitat	% of polygon covered by seagrass or oyster reef	10 points if the polygon ranks in the top 25% for coverage
Wetland habitat	% of polygon covered by wetlands	10 points if the polygon ranks in the top 25% for coverage
Water-vegetation edge*	Length of estuarine-marsh-water edge in the polygon	10 points if the polygon ranks in the top 25% for length
Proximity to protected habitat	Distance to an HAPC	10 points if the polygon is within ½ km of an HAPC
Proximity to development	Distance from marinas and ports	10 points for the 25% of polygons farthest from marinas and ports
Water quality	Total area of 303D sites	10 points for the 25% of polygons with the smallest area of 303D sites
Hardened shoreline	Length of hardened shoreline within the polygon	10 points for the 25% of polygons with the least amount of hardened shoreline
Habitat fragmentation	Linear ft. of causeway within a polygon	10 points if the polygon has 0 ft. of causeways

**Northern scenario only.*

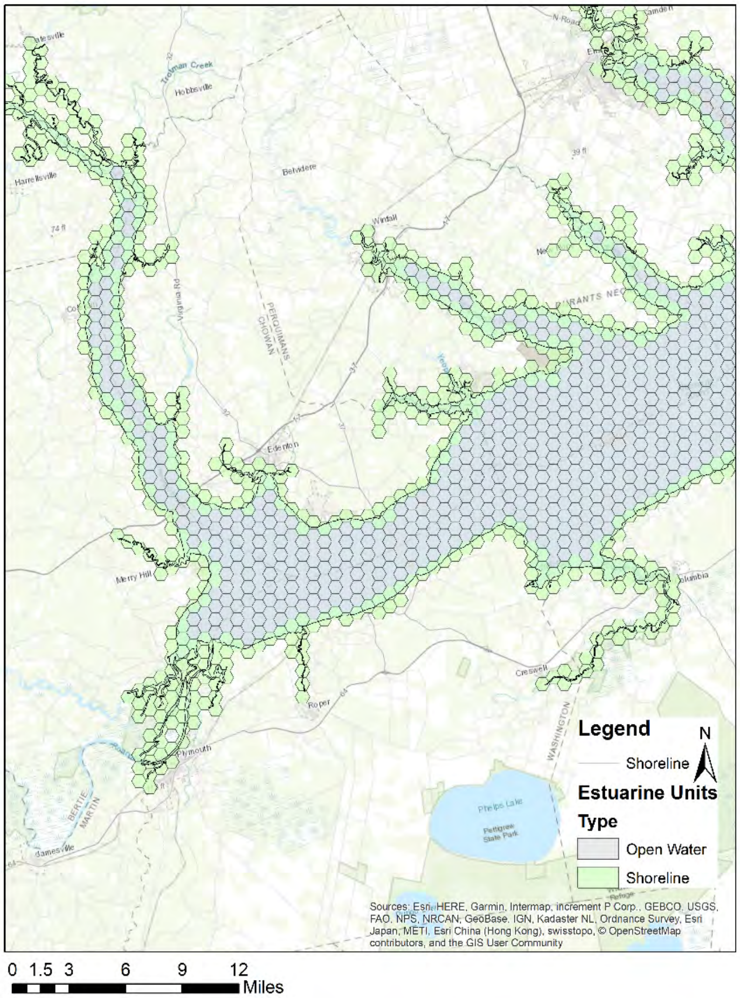

Figure 6. Hexagons generated for the estuarine analysis. Green represents those that intersect the NOAA medium resolution shoreline, and gray is open water. Both were included in the Estuarine Conservation Scenario.

Methods

To calculate the unit of analysis for the estuarine scenario, 1-km^2 hexagons were created using the 'create hexagon tessellation' tool within ArcGIS. Once generated, hexagons that intersected the NOAA medium resolution shoreline plus the open water in between were selected for the analysis (Clingerman et al. 2015) (Figure 6). For Florida Bay, Biscayne Bay, and the Gulf of Mexico, hexagons that intersected polygons with these names within the North American Water Dataset (Esri) were selected.

Seagrass and Oyster Reef Habitat
Data pertaining to the locations of seagrass and oyster reef habitat were obtained from TNC's South Atlantic Bight Marine Assessment (SABMA). Because both habitat types were considered to be of equal value for the analysis, both datasets were merged together and the resultant feature class was converted into a raster dataset.

Finally, the 'tabulate area' tool was used, with the hexagons as zones, to identify the area (m^2) of each hexagon that was composed of either seagrass and/or oyster reef. These areas were divided by the total area of each hexagon to come up with a percentage for each. The hexagons were ranked sequentially, and then binned into 5% tiers. Those hexagons that fell into the top 25% tier for oyster and seagrass coverage were given 10 points, all others were given zero points.

Wetland Habitat
Like the analysis for seagrass and oyster reefs, the percent of each hexagon covered by tidal wetlands was quantified. Wetland data was obtained from the National Wetlands Inventory (NWI), and only those wetlands considered 'tidal' by the NWI were retained using a 'select by attribute' function. This processed dataset was converted to a raster, and the 'tabulate area' tool was also used to identify the area in square meters of tidal wetlands present in each hexagon. These areas were divided by the total area, and hexagons were ranked and binned in 5% tiers. Those hexagons in the top 25% for wetland coverage were given 10 points and all others were given zero points.

Water-Vegetation Edge

This variable was only present within the Northern Estuarine Conservation Scenario, as the data were only available for the South Atlantic Landscape Conservation Cooperative (SALCC) region, which does not cover the peninsula of Florida where the Southern Estuarine Conservation Scenario was analyzed. This analysis was performed by the SALCC to identify the length of the water's edge that intersects wetlands. The data were in raster format, with a rating of 1:4 for each 30 x 30 m^2 cell representing the length of marsh. To use these data in the analysis, the average score for each hexagon was calculated using the 'zonal statistics as table' tool and the hexagons as zones. The hexagons were then ranked and binned into 5% tiers identifying those hexagons with the highest average score. Those in the top 25% were given 10 points, all others were given zero points.

Proximity to Protected Habitat

Protected habitat for this analysis was designated through using the Habitat Areas of Particular Concern (HAPC) dataset obtained from the NOAA Marine Cadastre. A planar distance from each hexagon to an HAPC was calculated using the 'near' tool in ArcGIS. It is important to note that for this variable, the majority of estuaries are considered to be inlet HAPCs, so very few hexagons were outside of these boundaries. All hexagons within 0.5 km of an HAPC were given 10 points, and all others were given zero points.

Proximity to Development

Marinas and ports were used to represent development. Ports and marinas were obtained from the TNC SABMA, and supplemented with state data where available. Marinas and ports were point datasets, however, some state data came in polygon format. These polygons were converted to points and merged into the master dataset. Once merged, the 'near' tool was used to calculate the planar distance from each hexagon to the nearest marina or port. Those hexagons in the top 25% (farthest away) from marinas and ports were given 10 points, all others were given zero points.

Water Quality

Identifying a suitable measurement to assess water quality within estuaries was particularly challenging, given multiple sources of non-point source pollution, complex mixing patterns, and large area covered by estuaries. To create a metric for this variable, 303D listed waters were used. These data were obtained from the EPA website and were in the form of polygons. These polygons were converted to a raster, and the area of each hexagon that was considered impaired waters was calculated using the 'tabulate area' tool. Those hexagons in the top 25% for the least amount of impaired waters were given 10 points, all others were given zero points.

Hardened Shoreline

Hardened shoreline data were obtained from the TNC SABMA. To quantify the length of the hardened shoreline (in km) within each hexagon, the 'intersect' tool was used to split the hardened shoreline polylines at the hexagon boundaries. The resultant split polylines were dissolved by Hexagon GridID to quantify the number of km of hardened shoreline within each hexagon. Ten points were given to those hexagons in the top 25% tier for least amount of hardened shoreline within their borders, all others were given zero points.

Habitat Fragmentation

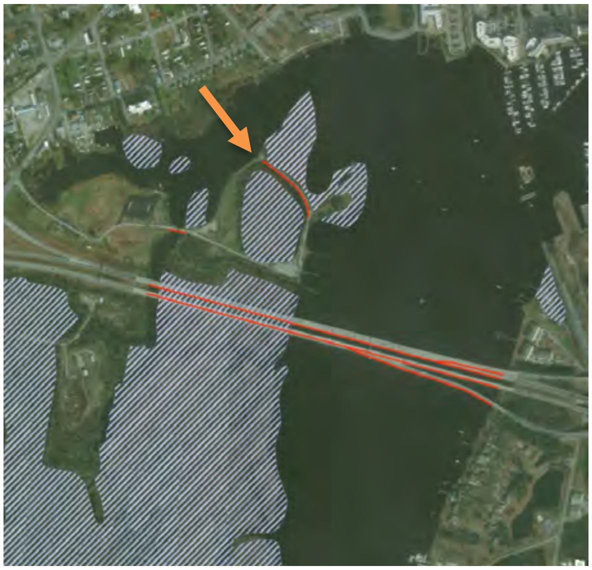

Figure 7. Causeways (red) generated for the habitat fragmentation variable.

Hexagons with the least amount of habitat fragmented by causeways were identified for this variable. Causeways were defined as a road having marsh on at least one side. To create these causeways, Tiger Roads data were used to first identify all roads within estuarine areas. These roads were then clipped by the hexagon boundaries using the 'clip' tool. Tidal wetlands previously generated from NWI data were then aggregated using the 'aggregate polygons' tool with a distance of 300 m to remove any small gaps from within them that would erroneously identify an area of road as being devoid of wetlands all together. The orange arrow in Figure 7 depicts this error, when road fill on either side of the wetland creates a gap between the road line and the wetlands data. Despite the road fill, this is still considered a causeway. By aggregating the wetland polygons, this road fill gap was filled in. Once the wetlands were aggregated, the clipped roads were split by the wetlands boundaries using the 'intersect' tool, resulting in those roads that crossed wetlands, or causeways. The 'dissolve' tool was then used to dissolve the causeways by hexagon GridID, specifying 'shape length' and 'SUM' in the statistics field in order to quantify the length of causeway within each hexagon. Lengths were converted to linear ft., and those hexagons with 0 linear ft. of causeway were given 10 points, all others were given zero points.

Results

Once all of the metrics were calculated, they were added together to produce a final score, highlighting those hexagons considered more 'pristine.' A higher score, identified as blue in Figures 8 and 9, indicates more 'pristine' areas better suited for protection, and medium scores – those in yellow or green – are areas likely better suited for restoration, based on the variables in our analysis.

Results of the estuarine scenarios highlighted many 'pristine' areas that were already protected, such as Roanoke Island and the Elizabeth River, both in North Carolina (Figure 10). However, other clusters of hexagons that are not protected also fell into the top tier for protection, highlighting the need to further protect 'pristine' habitat in the region. It is important to note that this analysis often prioritized open water for protection. Open water hexagons ranked higher than shoreline hexagons in many cases because they tended to be furthest from development. In the future, including information on open water impacts such as trawling, as well as species presence and diversity, should be included when updating this analysis. In addition, sub-setting the analysis to include only those hexagons marked as 'shoreline' and re-ranking and scoring the hexagons could be completed if a shoreline-only scenario is desired.

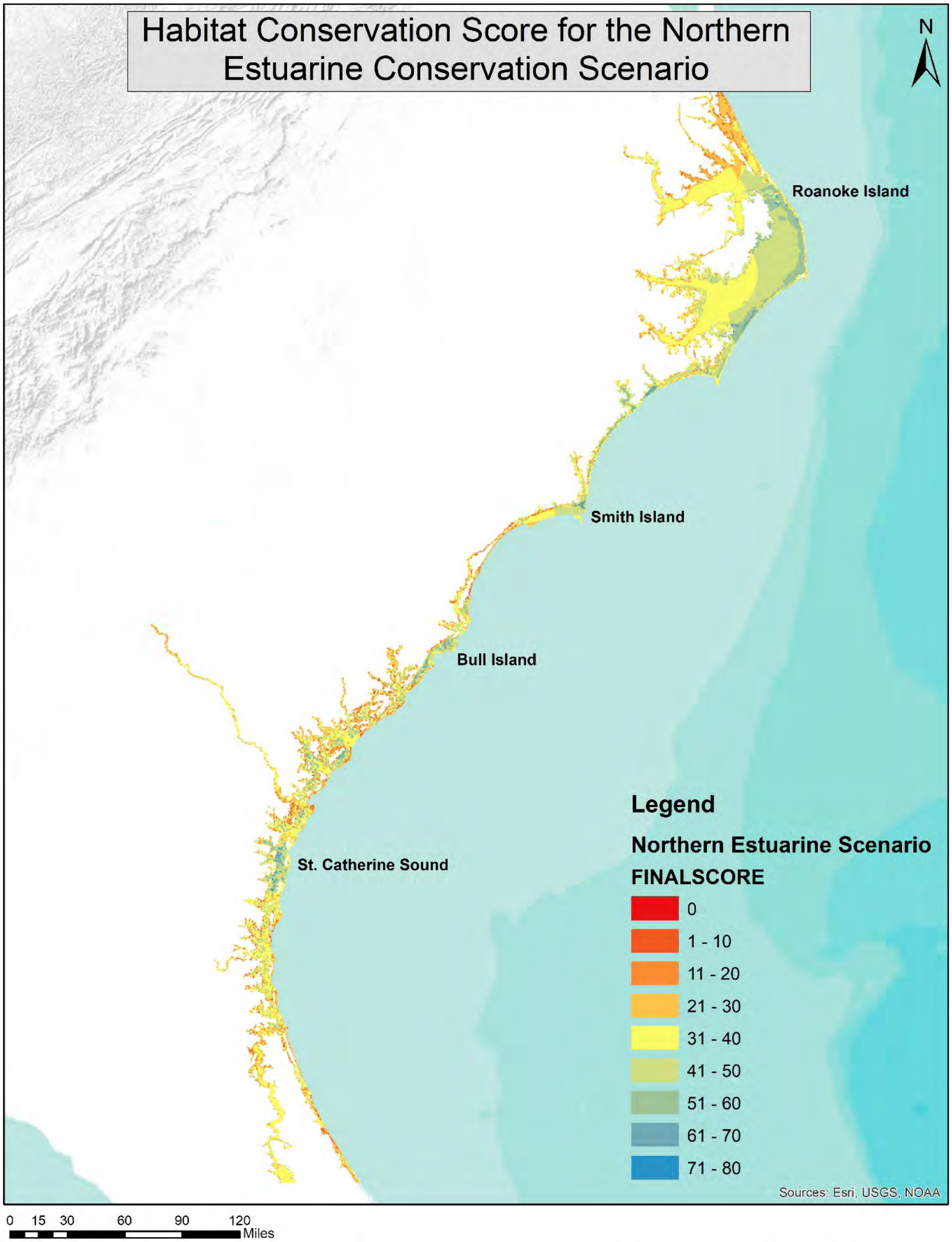

Figure 8. Results of the Northern Estuarine Conservation Scenario. Higher scores (blue) are likely areas better suited for protection, whereas medium scores – those yellow or green, are likely better suited for restoration. Locations with the highest scores are labelled

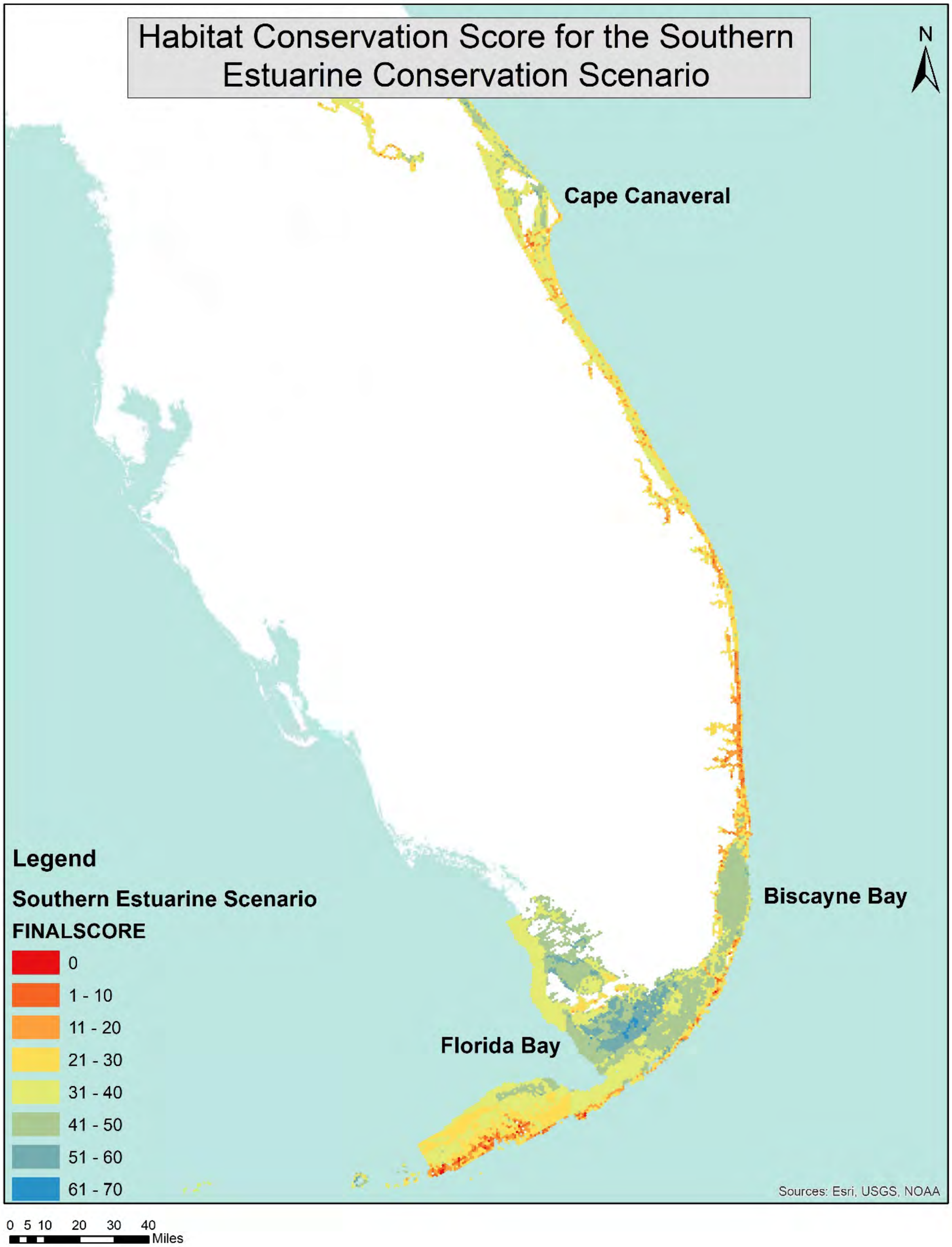

Figure 9. Results of the Southern Estuarine Conservation Scenario. Higher scores (blue) are likely areas better suited for protection, whereas medium scores – those yellow or green, are likely better suited for restoration. Locations with the highest scores are labelled.

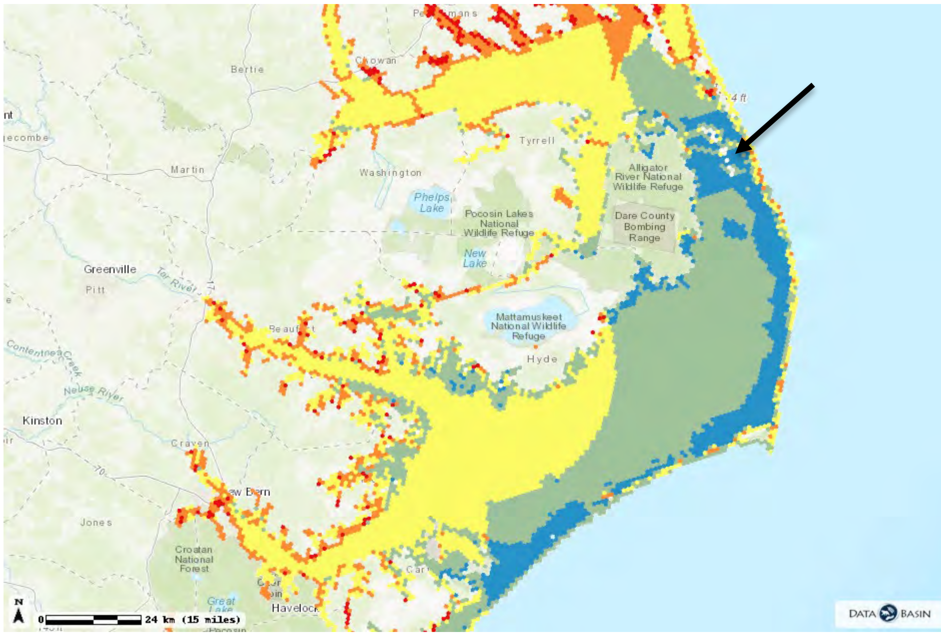

Figure 10. Roanoke Island (black arrow) in North Carolina, had a high score in the Northern Estuarine Conservation Scenario. Part of the island is secured lands, but not all.

Southern Coastal Conservation Scenario

The goal of the Southern Coastal Conservation Scenario was to identify coastal areas south of Cape Canaveral that contained coral habitat, a priority habitat for ACFHP's South Florida subregion. The ACFHP Science and Data Committee decided that all coral habitat was in need of conservation, regardless of quality, due to the slow growth and immediate threats to South Florida reefs (including bleaching, pollution, and disease). Because coral reef restoration is expensive, incapable of replicating the diversity of natural reefs, and already has a multitude of organizations focused solely on these efforts, ACFHP thought it was best to communicate that these reefs are in trouble, and use the map produced in the Southern Coastal Conservation Scenario for outreach purposed to try and minimize threats moving forward.

Methods

To identify priority coral habitat, we combined the Unified Reef Map from the Florida Fish and Wildlife Commission with coral reef and hard bottom HAPC designations. The latter were selected using 'select by attribute' on the Marine Cadastre's HAPC data. These two datasets were then merged together using the 'merge' tool in GIS, to show all of those areas considered to be important for corals.

Results

The Southern Coastal Conservation Scenario highlights both HAPCs and known coral and hard bottom habitat. Originally, for this scenario, 10' squares were the target unit of analysis. However, after identifying all of the area that coral habitat is located, the squares were too large and resulted in a swath of priority area that covered the entire South Florida coast. As a result, the combined dataset of the Unified Reef Map and coral HAPCs were used as the final areas for protection (Figure 11). If more data becomes available in the future, another unit of analysis may be more appropriate.

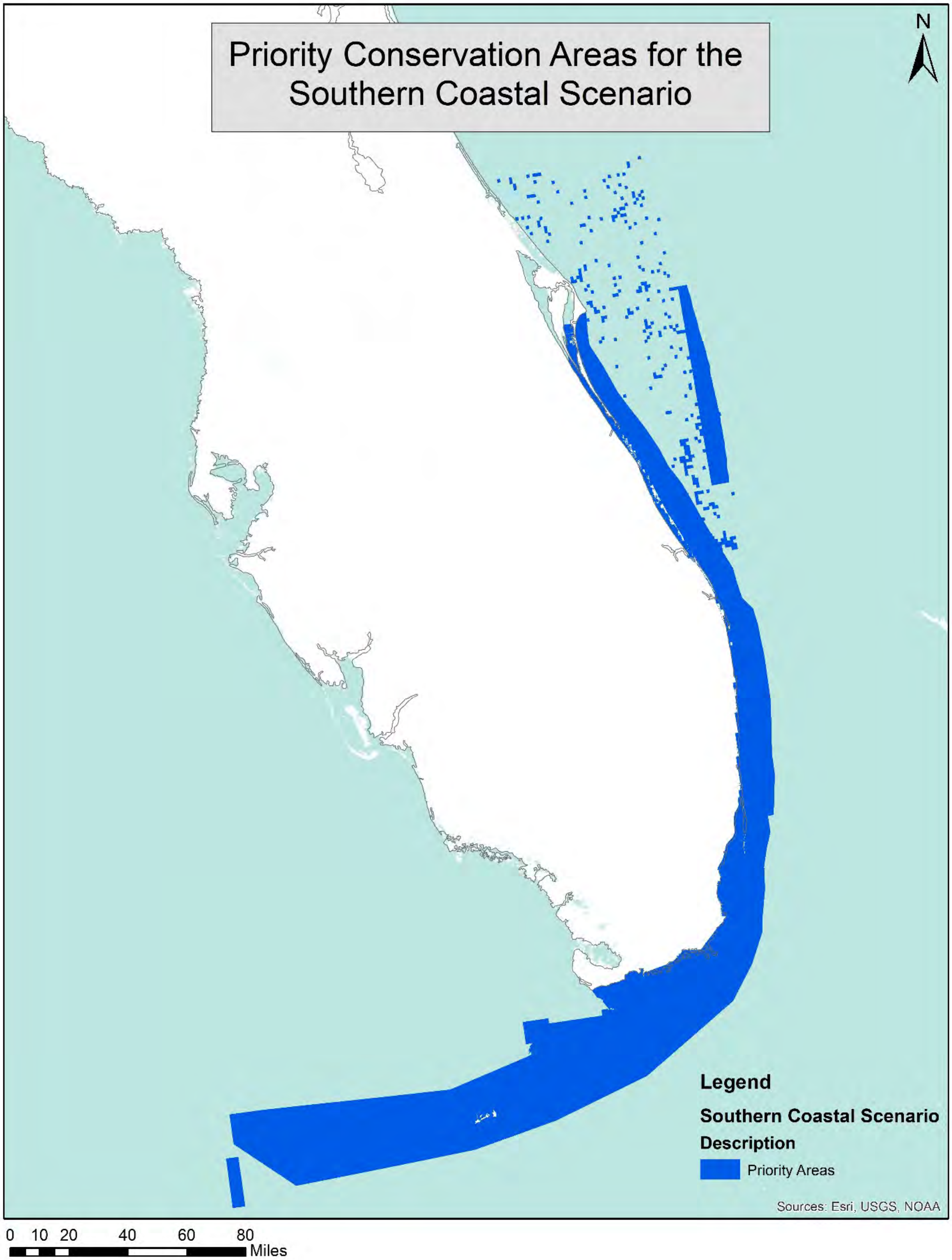

Figure 11. Results of the Southern Coastal Conservation Scenario. Blue areas indicate coral and hard bottom, based on the FL FWC Unified Reef Map and 'coral reef and hard bottom' HAPC designations.

Discussion and Caveats

This project was ACFHP's first attempt at spatially prioritizing areas for diadromous, estuarine, and coastal fish habitat conservation. It is meant as a starting point for resource managers, ACFHP, and other stakeholders to identify areas that are best suited for fish habitat conservation. To view the results online, see Appendix II. The following caveats are provided for interpreting the results.

Caveats

- These analyses focus on the conservation of ACFHP priority habitats, and do not necessarily reflect the need for conservation of other fish habitats or the overall ecosystem.
- Spatial comparisons should only be made within each of the four Conservation Scenarios, and not across them, because of the different variables and metrics used.
- Since not all variables were included in the analyses, we do not recommend selecting areas for protection based solely on these results.

Though a variety of variables were included in these analyses, not all variables that affect fish habitat were considered. Some variables were not included in the analysis due to mixed effects or lack of spatial coverage. For example, sea level rise and sea surface temperature projections were left out, because these changes would affect our priority habitats differently. Sea level rise might create an opportunity for SAV expansion, but drown tidal vegetation. Fish presence and fishing data were not included, because sampling methods were inconsistent across our study area, and were unavailable in many of the shallow water habitats. For these reasons, we do not recommend selecting areas for protection (e.g. Special Management Zones, Marine Protected Areas, Wildlife Management Areas, etc.) based solely on these results.

Research Needs

- A better understanding of the relationship between fish presence and habitat presence and health is needed.
- To better inform the effects of point and non-point source pollution, estuarine mixing and hydrodynamics models for all estuaries would be helpful.
- More quantitative data to support cutoffs for the various metrics would be helpful in the assessment. Aside from a few metrics (e.g. impervious surface, Atlantic sturgeon Critical Habitat), the 25% cutoff for receiving points for a particular variable was chosen for consistency, but not based on scientific findings.

Our goal is to apply the framework developed in this project to the rest of the ACFHP region: from Maine to North Carolina, to create a comprehensive analysis of all ACFHP priority habitats on the East Coast. Feedback from this project, and lessons learned, will be applied to the Northeast Habitat Mapping Project.

Acknowledgements

This assessment was possible through a grant from the NOAA Southeast Regional Office. We thank Caroly Shumway and Josh Chase (formerly Merrimack River Watershed Council) for their help researching and collecting datasets, the Atlantic Coastal Fish Habitat Partnership Science and Data Committee for assessment development and review, the Atlantic Coastal Fish Habitat Partnership Steering Committee for assessment feedback, and Marek Topolski (Maryland Department of Natural Resources) and Julie Devers (US Fish and Wildlife Service) for their assessment feedback and review of this report.

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Appendix I: Data Sources

Note all data were accessed between July 2017 and April 2018.

Conley, M.F., M.G. Anderson, L. Geselbracht, R. Newton, K.J. Weaver, A. Barnett, J. Prince and N. Steinberg. 2017. The South Atlantic Bight Marine Assessment: Species, Habitats and Ecosystems. The Nature Conservancy, Eastern Conservation Science. https://www.conservationgateway.org/ConservationByGeography/NorthAmerica/UnitedStates/edc/reportsdata/marine/sabma/sabma/Pages/Reports-and-Data.aspx

Environmental Protection Agency. 2015. 303D Listed Waters. https://www.epa.gov/waterdata/waters-geospatial-data-downloads#303dListedImpairedWaters

Florida Fish and Wildlife Commission. 2018. Unified Florida Reef Tract Map. http://geodata.myfwc.com/datasets?q=unified%20florida%20reef%20tract%20map

Hill, R.A., M.H. Weber, S.G. Leibowitz, A.R. Olsen, and D.J. Thornbrugh. 2016. The Stream-Catchment (StreamCat) Dataset: A Database of Watershed Metrics for the Conterminous United States. Journal of the American Water Resources Association (JAWRA) 52:120-128. DOI: 10.1111/1752-1688.12372. ftp://newftp.epa.gov/EPADataCommons/ORD/NHDPlusLandscapeAttributes/StreamCat/WelcomePage.html#streamcat_documentation

Martin, E.H., K. Hoenke, E. Granstaff, A. Barnett, J. Kauffman, S. Robinson, and C.D. Apse. 2014. SEACAP: Southeast Aquatic Connectivity Assessment Project: Assessing the ecological impact of dams on Southeastern rivers. The Nature Conservancy, Eastern Division Conservation Science, Southeast Aquatic Resources Partnership. http://maps.tnc.org/seacap/

Martin, E. 2015. Atlantic Coast Whole System Diadromous Fish Prioritization. The Nature Conservancy. http://www.fishhabitattool.org/tnc-atlantic-coast-alosine-prioritization.html

McKay, L., T. Bondelid, T. Dewald, J. Johnston, R. Moore, and A. Rea. 2012. NHDPlus Version 2: User Guide. http://www.horizon-systems.com/NHDPlus/NHDPlusV2_data.php

National Oceanographic and Atmospheric Administration National Marine Fisheries Service. 2014. Habitat Areas of Particular Concern. http://www.habitat.noaa.gov/protection/efh/habitatmapper.html

National Oceanic and Atmospheric Administration National Ocean Service and Bureau of Ocean Energy Management. Marine Cadastre. https://marinecadastre.gov/

South Atlantic Landscape Conservation Cooperative. Water-Vegetation Edge. https://salcc.databasin.org/datasets/00ecbf6049d4481db1f1416e4e3b8cc2

USDA National Agricultural Statistics Service Cropland Data Layer. 2017. Published crop-specific data layer [Online]. https://nassgeodata.gmu.edu/CropScape/. USDA-NASS, Washington, DC.

United States Census Bureau. 2017. TIGER/Line Shapefiles (machine readable data files) / prepared by the U.S. Census Bureau. https://www.census.gov/geo/maps-data/data/tiger-line.html

United States Fish and Wildlife Service. 2016. National Wetlands Inventory. https://www.fws.gov/wetlands/data/mapper.html

Appendix II: Databasin Maps and Downloadable Data

Maps

All datasets are hosted online in the Databasin Map:
https://databasin.org/maps/e8327d587c1a4eb583cf9a007361dc8c/active

To toggle the different Conservation Scenarios on and off, click the 'Layers' tab on the box in the upper left corner of the map. Check the boxes located to the left of each Scenario of interest under 'Datasets.'

You can change the transparency of a layer by clicking the 'play' button to the right of the Scenario dataset, and then hovering over 'transparency.'

For Databasin video tutorials, FAQs, and support staff, visit:
https://databasin.org/help.

Data

To download the GIS data for each map, click on the 'play' button to the right of the Conservation Scenario you're interested in (in the table on the upper left corner of the map), then click 'details.' Click on the title of the Scenario that pops up under the header 'Dataset Details.' This will take you to a new page, with all of the Conservation Scenario's details. Click on the 'Data Layers' tab under the map, and scroll to the bottom. The 'Metadata Files' are located there, available for download.

Alternative, you can access the page directly via the following links:

Northern Diadromous Conservation Scenario
https://databasin.org/datasets/1319cc9dec6c4bb188cbc3e9e5e719b0

Northern Estuarine Conservation Scenario
https://databasin.org/datasets/0d21c83295984c3c89d7edf60d046ec8

Southern Estuarine Conservation Scenario
https://databasin.org/datasets/89314044554344bd98b1e099d52cc74d

Southern Coastal Conservation Scenario
https://databasin.org/datasets/80119a55b4c34aec95604c3e06dddd5a

Seagrass Indicators

(Additional indicators that may be sampled)

Tier 1:

Parameter	Indicator
Seagrass	Acreage
	Bed Patchiness
	Species Composition
Macroalgae	Presence/Absence
Condition	Prop Scarring
	Bioturbation

TIER 2:

Parameter	Indicator
Seagrass	Canopy Height
	Condition (Observed)
	Deep Edge
	Percent Cover
	Percent Cover by Species
	Biomass
	Species Composition
Environment	Depth
Macroalgae	Presence/Absence (Drift vs. Attached Algae)
Water Quality	Dissolved Oxygen
	Light Attenuation (PAR profile/Secchi)
	pH
	Salinity
	Temperature
	Turbidity/TSS
	Color/CDOM
	Chlorophyll A
Community	Composition (e.g. sponges)
Condition	Prop Scarring
	Bioturbation
	Elemental Composition of Leaf Tissue

Tier 3:

Parameter	Indicator
Seagrass	Biomass
	Canopy Height
	Condition (observed)
	Stable Isotope Analysis of C&N
	Percent Cover
	Shoot Count/Density
	Species Composition
	Tissue Element Composition (CNP)
	Flowering
	Presence/Absence of Keynote species
	Growth/Productivity
	Stable Isotopes (C, N, P, S)
	Herbivory
	Genetic Diversity
	Stressor Proteins
	Leaf Allometry
Environment	Sediment/Substrate (grain size, organic content)
	Pore Water Chemistry
	Wave Energy
	Tidal Exposure
	Freshwater Inflow
Macroalgae	Dissolved Oxygen
	Canopy Height
	Drift vs Attached Algae
Water Quality	Dissolved Oxygen
	Light Attenuation (LICOR/Secchi)
	TSS
	CDOM/NTU
	Chlorophyll A
	Salinity
	Temperature
	Turbidity
	Nutrients
	Polycyclic Aromatic Hydrocarbon (PAH)
	pH
	Stable Isotopes (C, N, P, S)
Community	Composition (e.g. sponges)
	Epiphytic Grazers
	Invertebrates
	Epiphytic Load
	Faunal Usages/Abundance
	Herbivory
	Presence/Absence of Keynote Species
	Secondary Productivity
	Prop Scarring
	Bioturbation
	Disease

***Explanation of how Indicators were determined*:**
Forty seagrass and environmental specialists at the 2017 Seagrass Workshop formulated a list of Indicators for each Tier. All Indicators were prioritized in a post-workshop survey of the participants. The highest priority Indicators were determined to be the minimum needed to be sampled at each Tier location. Any/all of the Indicators listed in the Seagrass Indicator Table plus others that did not make the listing may be sampled.

Tier Application

A seagrass inventory and monitoring protocol will produce an invaluable resource to guide future efforts for conservation and restoration. The first step in producing a protocol is the development of a comprehensive approach for seagrass monitoring. The Approach Construct is best viewed through a matrix concept by tier hierarchy based on spatial area, frequency of monitoring, and scope of intent.

Tier 1 characterizes the overall distribution and extent of seagrasses in a defined ecosystem. The metrics used in Tier 1 are typically acquired by well-established and widely used and available remote sensing methods (aerial or satellite imagery) and analysis techniques. Tier 1 in the hierarchy is designed to characterize a few numbers of specific properties, ideally to inventory seagrasses over the entire system of interest (e.g., GOM), while simultaneously characterizing relatively large regional areas. Tier 1 monitoring has been one of the most commonly used approaches for assessing the status and trends of seagrasses over long time periods and broad scales.

Tier 2 characterizes the ecological condition of seagrasses over relatively large areas by carefully selecting statistically valid sample sites and monitoring frequency. Tier 2 surveys are generally restricted to subsections of the larger ecosystem, collected in or on the water at a greater number of sites and a higher temporal frequency than Tier 1. Tier 2 data provides more detailed properties describing the spatial-temporal variation in seagrass structure (e.g., species composition, size) and abundance (e.g., percent cover, shoot density) to quantify stressor/response relationships and produce estimates of the ecological condition of resources over broad areas.

Tier 3 monitoring includes more intensive monitoring than Tier 2, sometimes using a larger number of metrics sampled simultaneously and more frequently, and usually at a smaller number of sites that are smaller in size. Tier 3 monitoring is driven by specific scientific hypotheses (e.g., measuring levels of uncertainty, evaluating multiple process-related responses) and local and regional programs that directly address questions regarding the specific mechanisms responsible for the changes detected in Tiers 1 and 2. Tier 3 can be effectively used to monitor the suspected drivers of change simultaneously with multiple seagrass stress response metrics in order to gain much better resolution and decrease ambiguity. Tier 3 monitoring is designed to test hypotheses and confirm or refute suspected mechanisms for stressor/response relationships.

Matrix and Hierarchy Integrations

The benefits of integrating Tiers 1 and 2 in the hierarchical framework are major improvements for understanding the status and trends of seagrasses with regard to the factors responsible for change. Tier 2 metrics are also used to ground truth and verify the interpretation and accuracy of remotely sensed data acquired in Tier 1. Also, Tier 1 and Tier 2 metrics can be combined with other environmental monitoring to assess broad-scale relationships. When integrated with Tiers 1 and 2, the high-resolution information generated from Tier 3 metrics can be used to provide resource managers with scientifically defensible support and the necessary guidance for making critical conservation and management decisions. A fully integrated hierarchical approach to monitoring also provides the comprehensive multi-scale information needed to develop more reliable predictions with ecosystem-based models that are designed to incorporate seagrasses.

Indicators

Seagrass beds are dynamic, complex systems, and many of the parameters used to characterize habitat condition exhibit considerable temporal and spatial variability. To accurately assess seagrass ecosystem condition, monitoring should include frequent sampling at selected permanent stations. The Tier 1, 2, and 3 indicators would yield consistent and comparative information on Gulf-wide and regional seagrass habitat status and trends.

The selection of seagrass condition indicators takes into account several generic attributes:

1) is measurable with standardized and repeated non-destructive or minimally destructive techniques,
2) is sensitive and responsive to change with low measurement error,
3) does distinguish natural variation from background, and
4) is predictable in a threshold response to factors known or hypothesized to affect seagrasses.

The integrated characteristics of the Tier Approach are designed so that metrics collected at different spatial-temporal scales can be shared and integrated across the Tiers to comprehensively inform scientists and managers about the complex interactions that occur between components across the large seagrass ecosystems of the Gulf of Mexico.

Each Tier measures different metrics determined by:

- a consensus of the scientific understanding of ecological processes,
- the policy needs of environmental managers, and
- the stakeholders expected to benefit from using the information gathered in the monitoring program.

Seagrass conservation and management program goals span different temporal and spatial scales and some of the attributes may be more or less applicable to a program, depending on its scale.

Acknowledgements:

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A Seagrass Monitoring Approach for the Gulf of Mexico

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Tier	Definition	Implementation (When and How)	Data Acquisition Technology	Data Analysis	Indicators[†] (Minimum to be Sampled)	What is informed by Tier
1	Characterizes a few ecosystem properties simultaneously at very large spatial scale, typically using high resolution remote sensing methods.	• Should be conducted on, at least, a 5-10 year update cycle. *Groundtruthing* • Must have a groundtruthing element (lower intensity sampling than Tier 2). Observations are not applied at a per unit area basis.	Remote observation • High resolution (≤1m pixel) satellite imagery • Airborne (≤1m pixel) imagery • Side-scan sonar • Single-beam sonar • LIDAR* • High resolution airborne hyperspectral imagery* *Groundtruthing* • On-water observation • Underwater video/still photography	• OBIA (Object-based Image Analysis) • Visual interpretation • Spectral clustering • Acoustic signal processing • Accuracy assessment statistics *Groundtruthing* • Visual determination	Seagrass Parameter • Acreage • Bed patchiness • Distribution (geographic)	• Adaptive Management • Presence or absence • Synoptic extent and distribution (ex. Patchy vs continuous beds) *Groundtruthing* • Species composition • Presence or absence
2	Broad-scale surveys in bays, sounds, and lagoons used to address specific environmental issues or biotic & abiotic ecosystem properties at a finer resolution of samples; provide more detailed information using field in-water sampling.	• Time scale should be more frequent than Tier 1. • Tier 2 and 3 monitoring should inform each other in terms of when to remap. • More samples quantified at a smaller scale, sufficient to characterize system-wide statistical estimators (e.g. mean, medium, coefficient of variation, etc.).	• Tier 1 technologies can be used with Tier 2 analysis and monitoring. • PAR profile/Secchi disc • Quadrats • Underwater video/still photography • UAS (drones)	• Beer's Law • In-situ visual interpretation (non-destructive) • Braun Blanquet scores • Visual interpretation (lab)	Seagrass Parameter • Percent cover • Percent cover by species • Species composition Environmental Parameter • Depth Water Quality Parameter • Light attenuation (PAR profile/Secchi) • Salinity	• Adaptive Management • Stressor/response relationships • Estimates of the ecological condition of resources over broad areas • Quality of the system as a function of physical, chemical, and biological parameters • Cover categories
3	Relatively smaller area surveys than Tiers 1 and 2 addressing a greater number of biophysical and chemical properties at a much smaller number of locations or index sites. These locations can be processed-based investigations or hypothesis testing conducted at a site or multiple sites within the larger system.	• Tier 3 locations may be monitored at greater frequency than Tier 2. • Tier 2 and 3 studies should inform each other. • Potentially, more samples quantified at a smaller scale. • Fixed stations / transects are preferred. • Some form of random sampling. • Monitoring on at least an annual basis. • Location of Tier 3 sites and sampling intensity/frequency is driven by the hypothesis being tested.	• Tier 1 and 2 technologies can be used with Tier 3 analysis and monitoring. • Destructive sampling • Multiple sampling sensors/data loggers • Elemental/gas analyzers • Additional data acquisition technologies	• In-situ (non-destructive) • Laboratory (destructive) • Visual interpretation (lab)	Seagrass Parameter • Percent cover • Percent cover by species • Species composition Water Quality Parameter • Light attenuation (PAR profile/Secchi) • Salinity	• Adaptive Management • Monitoring • Causal relationships • Specific research hypotheses • System-wide predictive capabilities or understanding past changes

[†] See reverse side for additional indicators.

*These technologies have been applied at small scales but have not been operationally applied at the Tier 1 level. Still in the R&D phase.