UPDATE:
U.S. FISH AND WILDLIFE SERVICE FUNDING FOR ACFHP PROJECTS

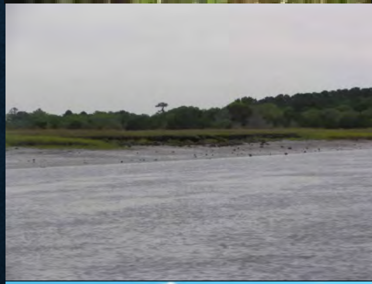
ON-THE-GROUND PROJECTS

- 2010 to 2018 – U.S. Fish and Wildlife Service funded 20 on-the-ground projects
- $672,234 awarded to partners
- Leveraged $11,948,033 matching funds and in-kind services
- Funding supported
  - 9 fish passage projects
  - 11 coastal habitat restoration projects
    - 3 marsh/mangrove restoration projects
    - 3 submerged aquatic vegetation (SAV) projects
    - 4 oyster reef restoration projects
    - 1 sturgeon spawning habitat restoration

ACFHP OPERATIONS

- From 2014 -2018 - U.S. Fish and Wildlife Service provided funding for ACFHP Operations
- $251,125 awarded to ASMFC
  - 2018 - $66,125
  - 2017 - $75,000
  - 2016 - $50,000
  - 2015 - $30,000
  - 2014 - $30,000

ON-THE-GROUND PROJECTS



LEVEL 3!!!

Based on 2015-2017 reported in the FY18 annual report.

- Habitat assessments
  - L3= habitat assessment addressing climate change – guide project selection
- % address priority species or priority areas
  - (L3=At least 95%)
- % address FWS or trust resources
  - (L3=at least 75%)
- % completed
  - (L3=at least 80%)
- % with a monitoring plan
  - (L3=at least 90%)
- Leveraged funding
  - (L3=At least 3:1)
- % FHP priority areas
  - (L3=95%)
- % actions achieve project goals
  - L3=100%



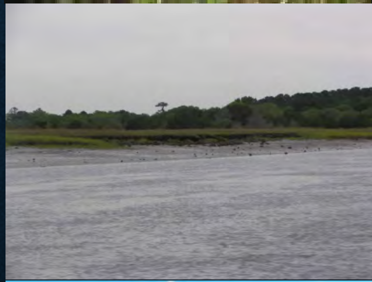


ON-THE-GROUND PROJECTS









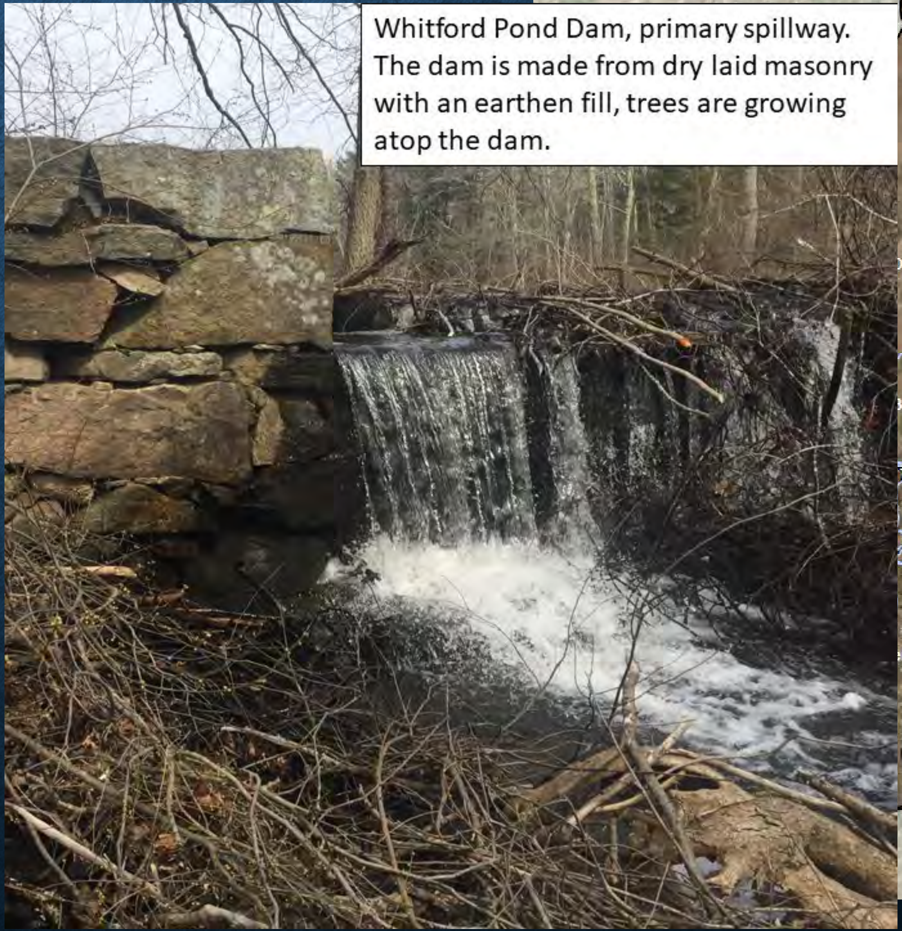

ON-THE-GROUND PROJECTS

FY19 Project Name	State	Request	Direct	Indirect	Match
ACFHP Operations	VA	$66,125	$66,125	$0	$0
Whitford Pond Dam and River Restoration Design, Mystic River	CT	$50,000	$50,000	$5,493	$271,000
Restoration of SAV in the Freshwater and Meso-haline Region of the Chesapeake Bay **	MD	$16,895	$7,170	$1,265	$30,018
Outlet Stream/Outlet Dam, North Vassalboro	ME	$50,000	$50,000	$8,824	$282,147
Outlet Stream/Box Mill Dam, North Vassalboro	ME	$50,000	$50,000	$8,824	$335,027
Old Mill Pond Dam Fish Passage, Wreck Pond Brook	NJ	$50,000	$37,539	$6,624	$89,718
Finding the Right Mix: Developing Best Practices for Cement/Oyster Composition Artificial Reefs **	FL	$48,091			$57,525
Repair of Fish Ladder in Pennamaquan River	ME	$50,000			$77,500
Desden Bog Wildlife Management Area Fish Passage Project	ME	$50,000			$57,750
TOTAL	ACFHP Allocation LEVEL 3!	$291,864	$260,834	$31,030	

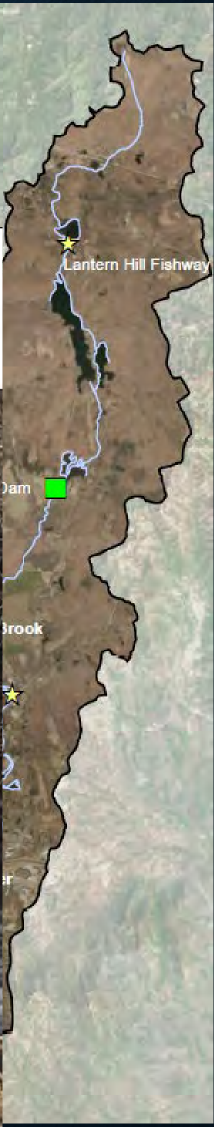
WHITFORD POND DAM RIVER RESTORATION DESIGN, MYSTIC RIVER, CT

FY19 - $50,000   Total - $321,000

- First barrier on the Mystic River
- 1.2 miles fish passage for diadromous fish
- 26.4 acres of improved habitat
- River restoration with fish passage at two other barriers
  - 9.5 miles of reconnected river/floodplain
- Timeline: 2019 - 2020



Whitford Pond Dam, primary spillway. The dam is made from dry laid masonry with an earthen fill, trees are growing atop the dam.



RESTORATION OF SAV IN THE FRESHWATER AND MESOHALINE REGION OF THE CHESAPEAKE BAY, MD

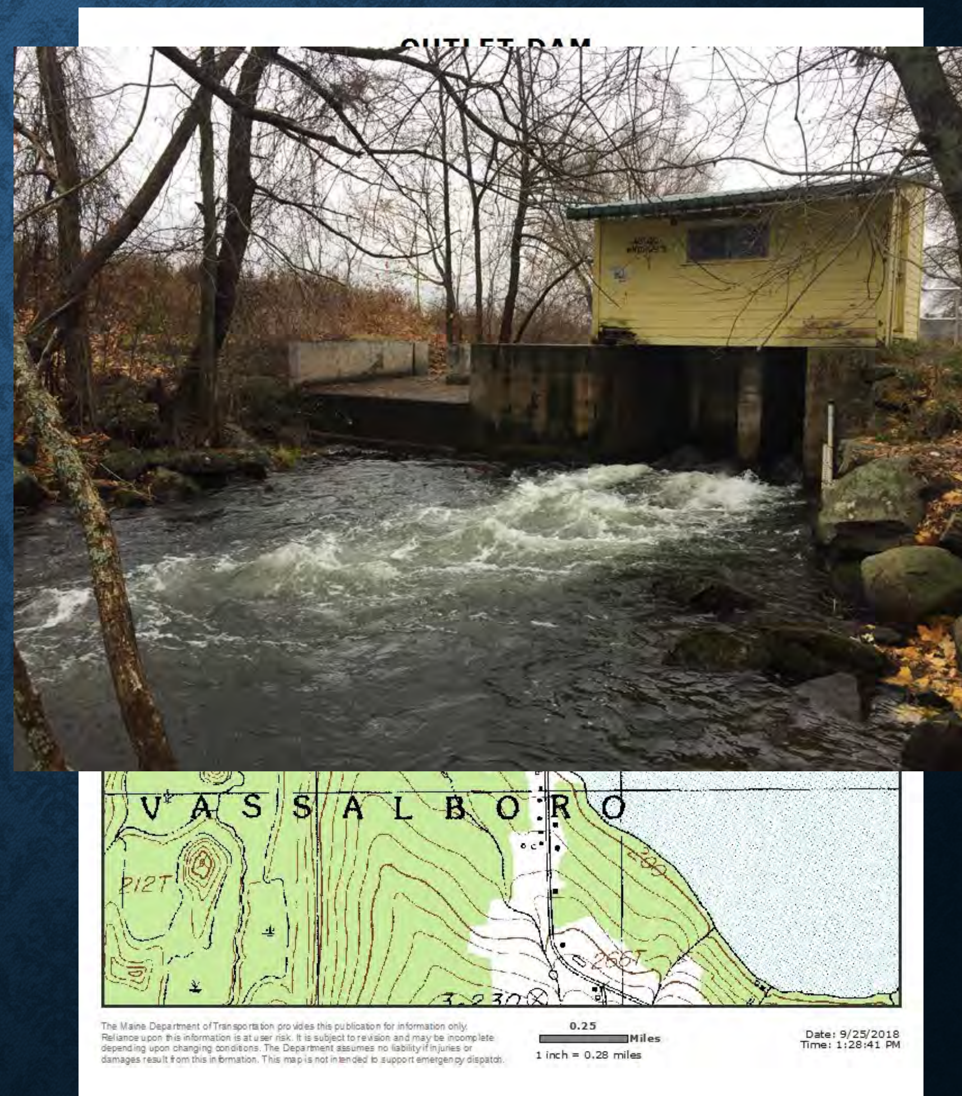
FY18 - $9,725 FY19 - $7,170 Total - $46,913

- 10-20 acres of SAV restoration through seed harvest and dispersal
- Timeframe: 2019 - 2020
- Part of Chesapeake Bay Program's goal of 185,000 acres of restoration

FISH PASSAGE, OUTLET STREAM/OUTLET DAM, ME

FY19 - $50,000   Total - $335,027

- Construction phase of a Denil fishway
- Last dam between the ocean (Sebasticook to Kennebec) and China Lake
- 4 other dams either with fish passage or being removed
- nursery habitat for ~800,000 alewives
- Timeline: design will be completed in 2019 and construction in 2020



FISH PASSAGE, OUTLET STREAM/BOX MILL DAM, ME

FY19 - $50,000   Total - $780,000

- Denil Fishway at Box Mill Dam
- First Barrier to Fish Passage in Outlet Stream
- 6 Dams on Outlet Stream will be removed or have fish ladders by 2021
- Denil Fishway will provide access to 800,000 alewives to upstream spawning habitat in China Lake (4,000 acres)
- Construction was planned for FY19

OLD MILL POND DAM FISH PASSAGE, WRECK POND BROOK, NJ

FY18 - $50,000   Total - $139,718

- Construction of a 60’ long Alaska steep pass fishway
- Opens 0.9 miles of spawning habitat
- Declining number of spawning alewife in Wreck Pond Brook
- Builds on 2013 fish passage project at Wreck Pond (600 foot concrete box culvert)
- Timeline: summer/fall 2019

DELAYED FUNDING

- FY18 reporting delayed (6 months)
  - Approval process for increase in coordination funding to $85,000
  - Furlough - January, 2019
  - New coordinator hired - Eric MacMillan - started March 4, 2019
  - TIME LINE
    - May 7, 2019 Instructions for FY18 Report sent
    - June 5, 2019 FY18 Reports submitted
    - June 30, 2019 FY19 Grant/coop agreement submitted
    - August, 2019 FY19 Funding allocation announced
    - September 12, 2019 FY19 project list to field staff and Lisa on
    - September - all systems shut down
- Financial Assistance back up and running and will process FY19 grant/coop agreements by the end of December
- FY19 Report Instructions sent out October 2, 2019

FY20 FUNDING

- July 19, 2019 Lisa released RFP
- September 13, 2019 - 13 proposals received by deadline
- September 16, 2019 - Lisa distributed to the review team:
    - Julia Socrates
    - Julie Devers
    - Kent Smith
    - Jimmy Johnson
    - Marek Topolski
    - Mark Rousseau
- October 10, 2019 – Review Team met to discuss

FY20 PROPOSALS

Project Name	Average Score
Magothy River Shoreline Restoration	213
Dam Removal and Diadromous Restoration of the Norwalk River Watershed at Merwin Meadows Park	210.17
Environmentally Friendly Oyster Reef Restoration in Mosquito Lagoon, Volusia County, Florida - NFHP	202.67
Armstrong Dam Removal, Monatiquot River, Braintree, MA NFHP	201.17
Rose Bay NFHP Estuarine Restoration, Port Orange, FL	196.5
County Line Dam Removal, Paulins Kill	189.17
Town Brook Stream Restoration: Jenney Grist Mill Nature-Like Fishway Bypass, Town Brook, Plymouth MA NFHP	186.4
Woodhull Dam Fish Passage and Peconic River Connectivity Project, Little River, Riverhead, NY NFHP	186.17
Crooked Brook Dam/Baskahegan Lake Fishway. Danforth, ME NFHP	177.17
Marine Meadow Eelgrass Habitat Restoration	171.5
2020 Severn River Operation Build-A-Reef, Severn River, Ann Arundel County, MD FFHP	168.5
Finding the Right Mix: Developing Best Practices for Cement/Oyster Composition Artificial Reefs for Oyster and Fish Recruitment	163.83
Lake Shenandoah Fish Ladder Rehabilitation, South Branch Metedeconk River, Lakewood, NJ NFHP	158.67

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FY20 PROPOSED PROJECTS

Project Name	Score	Request	Total Cost
Magothy River Shoreline Restoration, MD passage)	213	$50,000	$297,500
County Line Dam Removal, NJ (passage)	189.67	$50,000	$450,000
Environmentally Friendly Oyster Reef in Mosquito Lagoon, FL (non-passage)	202.67	$49,999	$172,283
Town Brook Stream Restoration: Jenney MA (passage)	186.4	$50,000	$399,638
Rose Bay Estuarine Restoration, FL (non-	196.5	$50,000	$100,145
Woodhull Dam Fish Passage and Peconic Connectivity Project, NY (passage)	186.17	$50,000	$887,460

MAGOTHY RIVER SHORELINE RESTORATION, MD

FY20 - $50,000 Total - $297,500

- Restore 500 Linear Feet of Shoreline
- Reduce chronic erosion problem
- Establish native plant tidal wetland
- Use seeded reef balls and
- Woody tree boles and root fans
- Design and permit completed – funding would be used for construction
- Timeframe: 2021

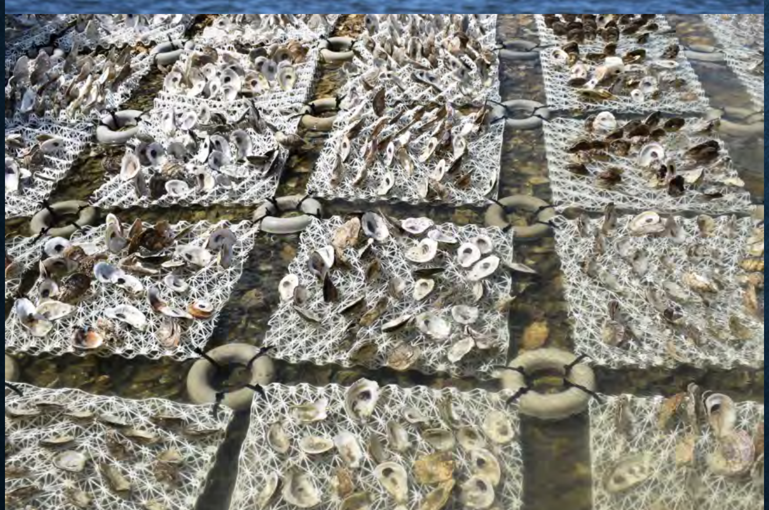
COUNTY LINE DAM REMOVAL, NJ

FY20 - $50,000   Total - $450,000

- Remove the 2nd Dam on the Paulins Kill to open 3.5 miles
- Columbia, Paulina (design phase) and County Line Dam removals will open 45 miles
- Timeframe: 2020

OYSTER REEF RESTORATION IN MOSQUITO LAGOON, FL

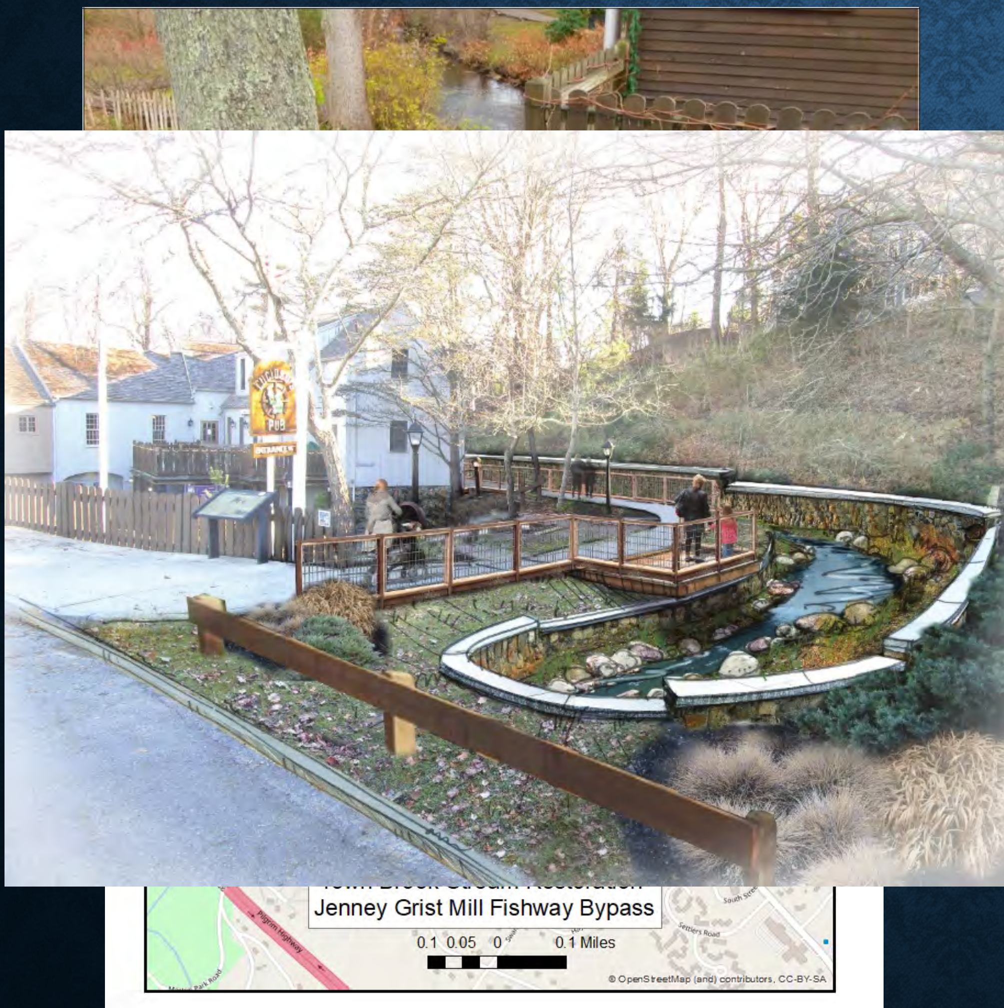
FY20 - $49,999   Total - $172,283



- Restore 420 Linear Feet of Habitat, 53 Linear Feet of oyster reef
- Reduce erosion from boat wake using oyster restoration mats – 4-6 reefs
- Timeline: 2020

TOWN BROOK STREAM RESTORATION: JENNEY BROOK GRIST MILL, MA

FY20 - $50,000   Total - $399,638



- First barrier on Town Brook (Plymouth Harbor)
- Open access to 269 acres of alewife spawning habitat in the Billings Sea
- Replace a 60 foot Alaskan Steep Pass with a 420 foot bypass chanel with a 2% slope and several resting pools
- Timeline: June 2021

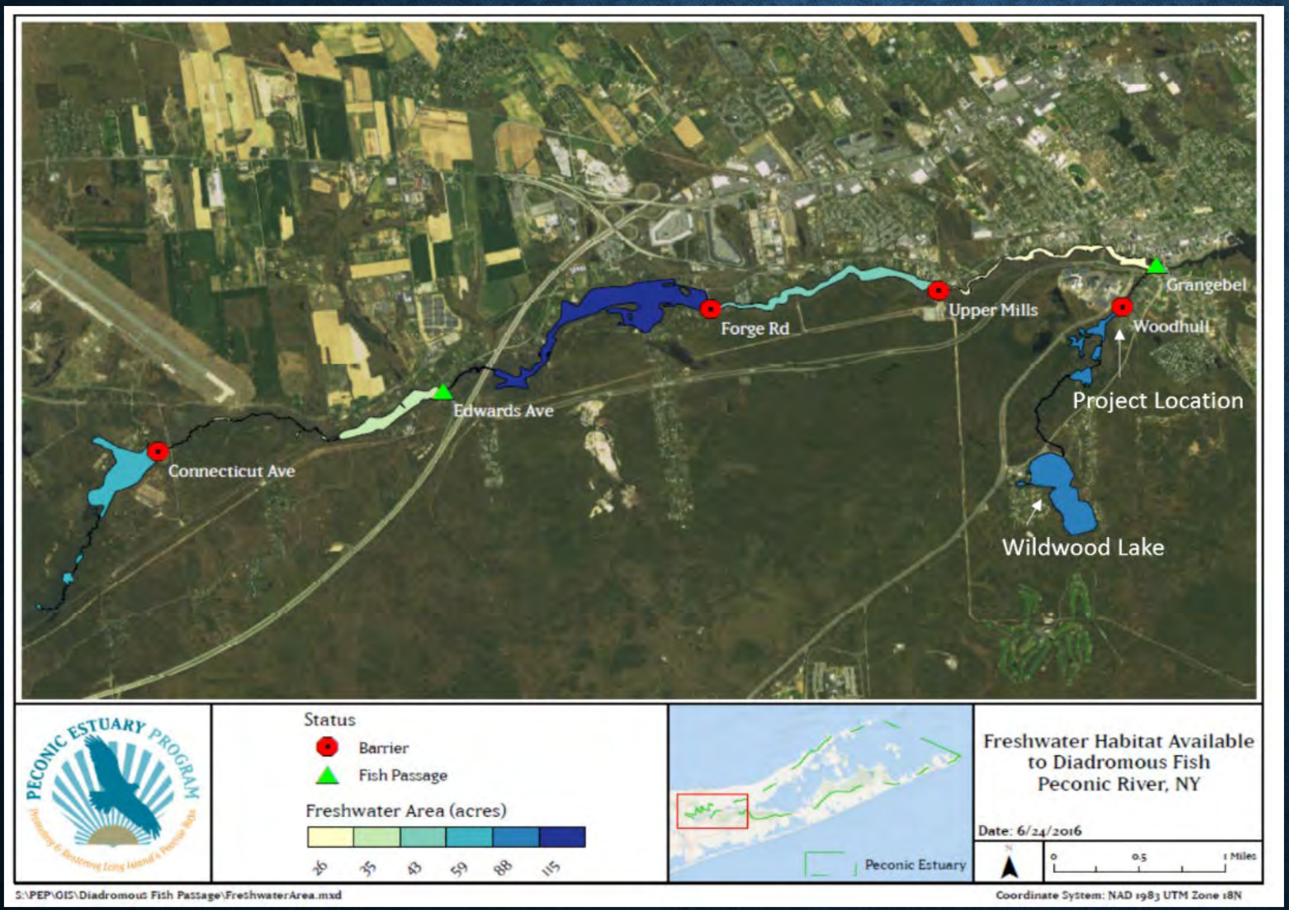
ROSE BAY ESTUARINE RESTORATION, FL

FY20 - $50,000 Total - $100,145

- 1-2 acres restored
- Replace hardened shoreline with estuarine friendly shoreline in a residential community
- Mangrove and spartina restoration
- Timeline: Winter 2021

WOODHULL DAM FISH PASSAGE AND PECONIC RIVER CONNECTIVITY PROJECT, NY

FY20 - $50,000   Total - $887,460



- Denil Fishway to provide access to spawning habitat in 2 upstream miles and 96 acres
- Timeline: February 2021

SHEEPSCOT RIVER BARRIER REMOVAL, ME

Coopers Mill FY17 - $15,000 Total - $930,600
Head Tide FY17 - $35,000 Total - $446,000

- Coopers Mill Dam Removal and Head Tide Partial Removal
- Opens 71 miles for Atlantic salmon and other species
- Southernmost Atlantic salmon river designated as Critical Habitat
- Timeframe: Coopers Mill completed summer/fall of 2018. Head Tide under way in 2019.

COOPER'S MILL DAM REMOVAL COMPLETED

HEAD TIDE DAM MODIFICATION UNDERWAY

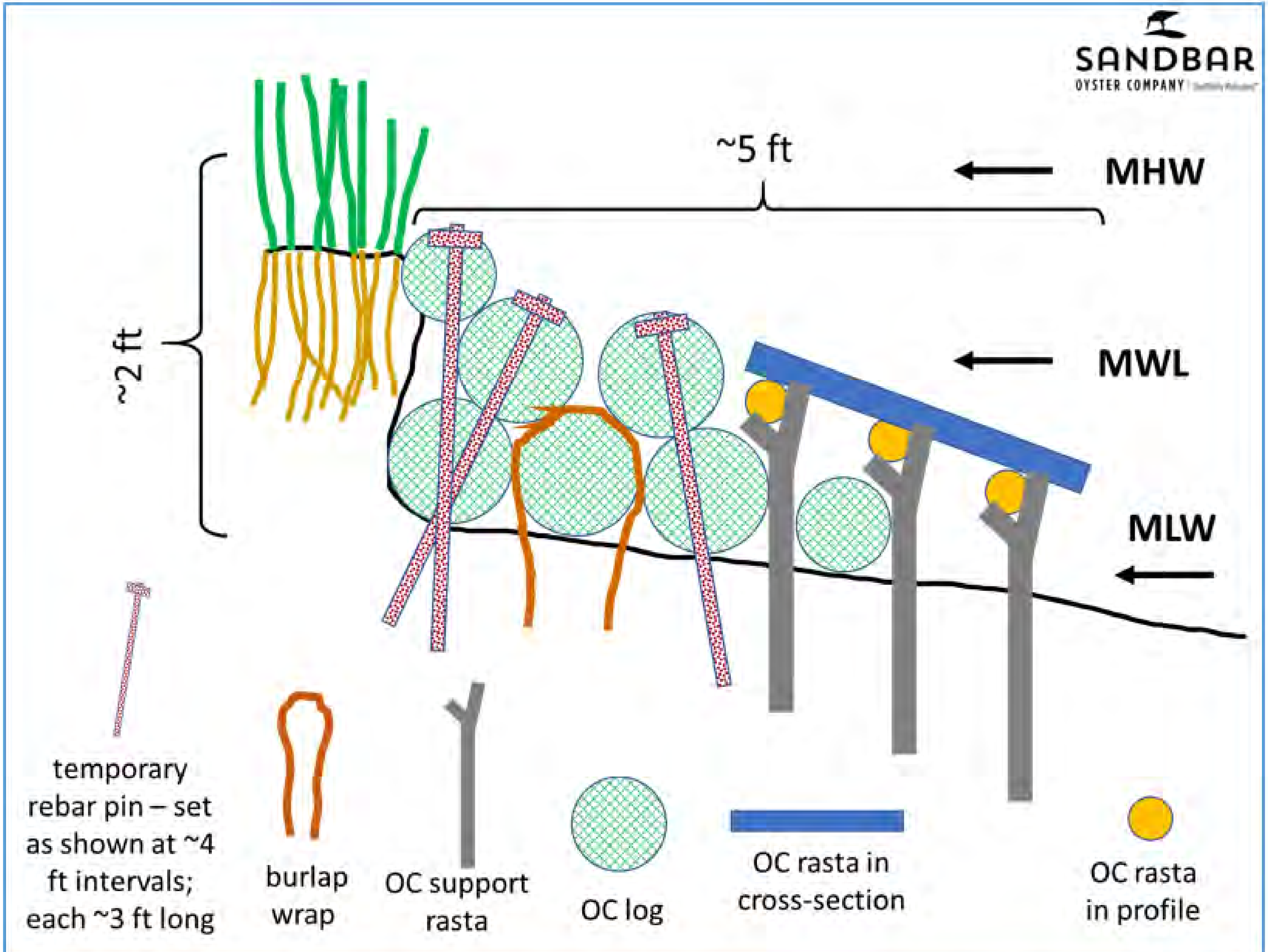
town's deed to the concrete dam specifies the dam must never be destroyed

HEAD TIDE DAM MODIFICATION UNDERWAY

BOGUE SOUND, OYSTER REEF AND ESTUARINE SHORELINE RESTORATION

FY18 - $38,110 Total - $77,236

- Recycled oyster shells placed along 300 ft. of shoreline to promote saltmarsh
- Nursery habitat for black sea bass, red drum
- Feeding ground for summer flounder
- Timeframe: summer 2018


SANDBAR
OYSTER COMPANY
~5 ft
MHW
~2 ft
MWL
MLW
temporary rebar pin – set as shown at ~4 ft intervals; each ~3 ft long
burlap wrap
OC support rasta
OC log
OC rasta in cross-section
OC rasta in profile

OYSTER CATCHER LOGS

FEBRUARY 21, 2019

COLUMBIA DAM REMOVAL, KNOWLTON TOWNSHIP, NJ

FY18 - $50,000   Total - $7,193,000

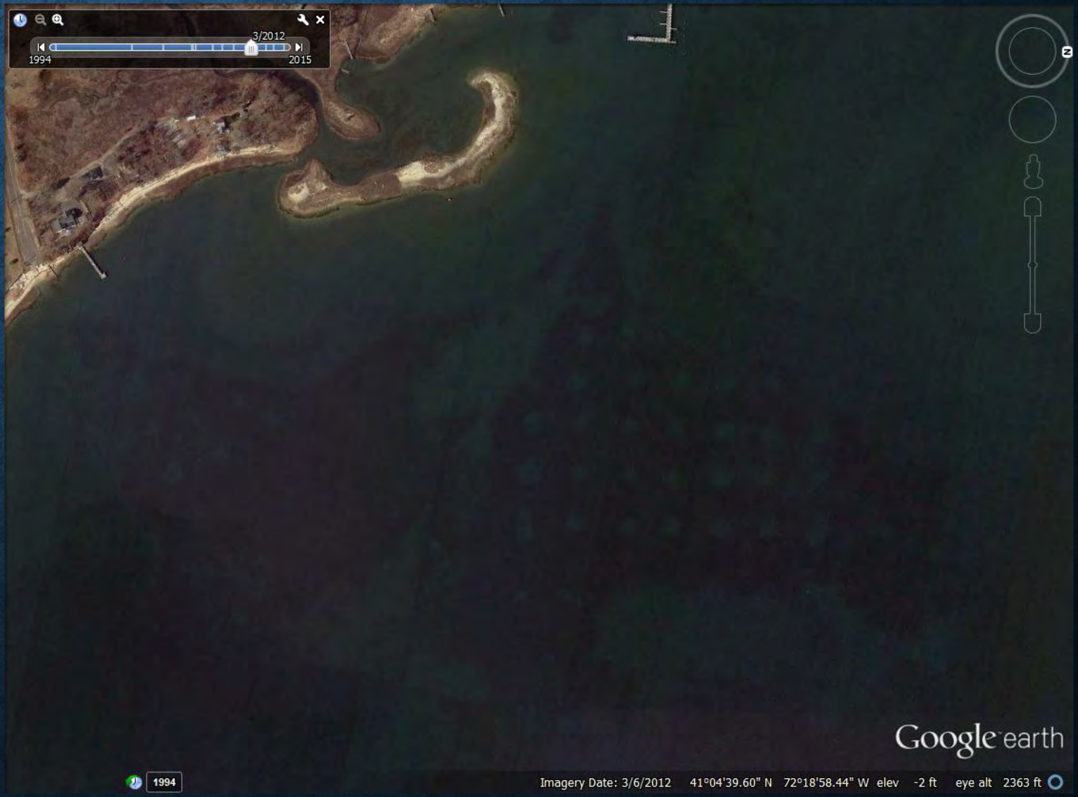
- Remove dam to open 20 river miles
- First obstruction to passage off the Delaware River in the Paulins Kill
- Received Delaware Watershed Conservation Funding
- Timeline: Removal began August, 2018

DAM REMOVAL COMPLETED IN MARCH, SHAD FOUND UPRIVER IN APRIL!

SEAGRASS CONSERVATION MOORINGS, COECLES HARBOR, NY

FY18 - $17,965   Total - $138,188

- Replace 6 traditional moorings with conservation moorings to protect seagrass in harbor
- Good visibility to inspire others to use conservation moorings
- Timeframe: 2019?

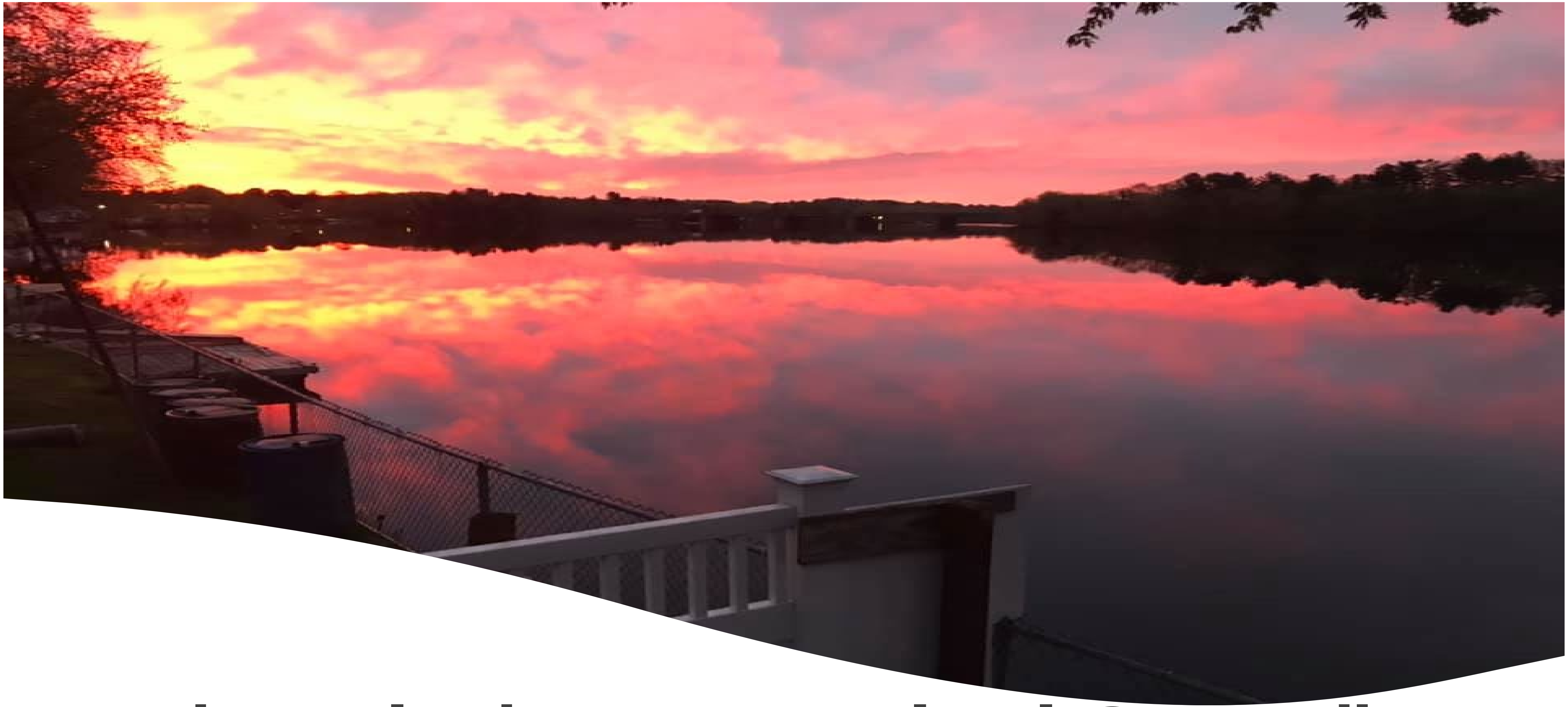


OYSTER REEF RESTORATION IN BACK SOUND, RACHEL CARSON RESERVE, NC

FY18 - $49,833   Total - $123,010

- Restore 0.11 acres of oyster reefs along eroding salt marsh
- Protects an additional 3+ acres of saltmarsh
- Timeframe: 7/18

Year	Organization	State	Project Type	NFHAP Amt	Total Project Cost
2018	The Nature Conservancy	NJ	Fish Passage	$50,000	$7,193,000
2018	NY Department of Environmental	NY	Submerged Aquatic	$17,965	$138,188
2018	East Carolina University	NC	Oyster Reef	$49,833	$123,010
2017	Atlantic Salmon Federation	ME	Fish Passage	$25,000	$1,376,600
2017	North Carolina Coastal Federation	NC	Oyster Reef	$27,519	$77,236
2016	The Nature Conservancy	RI	Fish Passage	$35,000	$1,187,650
2015	Town of Surry	ME	Fish Passage	$55,291	$223,161
2015	The Nature Conservancy	MA	Fish Passage	$50,000	$758,363
2015	Cape Fear River Watch	NC	Riverine Bottom	$30,000	$314,511
2014	The Nature Conservancy	NH	Oyster Reef	$40,525	$141,300
2014	North Carolina Coastal Federation	NC	Oyster Reef and Tidal	$24,657	$61,013
2013	University of North Florida	FL	Oyster Reef and Tidal	$31,437	$77,574
2013	Cornell Cooperative Extension	NY	Submerged Aquatic	$27,405	$95,992
2012	MA Division of Marine Fisheries	MA	Submerged Aquatic	$19,172	$63,874
2012	James River Association	VA	Riverine Bottom	$30,240	$189,800
2012	Marine Resources Council	FL	Tidal Vegetation	$50,000	$124,375
2011	SC Department of Natural Resources	SC	Tidal Vegetation	$24,603	$49,620
2011	Great Works Regional Land Trust	ME	Fish Passage	$13,587	$275,000
2010	SC Department of Natural Resources	SC	Fish Passage	$40,000	$70,000
2010	NY Department of Environmental	NY	Fish Passage and Riverine	$30,000	$80,000



Merrimack River Watershed Council

2019-2020 summary for ACHFP conference

Who is the MRWC?

MERRIMACK RIVER WATERSHED COUNCIL

Non-profit formed in 1976

Our mission: Give the next generation a cleaner and healthier Merrimack River

Our methods: using science, education, and advocacy to help solve key environmental issues and generate public interest and support for the river.

Our constituents: Primarily residents who live in the Merrimack Valley (in both Massachusetts and New Hampshire)

Advocacy & lobbying

Walking tours and presentations

Public awareness events,
scientific conferences

Clean ups

Water testing

Merrimack River

117 Miles long, from Franklin NH to the sea

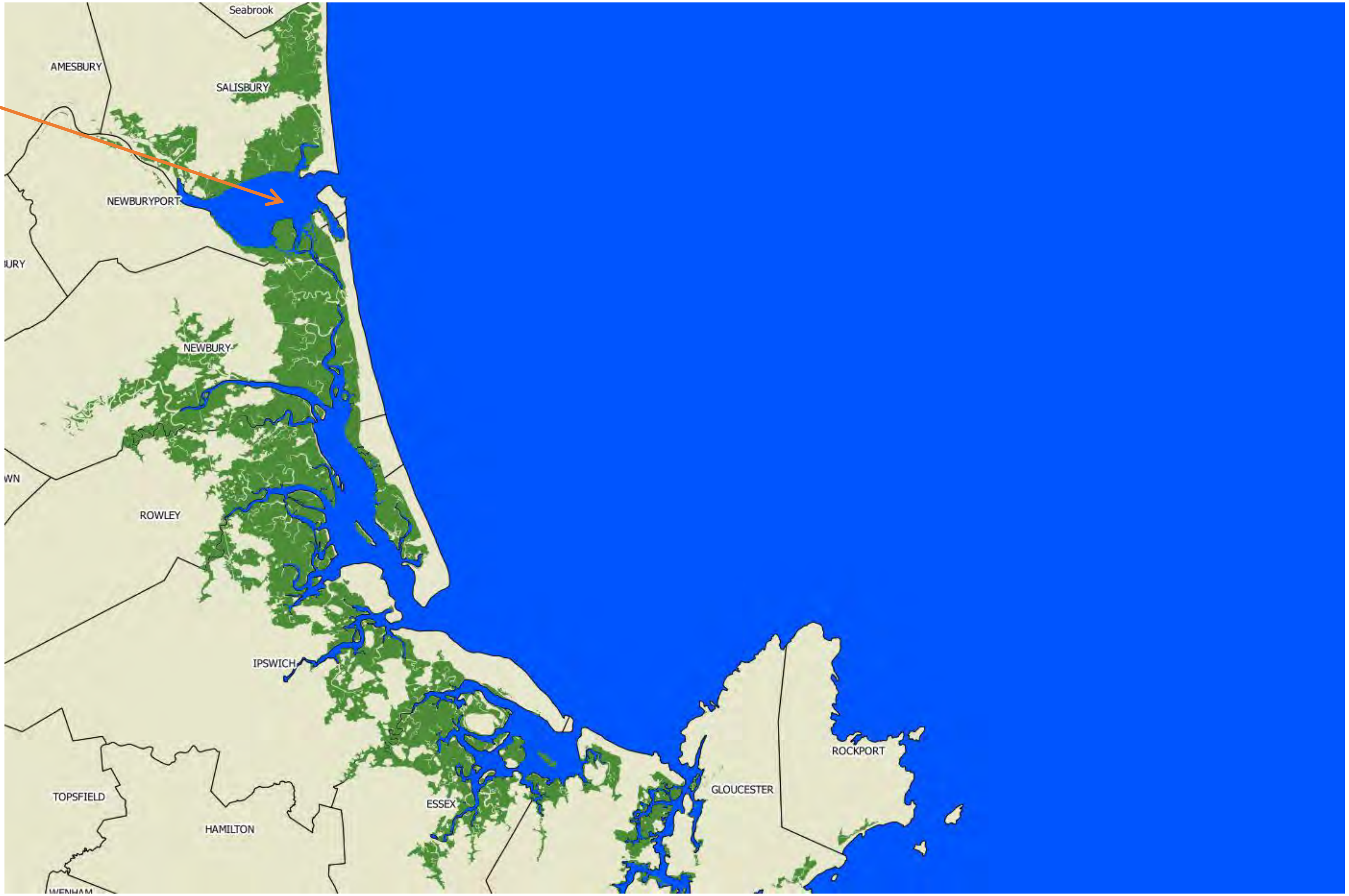
5,010 square mile watershed, 4th largest in New England, 2/3rds in New Hampshire, 1/3rd in Massachusetts

Important anadromous fish habitat (particularly blueback herring, alewives and Atlantic shad).

Industrial river, feeds region's largest estuary

Great Marsh, a 25,000-acre estuary habitat

Merrimack River Basin



Merrimack River: By The Numbers

600,000

Number of people who depend on the Merrimack as their drinking water supply.

5

Number of major dams on the Merrimack. Within the watershed there are over 600 dams.

#1

The U.S. Forest Service ranks the watershed as the most threatened in the country due to the development of forest lands, fourth for associated threats to water quality, and seventh for loss of habitat for species at risk.

Significant recreational fishery – striped bass

Fishing for striped bass, Plum Island Point

Site of Massachusetts' busiest state park – Salisbury Beach State Reservation, 1.2 million visitors annually.

Site of state's busiest boat ramp, Cashman Park in Newburyport, over 2,400 launches annually.

Extremely popular location for surfcasting and vessel-based fishing.

A glimpse at the Lawrence dam's fish ladder

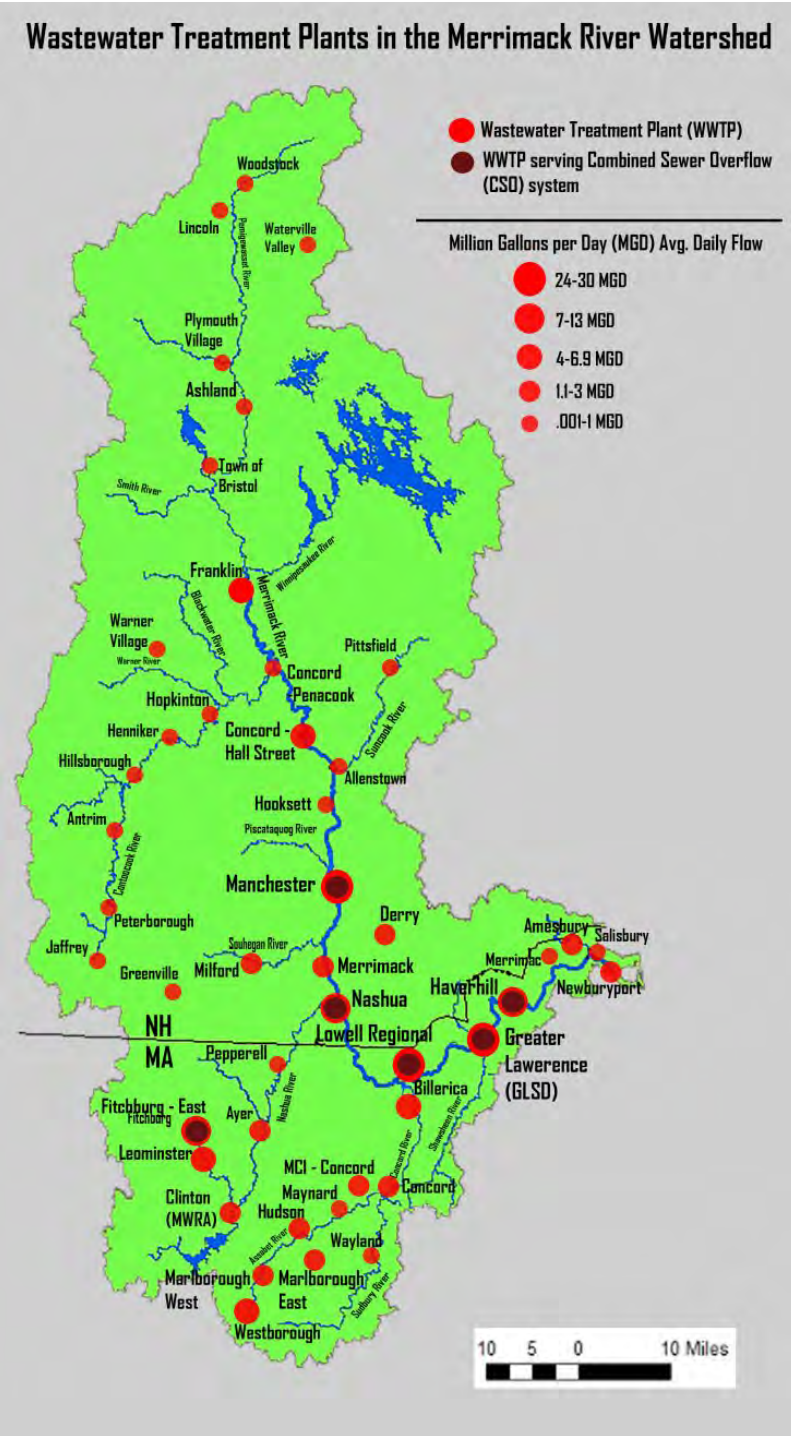
Species	2015	2016	2017	2018	2019
River Herring	128,692	417,240	91,616	449,356	143,541
Atlantic Shad	89,467	67,528	62,846	29,060	18,653
Sea Lamprey	5,035	5,169	2,056	5,619	9,112

2019-2020 priority: Combined Sewage Overflow notification and abatement

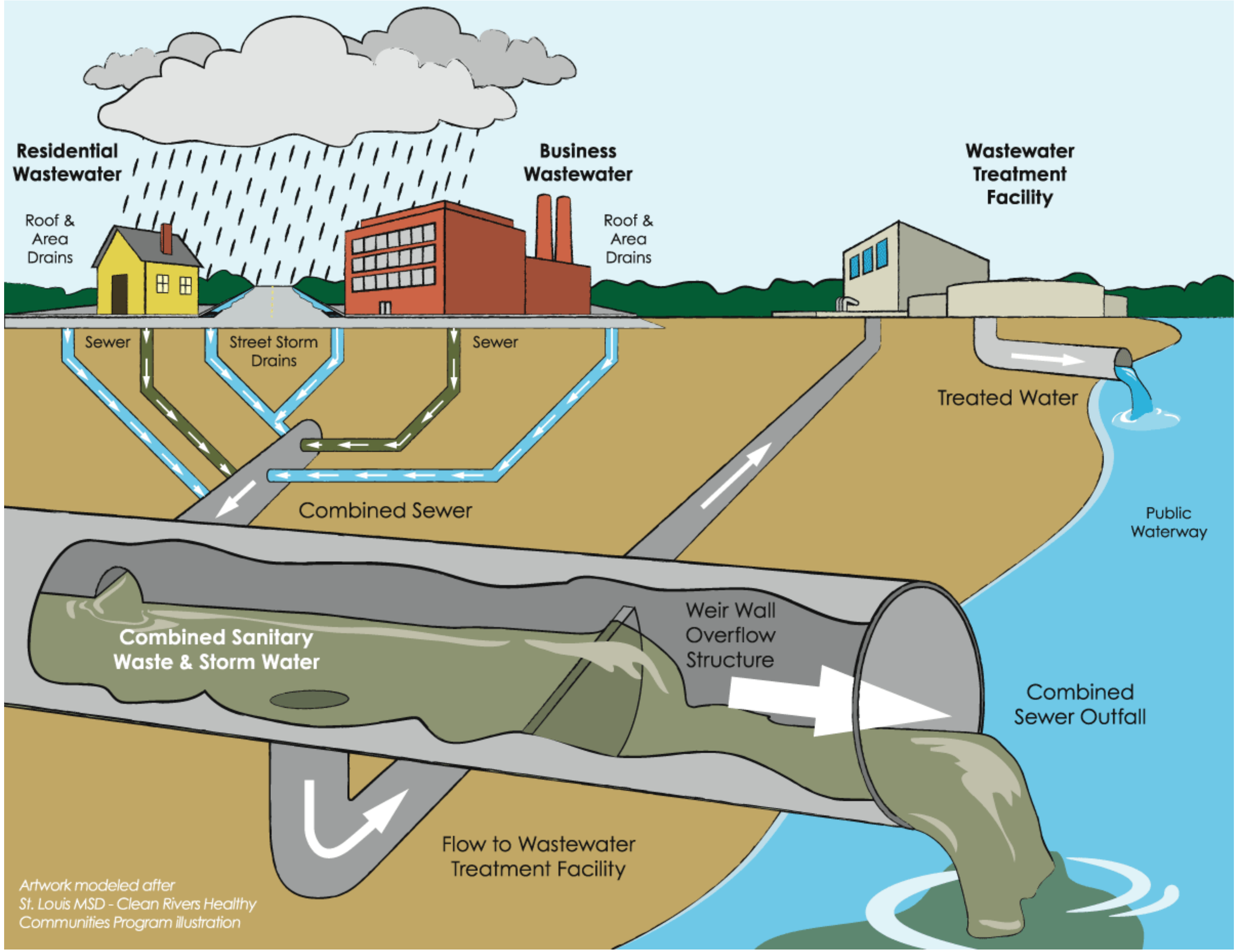
The Main Problem

- **5 sewage plants serving former mill cities are not capable of processing sewage flow during significant rainstorms. Excess sewage is diverted into the river.**

- **Manchester, NH**
- **Nashua NH**
- **Greater Lowell, Mass.**
- **Greater Lawrence, Mass.**
- **Haverhill, Mass.**



Combined Sewage Overflows

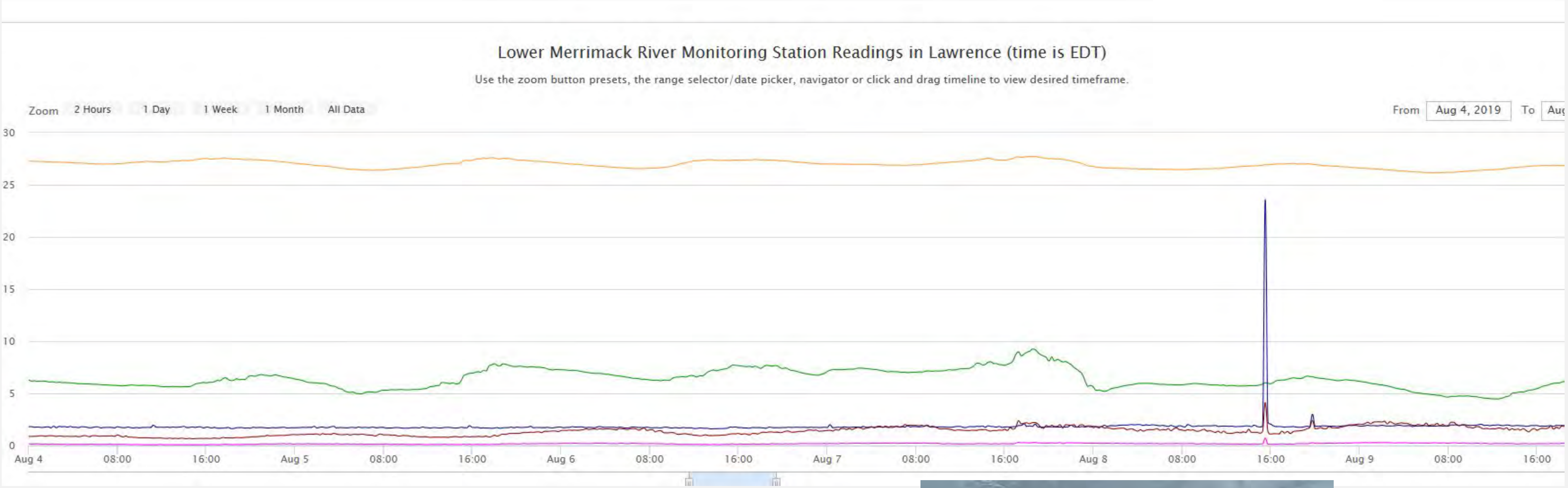


What's in CSO release?

- Microbial pathogens
- Oxygen depleting substances
- Total Suspended Solids
- Toxics & metals
- Nutrients (nitrogen, phosphorus)

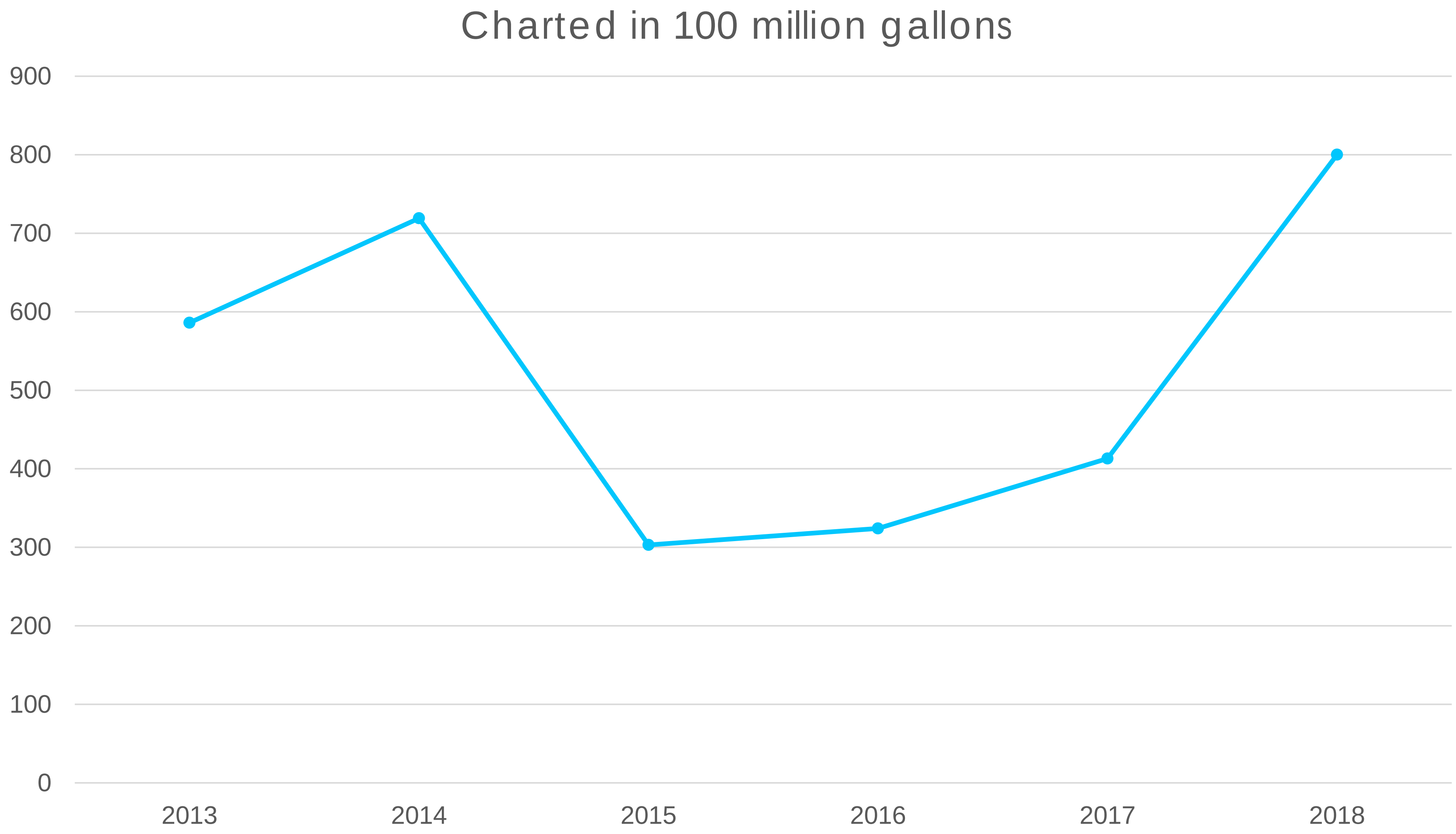
Oyster farm considers, rejects Merrimack River

CSOs and aquatic life



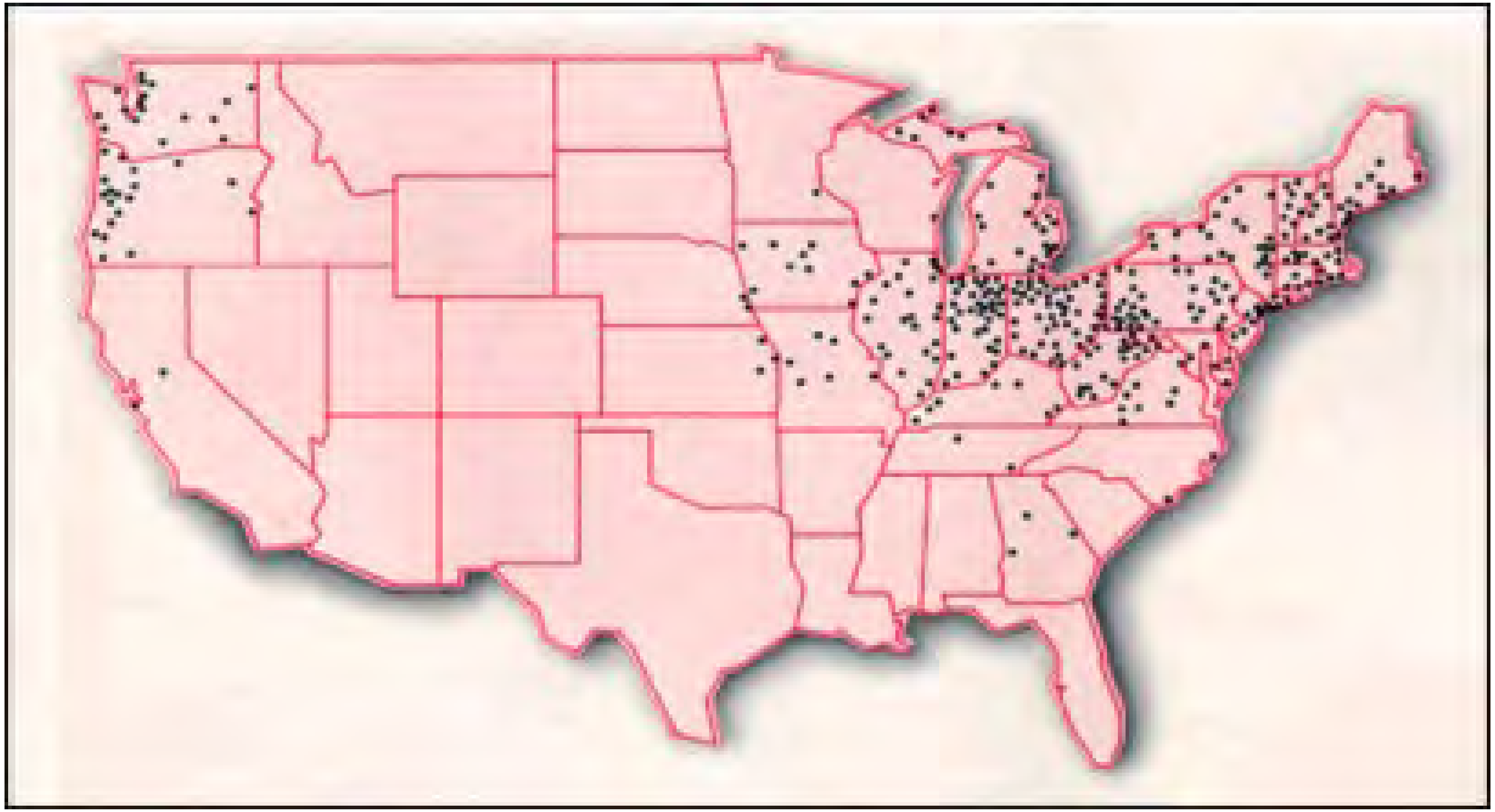
Mussel die-off reported Aug. 9

Combined Sewage Overflows, 2013-2018



Cost to fix: $1 billion+

Combined Sewage Overflows, a nationwide issue



772 CSOs nationwide

Associated problem: uncoordinated water testing

- Multiple entities are conducting bacteria tests
- Testing methodology is not in sync
- Some areas of Merrimack are well covered, others are not.

Associated problem: Notification

- Only one sewage plant on the Merrimack River (Nashua) is required to issue public notifications when CSOs occur

- Other plants voluntarily issue email alerts to small list of subscribers.

- Alerts are sometimes issued several hours after CSO begins.

Solution strategy

Public Awareness Campaign

Press releases, interviews with local media

Public Awareness Campaign

Press releases, interviews with local media

Intensive social media campaign

Public Awareness Campaign

Press releases, interviews with local media

Intensive social media campaign

Public meetings throughout watershed communities

Public Awareness Campaign

Press releases, interviews with local media

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Public meetings throughout watershed communities

Meet with state and federal legislators for informational sessions

Public Awareness Campaign

Press releases, interviews with local media

Intensive social media campaign

Public meetings throughout watershed communities

Meet with state and federal legislators for informational sessions

Invite sewage plant operators to take part

Public Policy Campaign

At state level, work with legislators on bills

Public Policy Campaign

At state level, work with legislators on bills

At state level, testify and lobby for specific bills

Public Policy Campaign

At state level, work with legislators on bills

At state level, testify and lobby for specific bills

At federal level, suggest funding bills

Results

Within EPA:

3 sewage plants required to issue public notification as part of their operating permit, 2 more expected to follow

Within region

Boston University agrees to conduct analysis of CSO impact on Merrimack River, help coordinate water testing.

New regional council formed to study CSOs' economic, health and environmental impact

Lowell sewage plant spearheads effort to bring real-time bacteria testing equipment to Merrimack. Also unveils plan to reduce CSO volume by 72%.

Results

In Mass. state legislature:

7 bills filed

2 passed (Funding for Merrimack River District Commission, notification pilot program)

1 likely to pass (Statewide notification program)

In Congress:

2 bills filed

- Nationwide CSO notification standard
- Nationwide CSO abatement funding (double the current funding, to $500 million)

Next steps

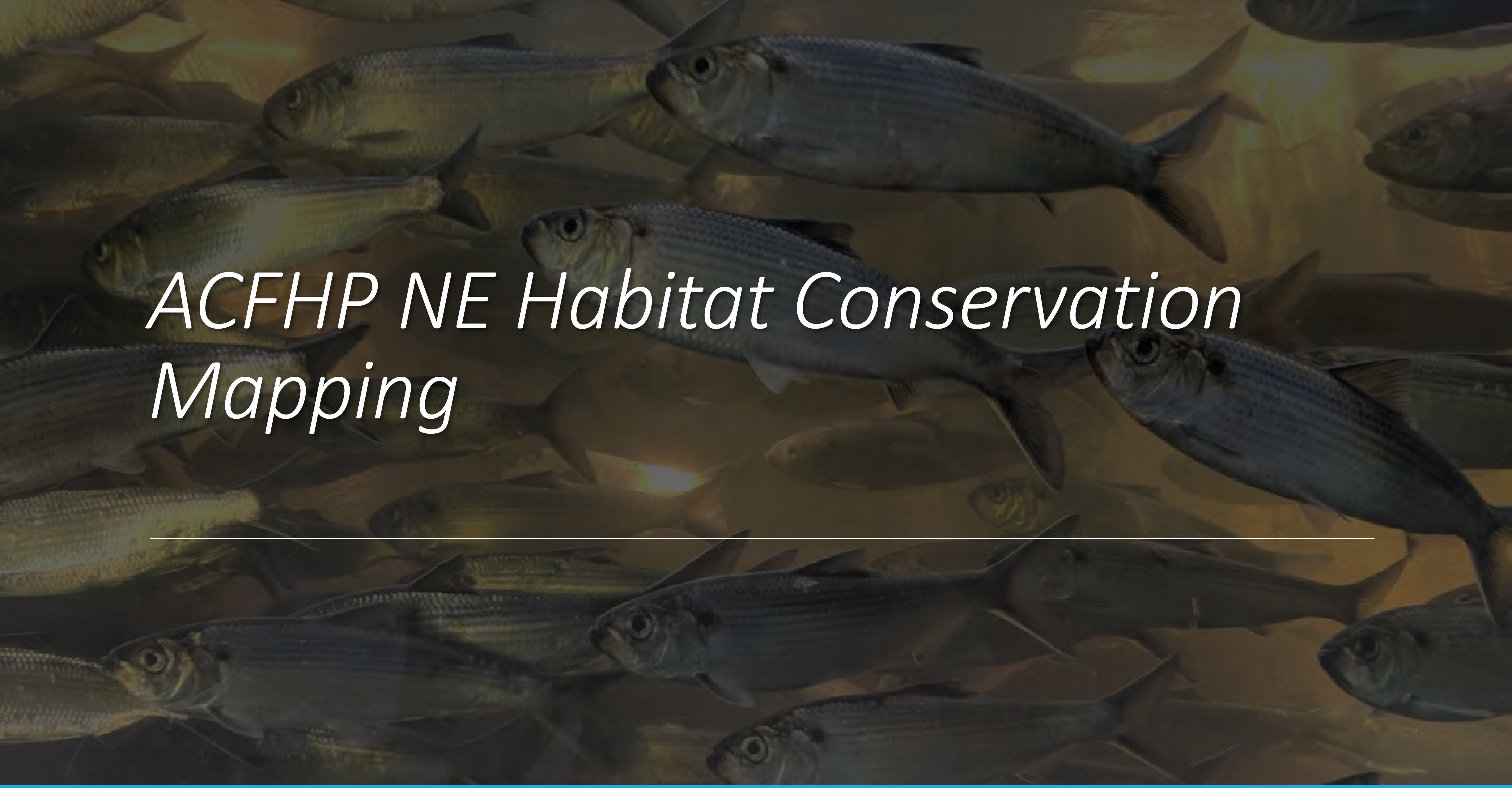
Develop health & economic impact analysis

Continue lobbying and public education efforts

Implement next-generation bacteria monitoring


THANK YOU
MRWC
MERRIMACK RIVER
WATERSHED COUNCIL

ACFHP NE Habitat Conservation Mapping



Purpose

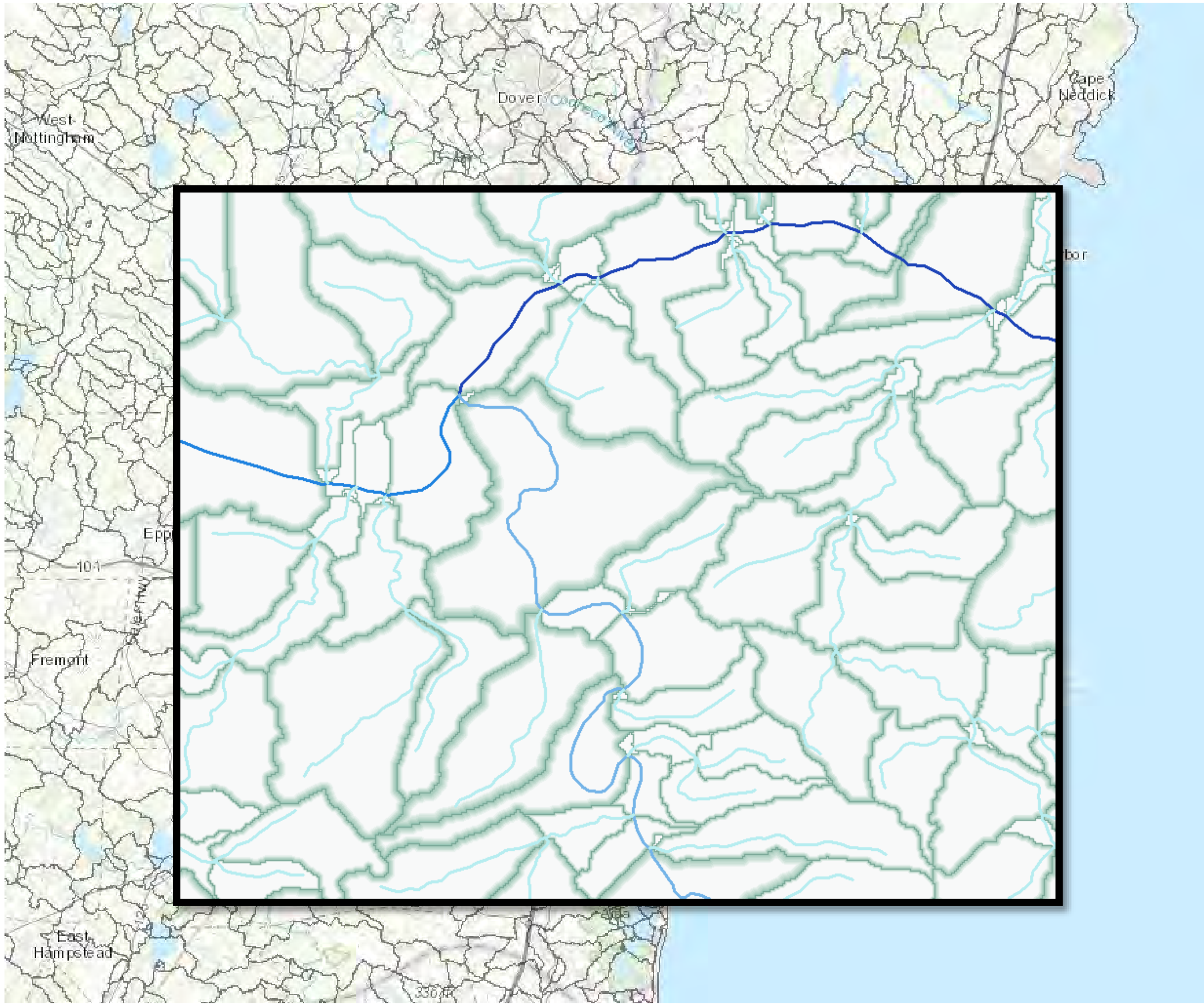
Spatially prioritize diadromous and estuarine fish habitat conservation sites through GIS analyses for the northeast region of the U.S. from Maine through Virginia.

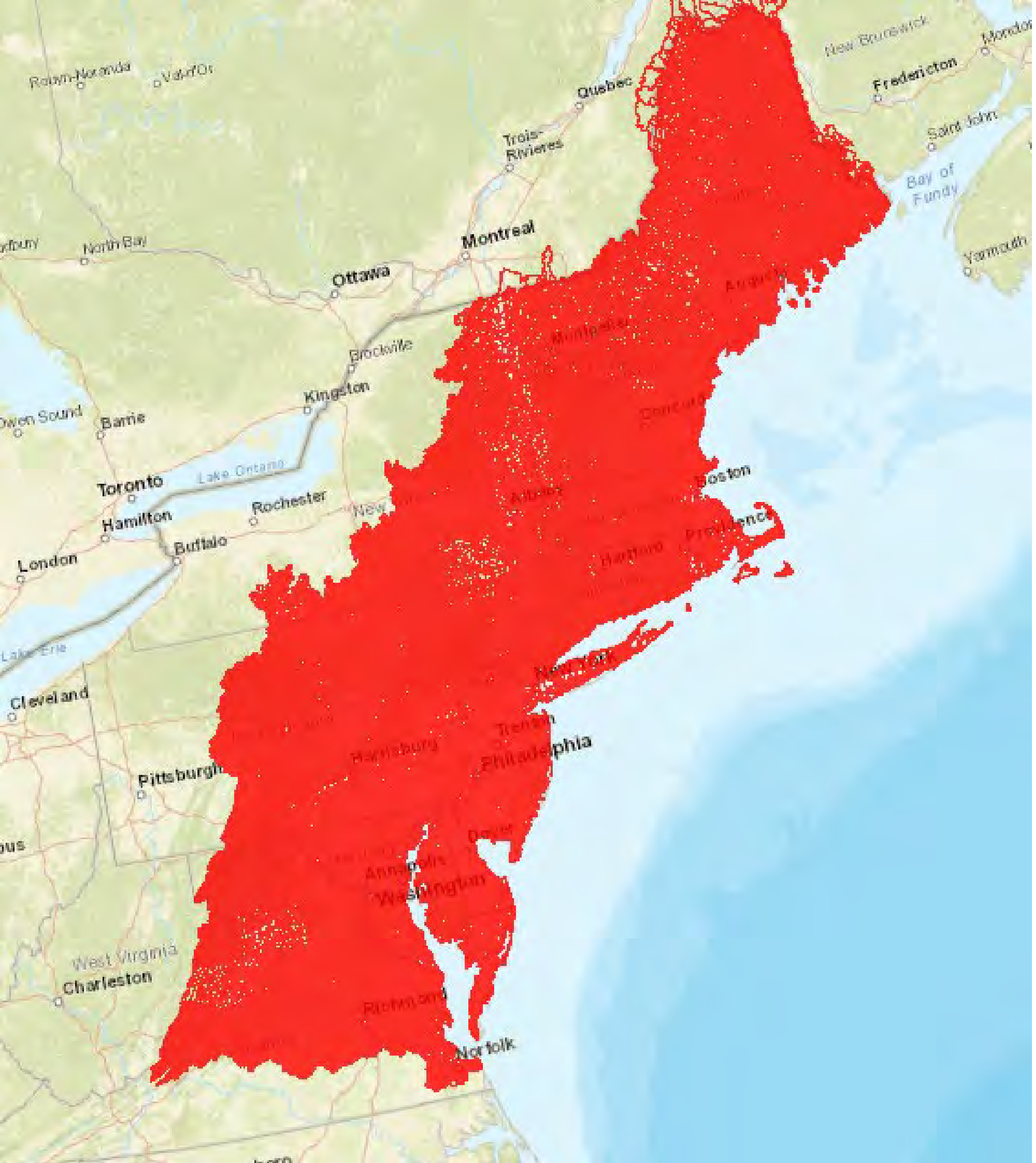
Resulting maps will assist ACFHP in identifying where best to invest effort and future NFHP habitat restoration funds.

Diadromous fish

Units of analysis

- NHD plus catchments (mean 2 km^2)
- Each catchment corresponds to a river reach





Spatial extent

ATLANTIC DRAINAGES FROM MAINE - VIRGINIA

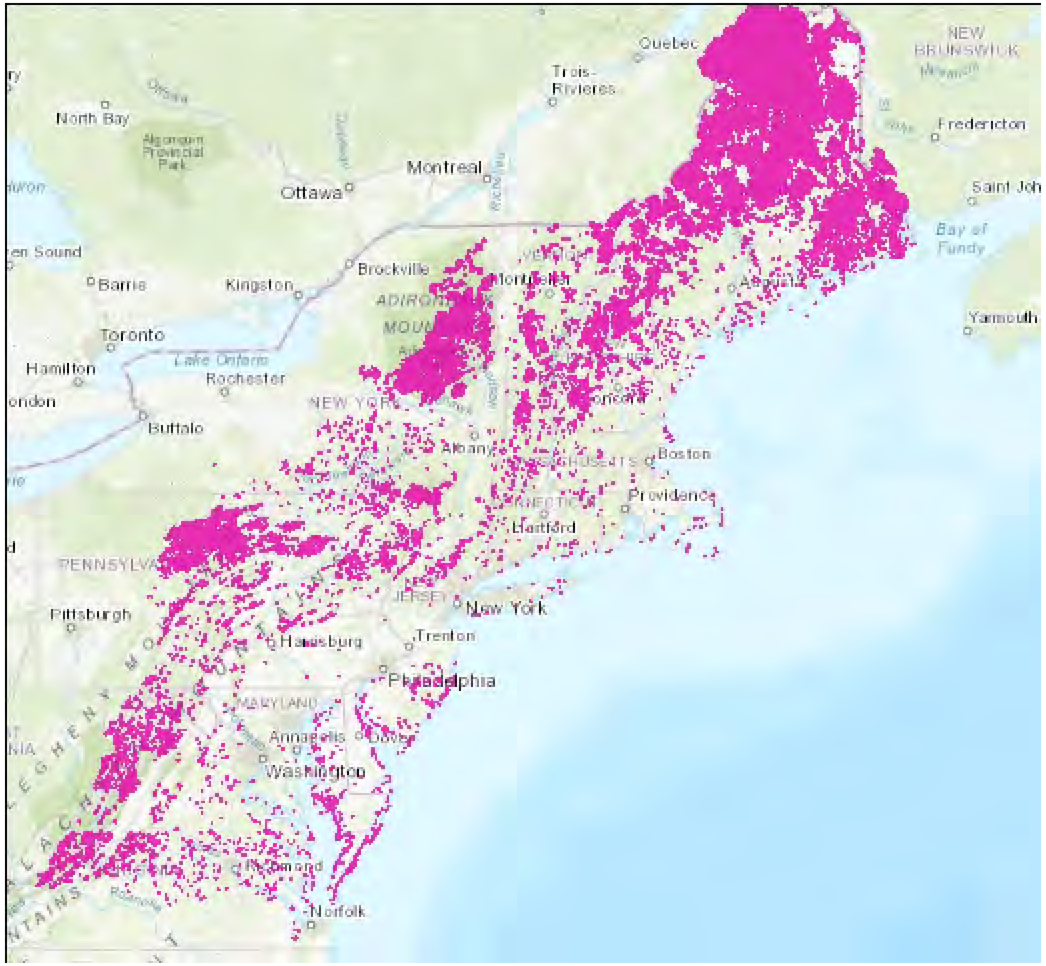
Diadromous Metrics

Variable	Measurement	Metric
Impervious surface	% impervious surface in upstream drainage area	10 points if <=5% cumulative impervious surface
Point source pollution	Density of Toxic Release Inventory sites in catchment (EPA StreamCat)	10 points if catchment is ranked in the lowest 25% for pollution (least polluted)
Non-point source pollution	% of catchment covered by developed open space, low intensity developed, pasture/hay, or row crops (NLCD 2016)	10 points if the catchment is ranked in the lowest 25%
Riparian buffers	% of floodplain area (ARA) with natural land cover	10 points if the catchment is ranked in the top 25% for natural coverage
Potential for species access	Diadromous species presence & 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 upstream storage	10 points if the catchment is ranks in the lowest 25% for volume
Local fragmentation	Density of road crossings + dams in catchment	10 points if the catchment is ranked in the lowest 25% for fragmentation (least amount of crossings and dams).
ESA Critical Habitat	Atlantic salmon/Sturgeon Critical Habitat designation	10 points if the catchment is designated Atlantic sturgeon or Atlantic salmon Critical Habitat

Impervious Surface

- % impervious surface in upstream drainage area
  - National Land Cover Dataset (2016)
  - Accumulated for each reach's upstream drainage area

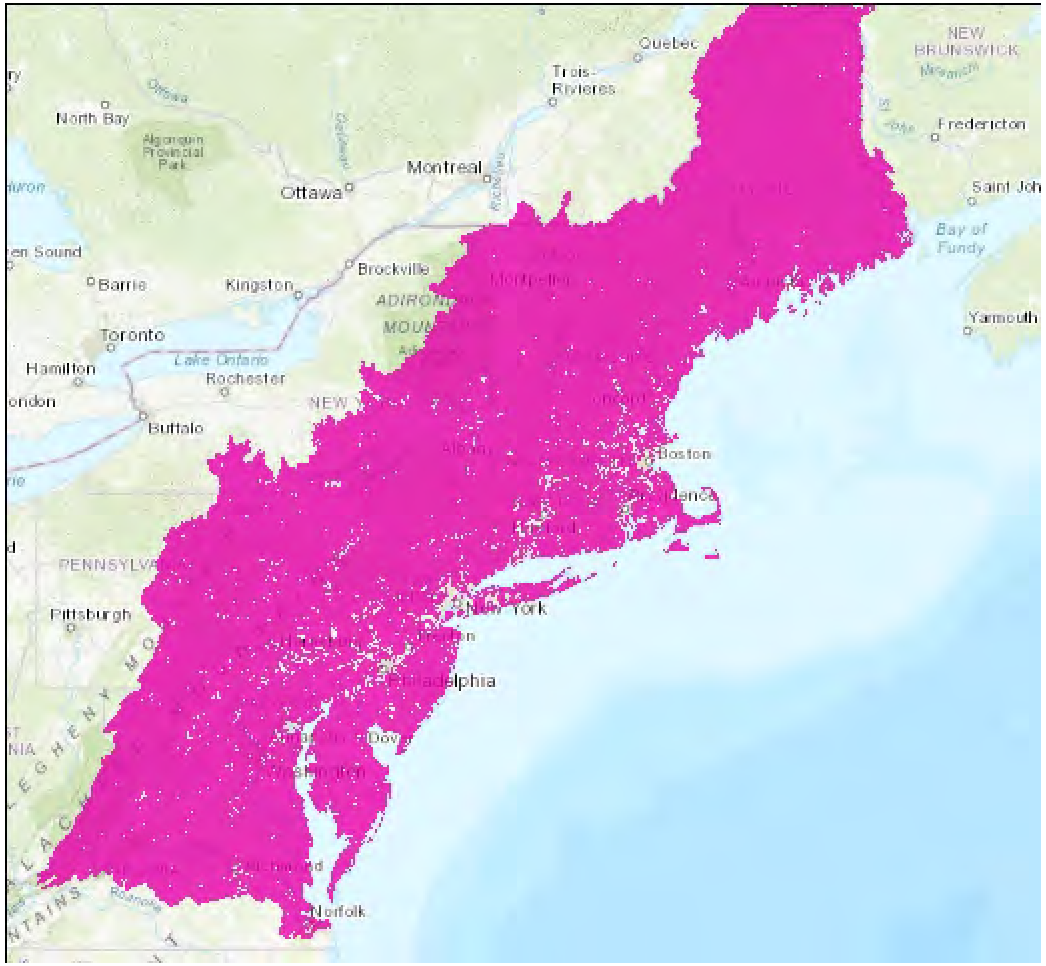
- 10 points if <=5% cumulative impervious surface



Point Source Pollution

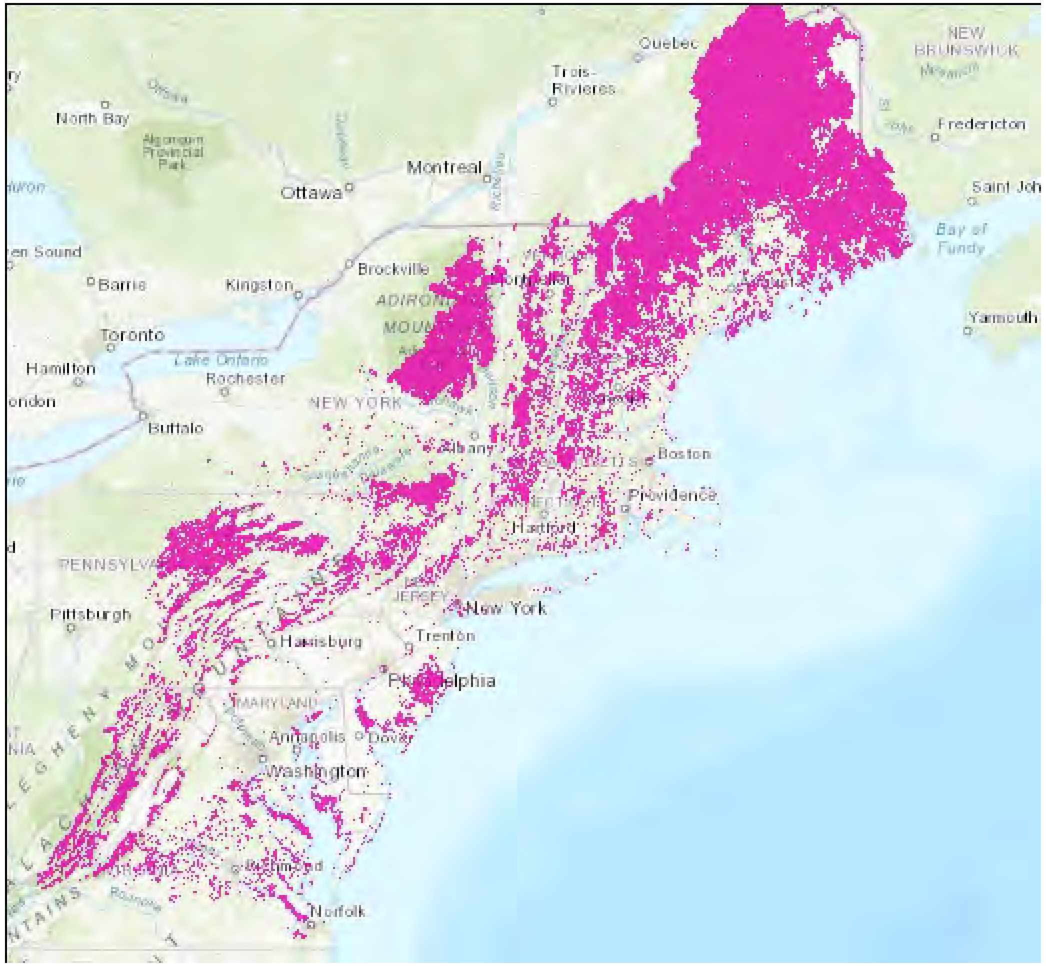
- Density of Toxic Release Inventory sites in catchment from EPA StreamCat
  - TRIDensCat– Density of georeferenced Toxic Release Inventory sites (TRI.shp) within the local catchment (Cat) and upstream watershed (Ws).

- 10 points if catchment is ranked in the lowest 25% for pollution (least polluted)



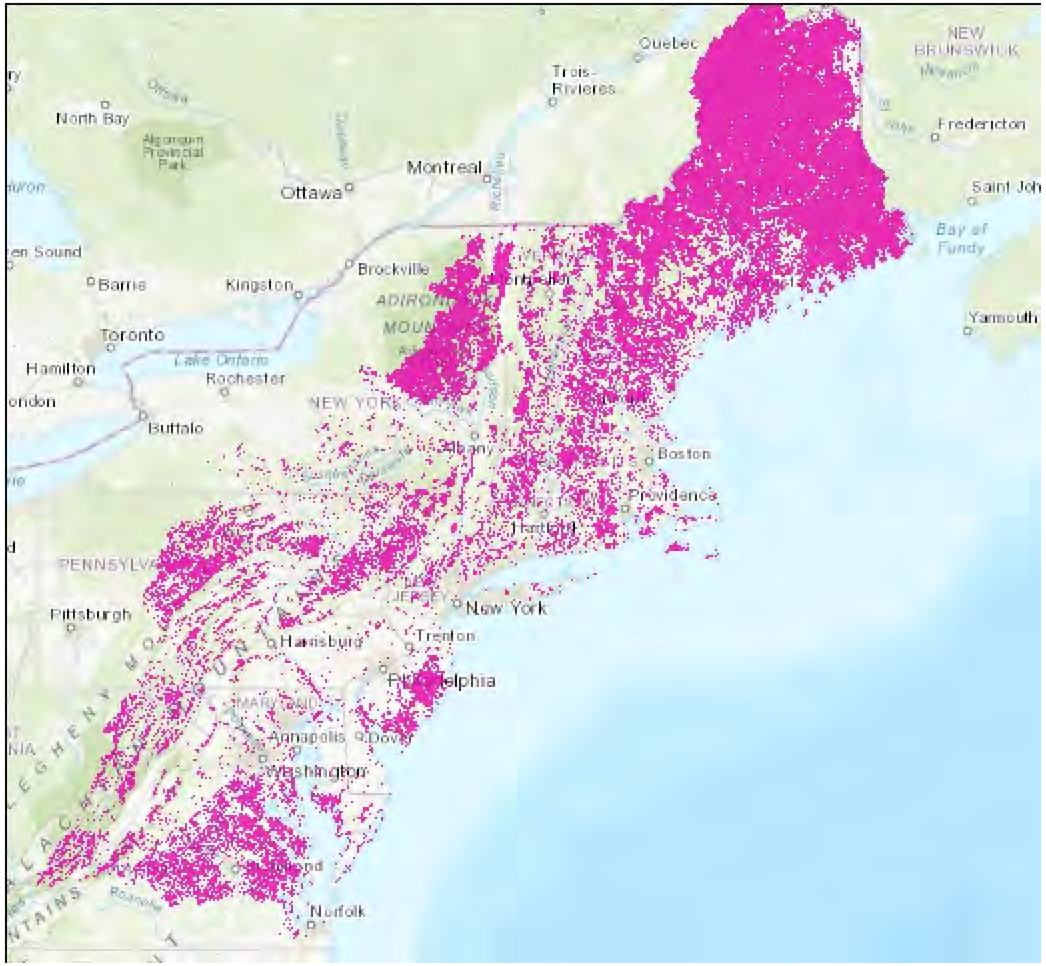
Non-Point Source Pollution

- % of catchment covered by developed open space, low intensity developed, pasture/hay, or row crops
  - NLCD 2016
  - Summarized for each catchment
- 10 points if the catchment is ranked in the lowest 25%



Riparian cover

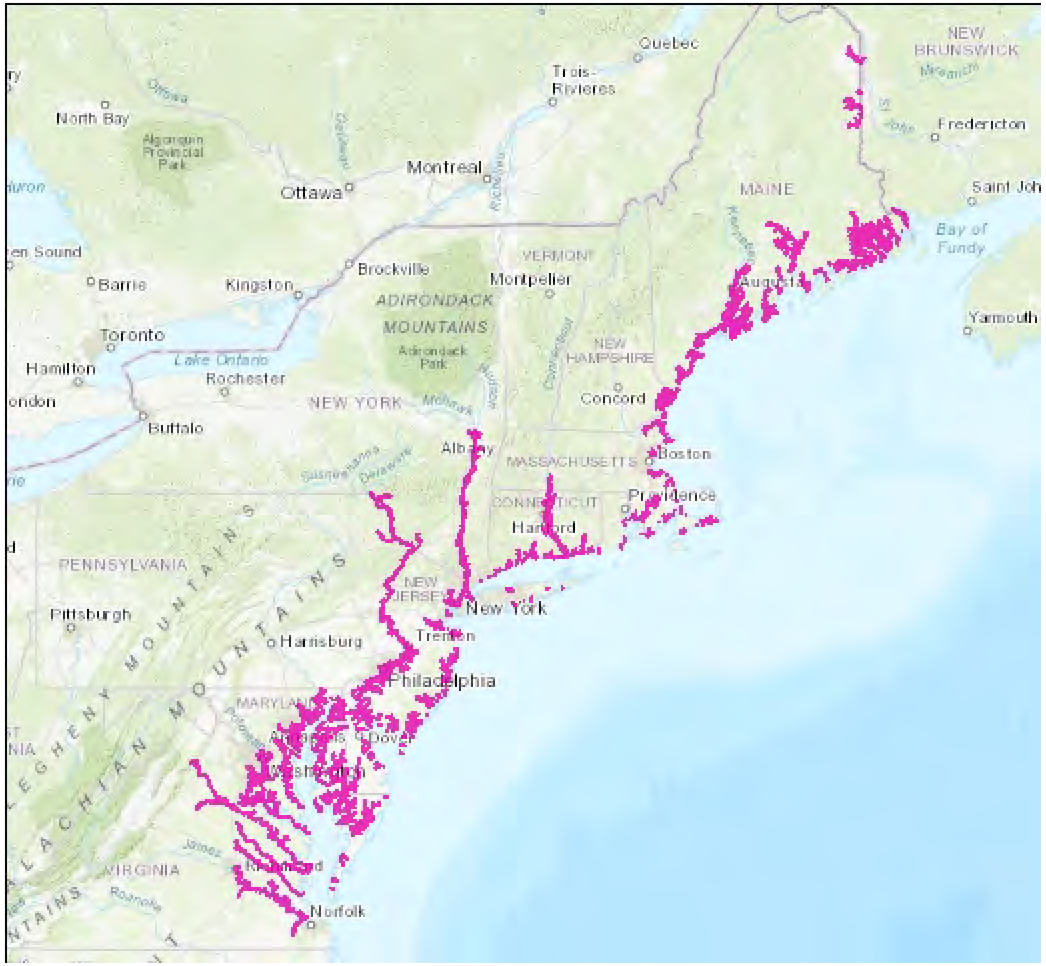
- % of floodplain area (ARA) with natural land cover
  - NLCD 2016
  - Open water, barren land, deciduous forest, evergreen forest, mixed forest, shrub/scrub, grasslands/herbaceous, woody wetlands, emergent herbaceous wetlands



- 10 points if the catchment is ranked in the top 25% for natural coverage

Potential species access

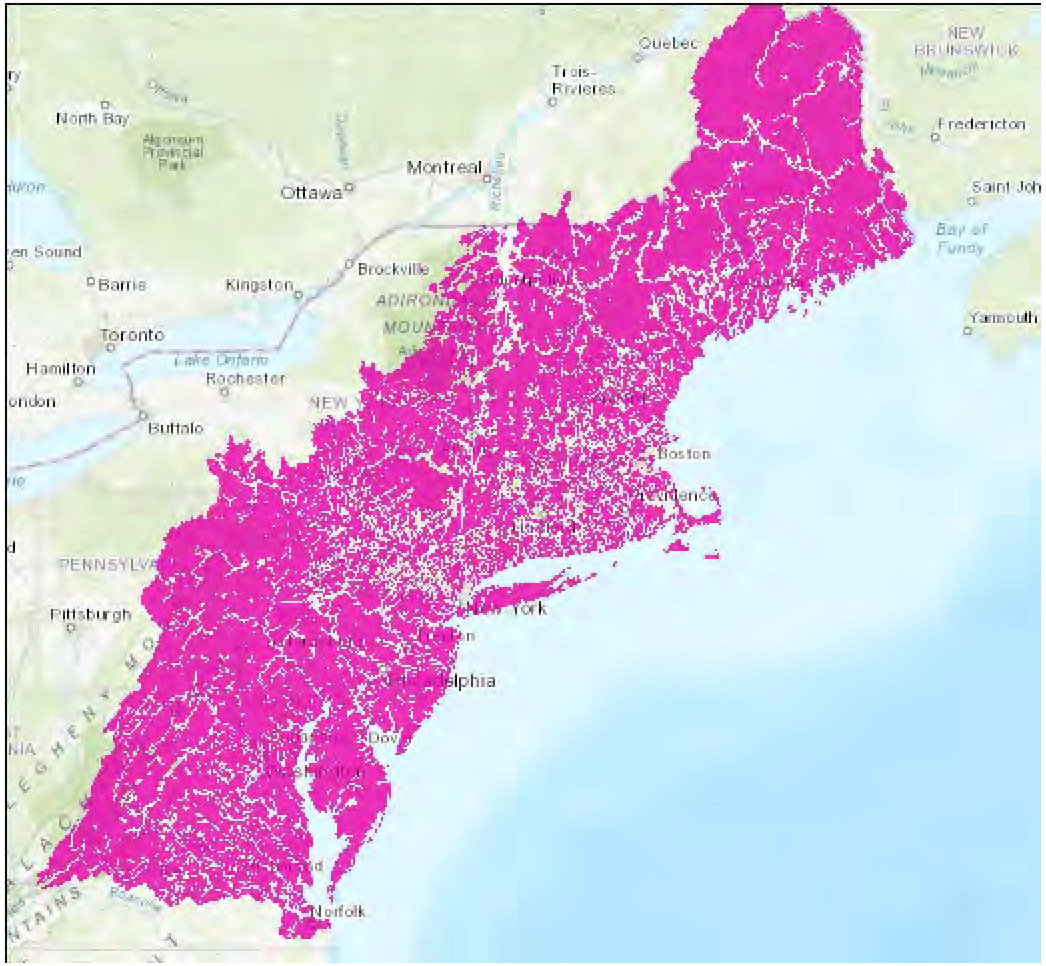
- Diadromous species presence & access
  - Northeast Aquatic Connectivity project dams & anadromous fish habitat by reach
  - Alewife, blueback herring, American shad, hickory shad, striped bass, Atlantic sturgeon, Atlantic salmon
- 10 points if catchment had an anadromous species present AND was on a network with zero dams downstream to the ocean.



Flow Alteration

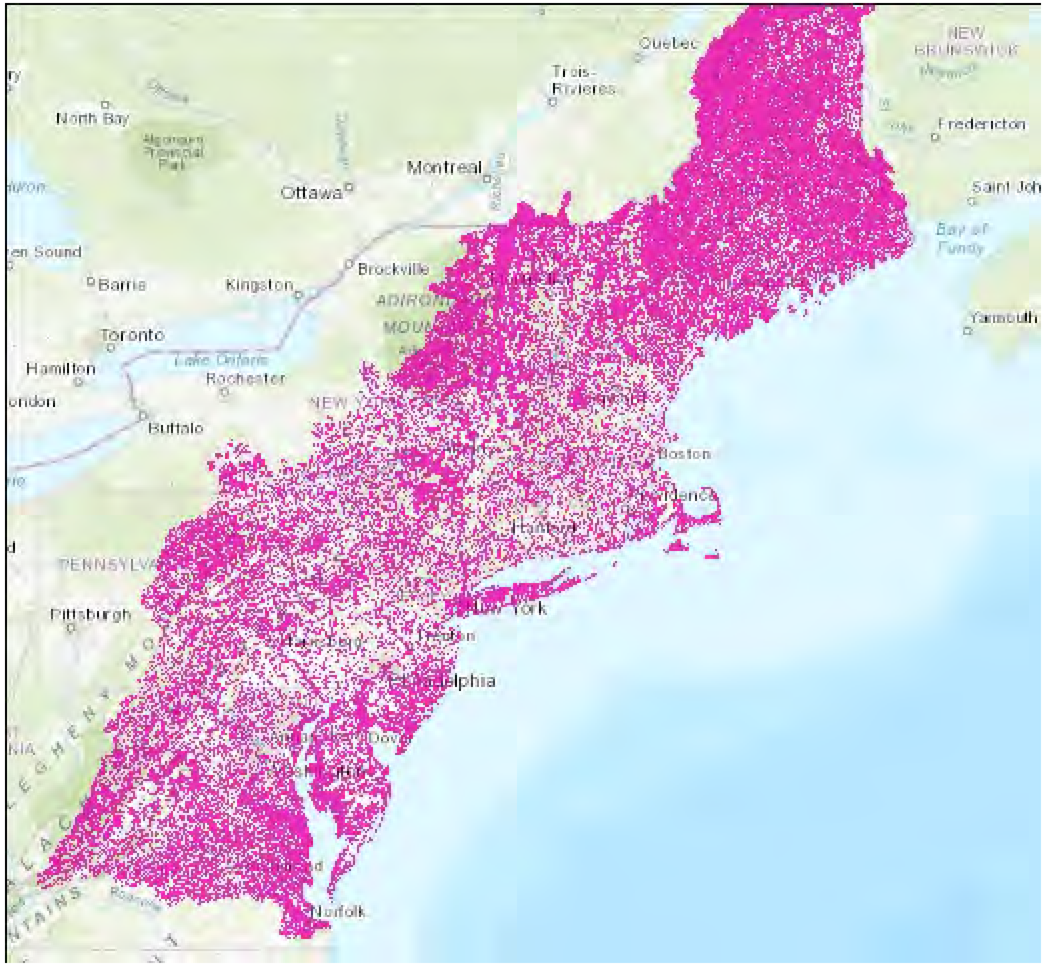
- Volume of all upstream storage
  - EPA StreamCAT
  - DamNIDStorWs - Volume all reservoirs (NID_STORA in NID) per unit area of the local catchment (Cat) and upstream watershed (Ws).

- 10 points if the catchment is ranks in the lowest 25% for volume



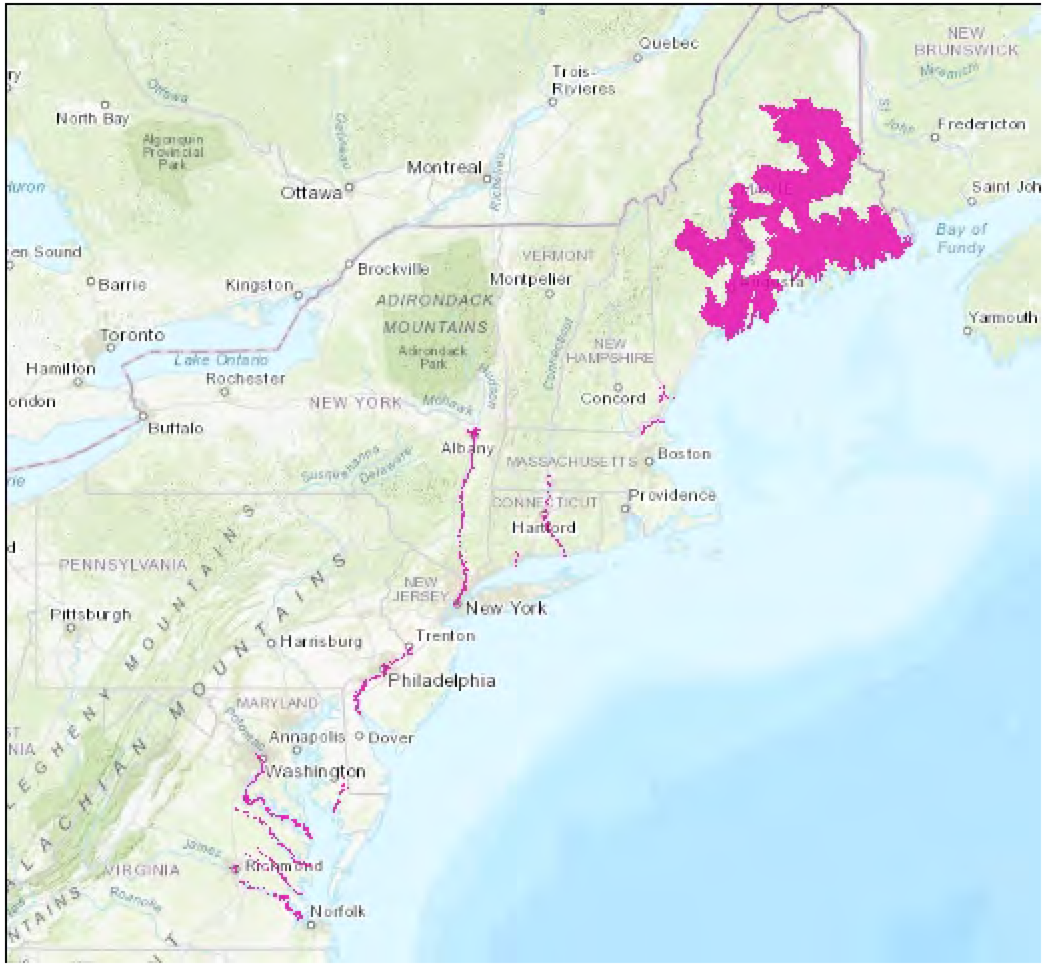
Local Fragmentation

- Density of road crossings + dams in catchment
  - Northeast Aquatic Connectivity dams + road stream crossings (from NAACC)
  - /area of catchment
- 10 points if the catchment is ranked in the lowest 25% for fragmentation (lowest density of crossings and dams)



ESA Critical Habitat

- Atlantic salmon/Atantoic sturgeon Critical Habitat designation
  - NOAA GARFO by reach (sturgeon) and HUC10 (salmon)
- 10 points if the catchment is designated Atlantic sturgeon or Atlantic salmon Critical Habitat



Total score

- Sum of all diadromous points for each catchment

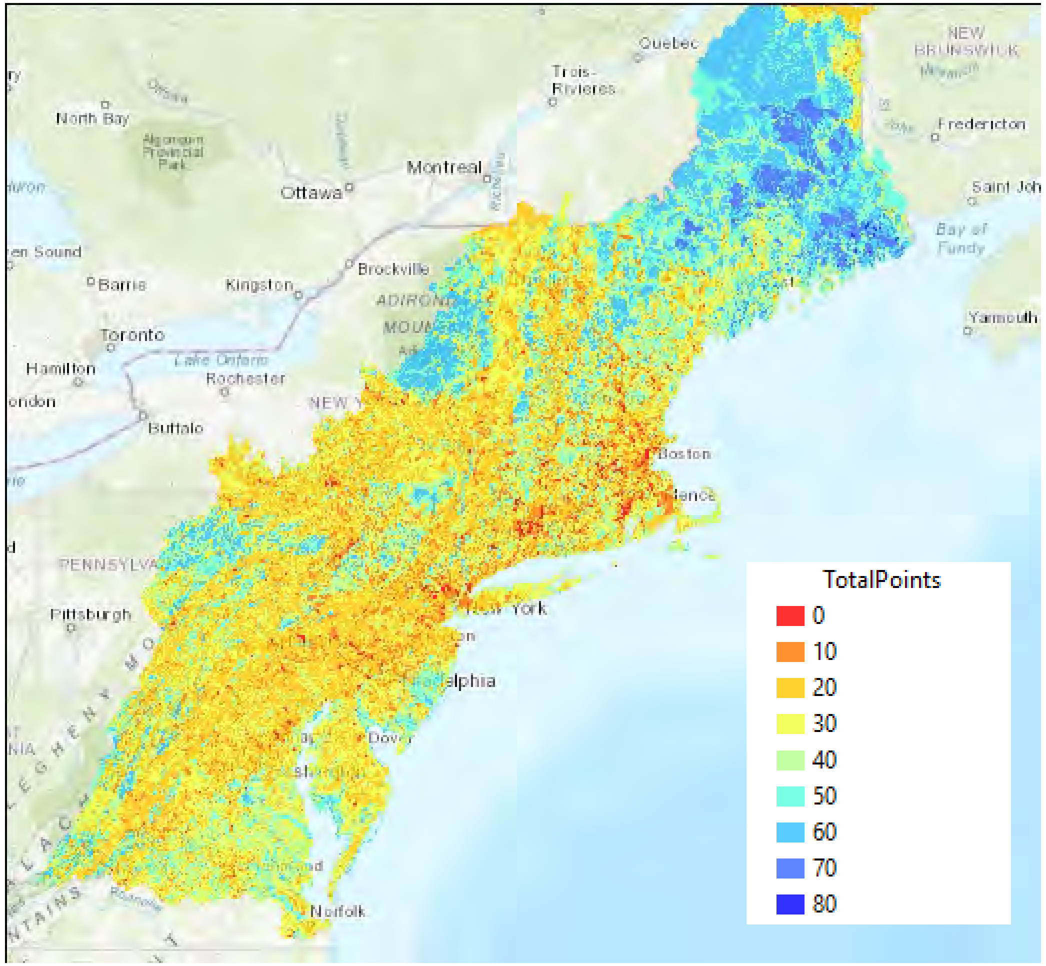
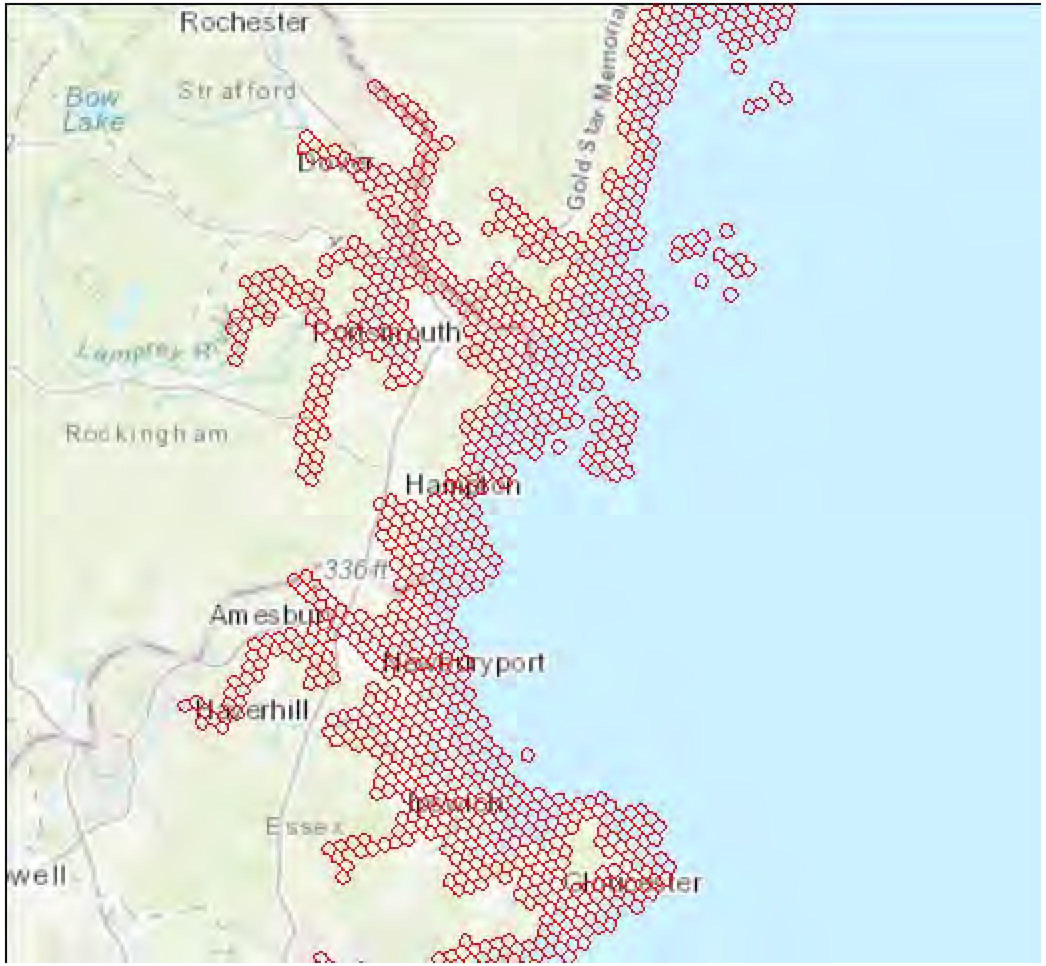


Photo © Jim Culp / Flickr Creative Commons

Estuarine

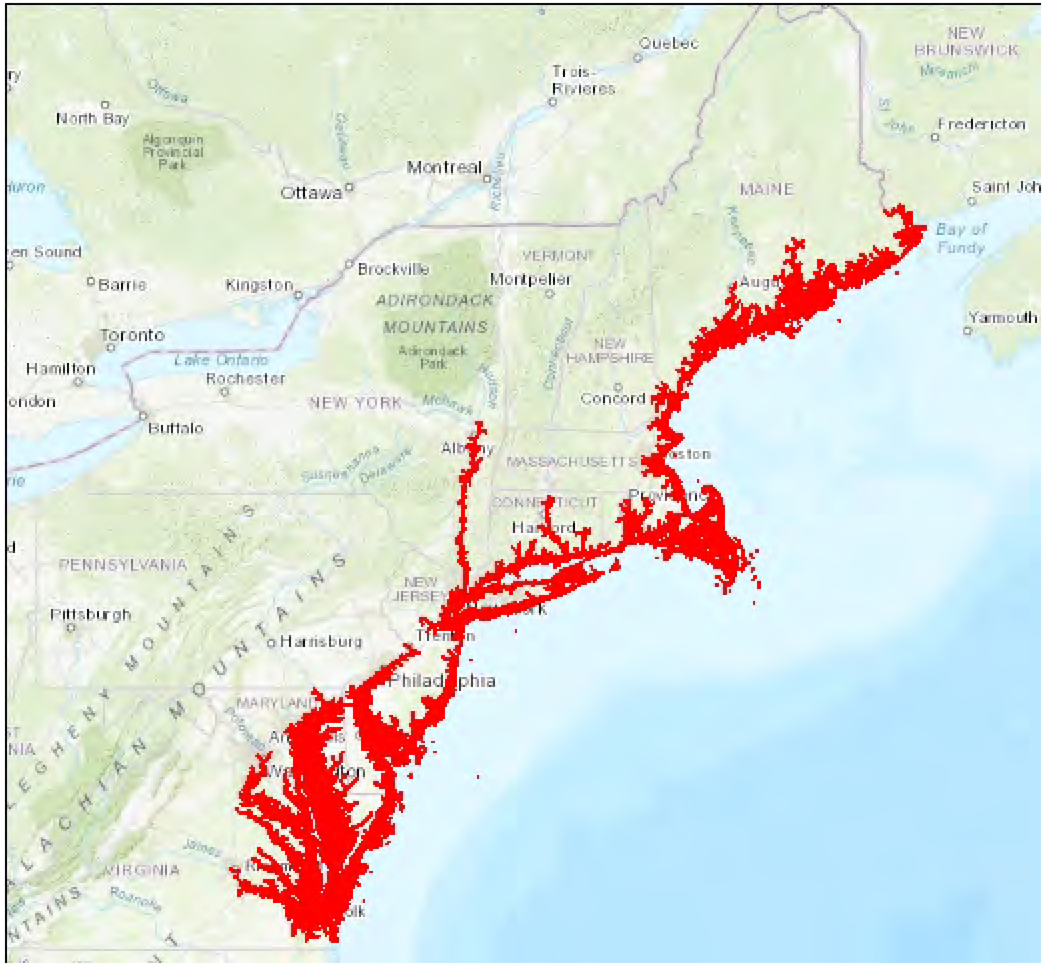
Units of analysis

- 1 km^2 hexagons



Spatial Extent

- Maine – Virginia
- Inland boundary defined by NOAA ESI Shoreline
- Seaward boundary defined by depth contour
  - NOAA NCEI bathymetry
  - 60 ft depth in New England
  - 35 ft depth in Mid-Atlantic



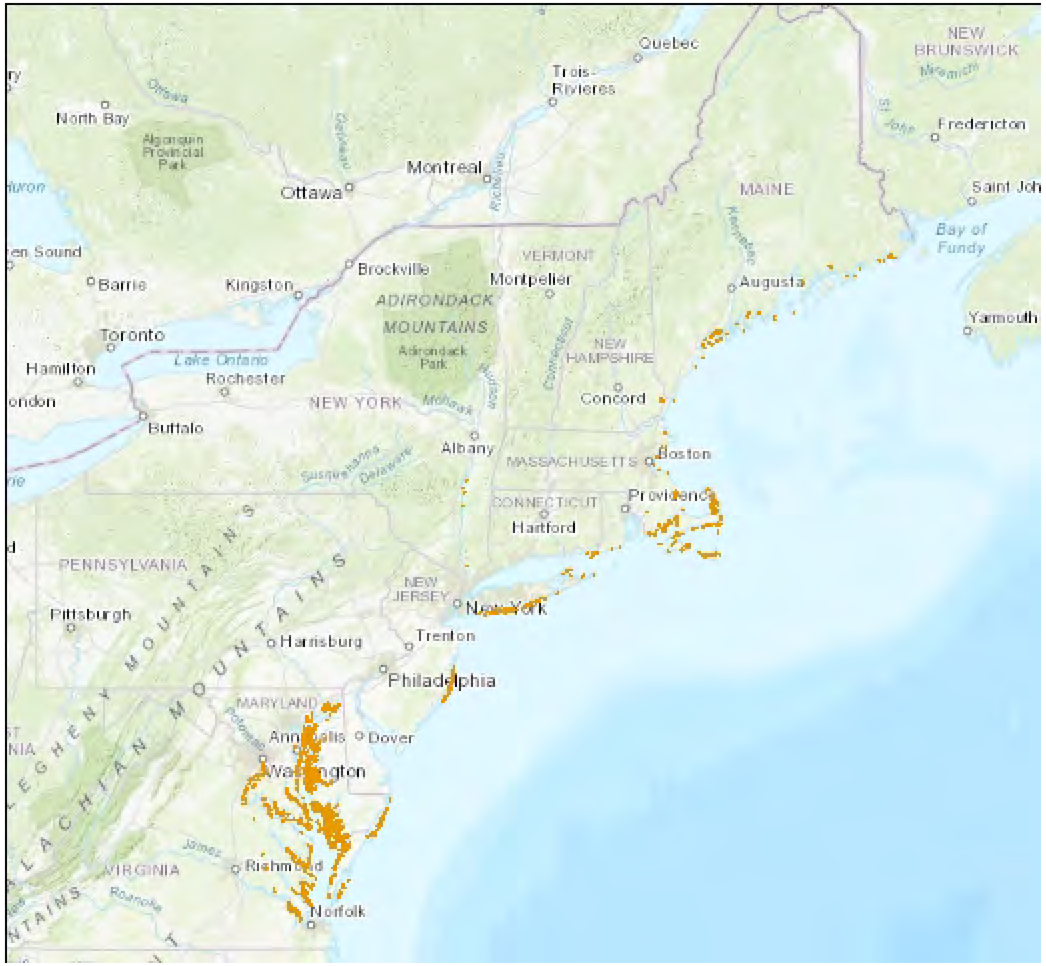
Estuarine metrics

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 a protected area	10 points if the polygon is within ½ km of a protected area
Proximity to development	Distance from marinas and ports	10 points for the 25% of polygons farthest from marinas and ports
Water quality	Polygon falls in 303(d) listed water (excluding listed due to fecal coliform)	10 points if polygon does not overlap 303(d) listed waters
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

Seagrass and oyster reef habitat

- % of hexagon covered by seagrass or oyster reef
  - SAV merged from state data by TNC Eastern Science (Marta Ribera)
  - Oysters:
    - NOAA's Chesapeake Bay Office. Coastal and Marine Ecological Classification Standard (CMECS)
    - Oyster & Blue Mussel from NE Ocean Data Portal

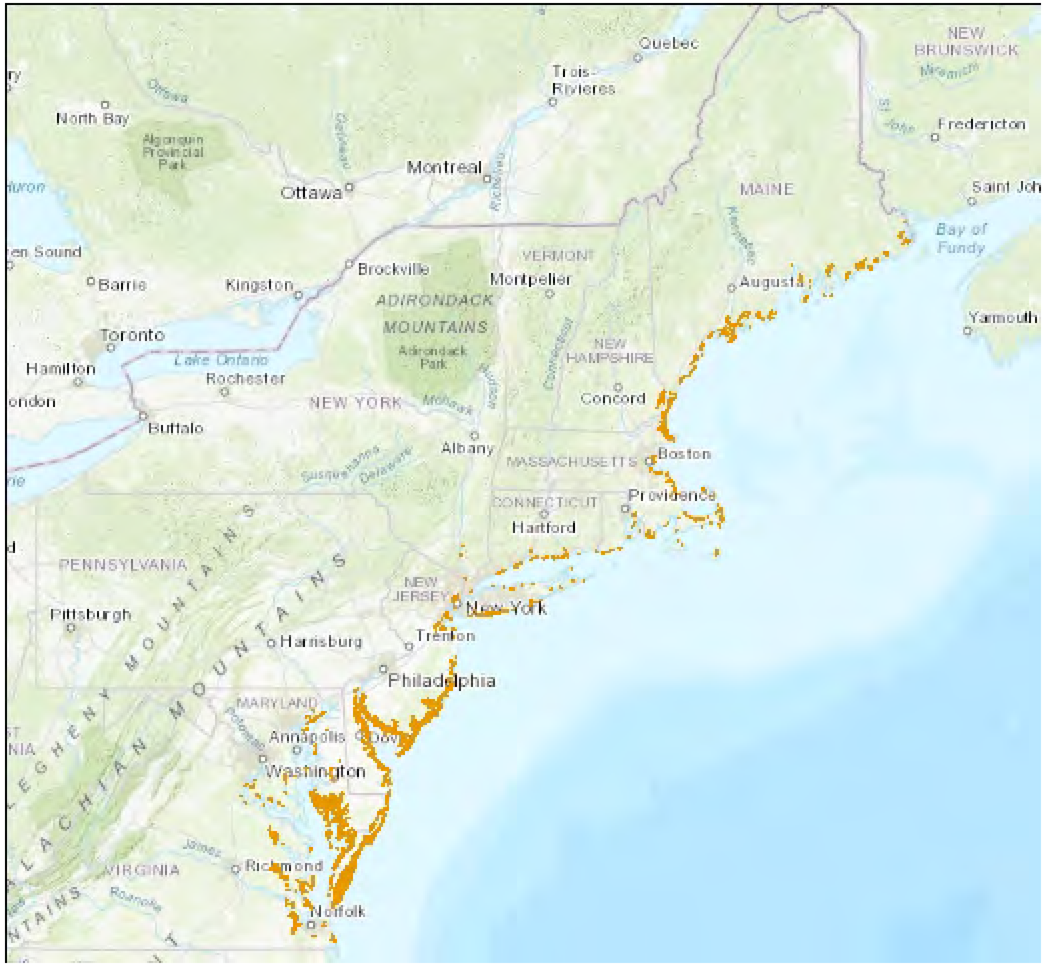
- 10 points if the polygon ranks in the top 25% for coverage



Wetland habitat

- % of hexagon covered by wetlands
  - National Wetlands Inventory (NWI)
  - Estuarine wetlands (ATTRIBUTE LIKE 'E2%')

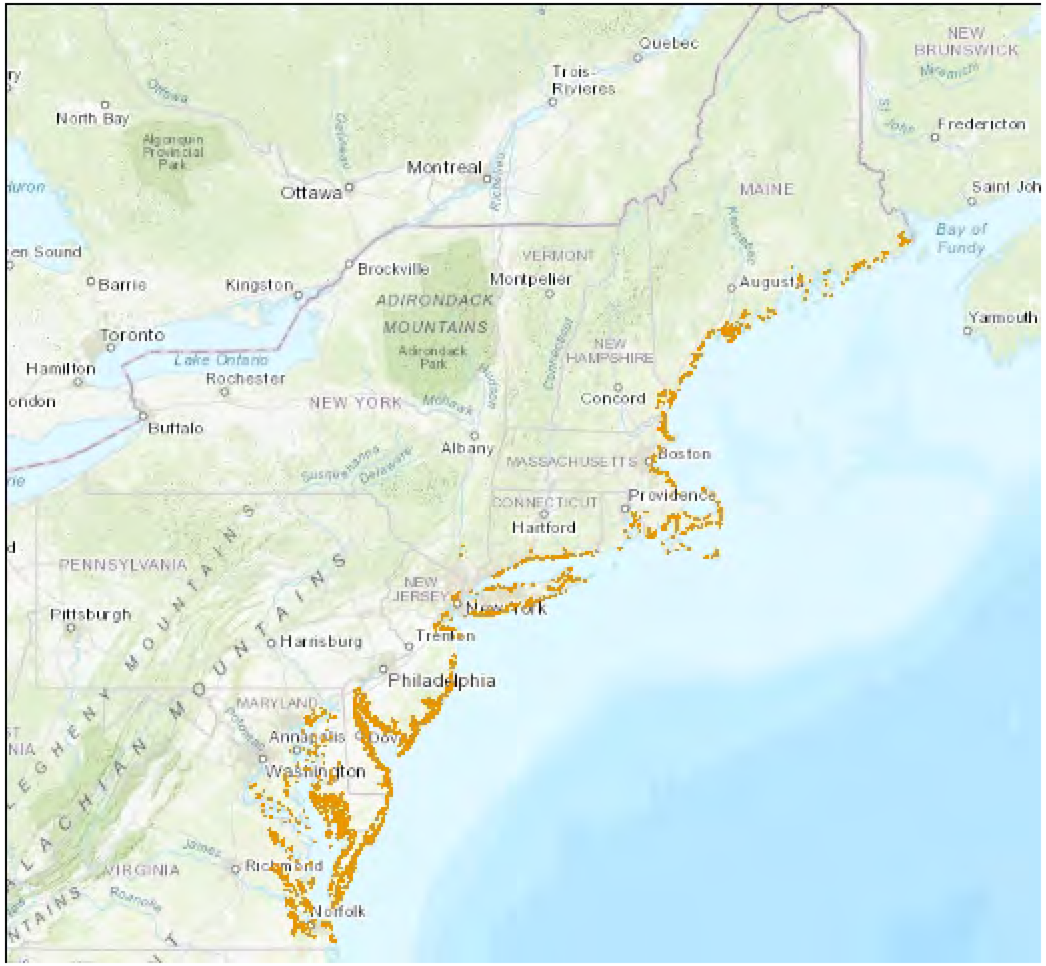
- 10 points if the polygon ranks in the top 25% for coverage



Water-Vegetation Edge

- Length of estuarine-marsh-water edge in the hexagon
  - National Wetlands Inventory (NWI)
  - Estuarine wetlands (ATTRIBUTE LIKE 'E2%')

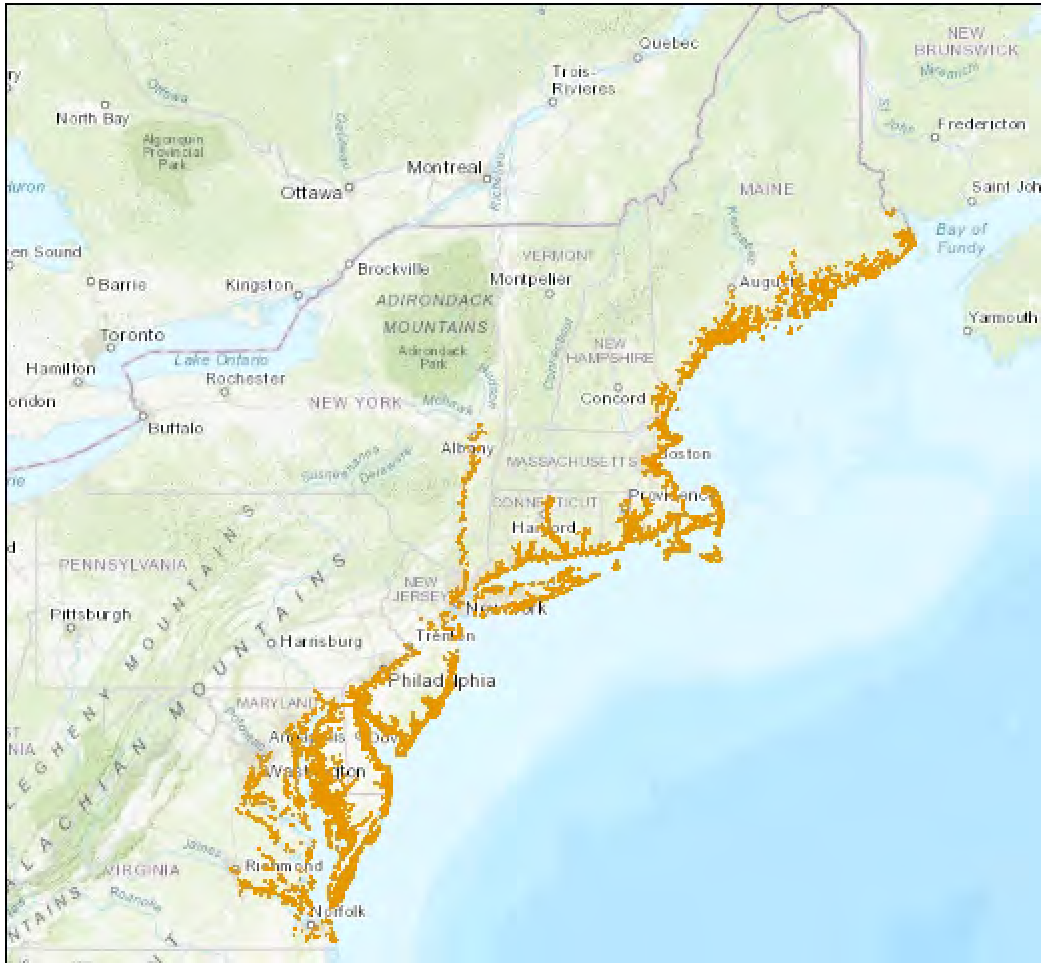
- 10 points if the polygon ranks in the top 25% for length



Proximity to protected habitat

- Distance to a protected area
  - Protected Areas Database v2.0 (PAD-US)

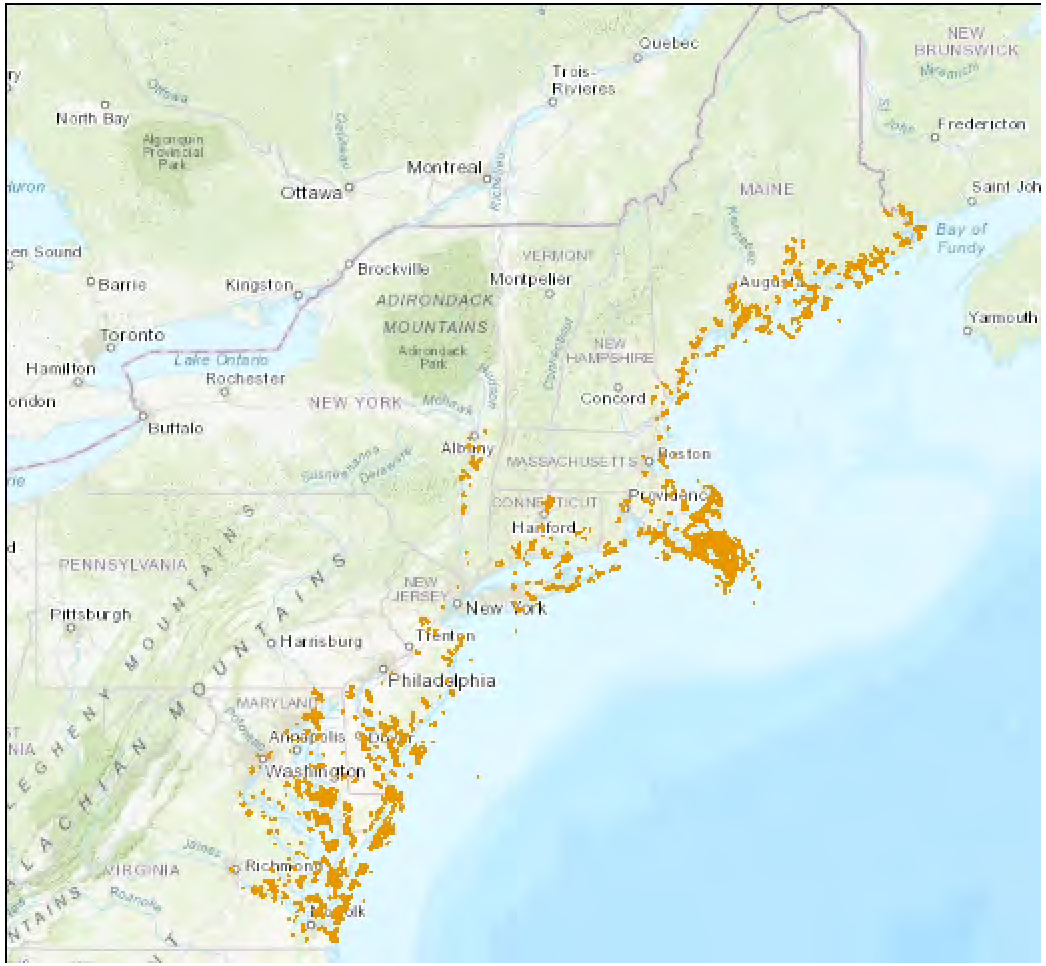
- 10 points if the hexagon is within ½ km of a protected area



Proximity to Development

- Distance from marinas and ports
  - Ports from US DOT Ports

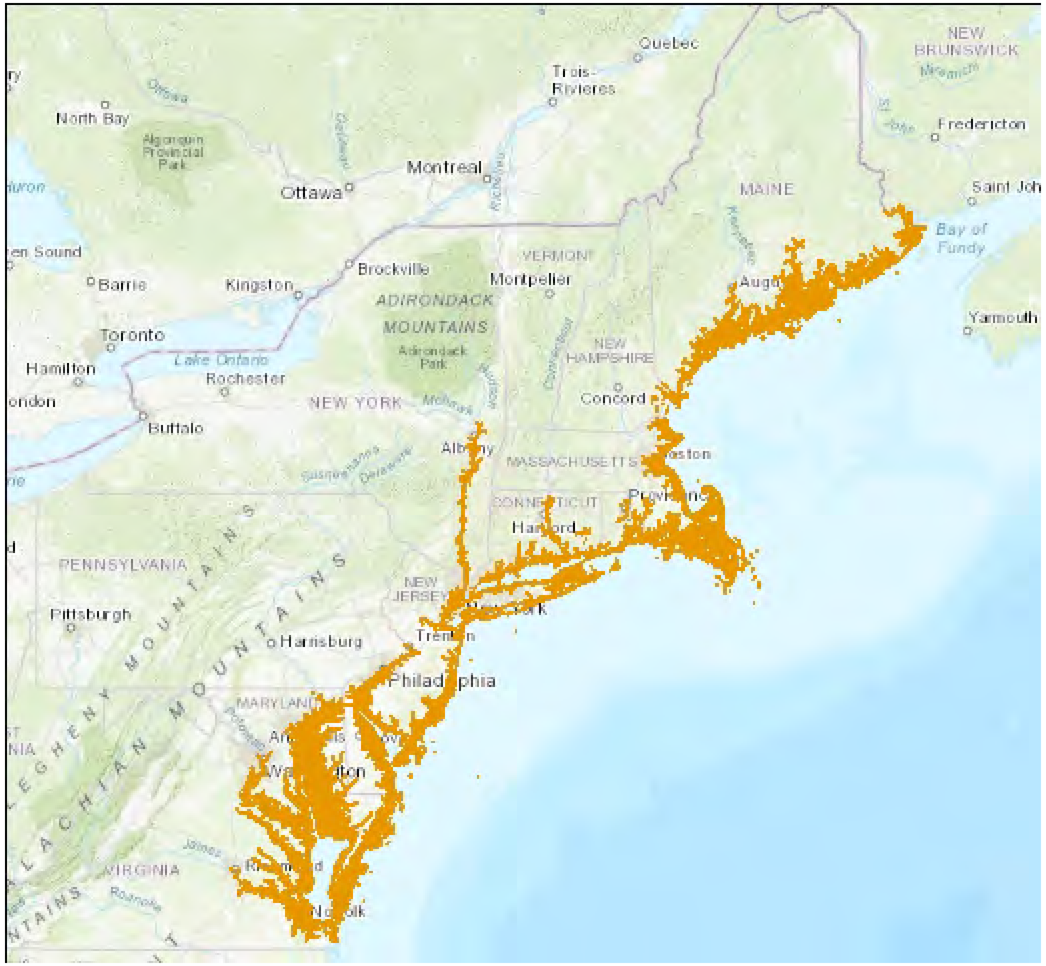
- 10 points for the 25% of hexagons farthest from marinas and ports



Water quality

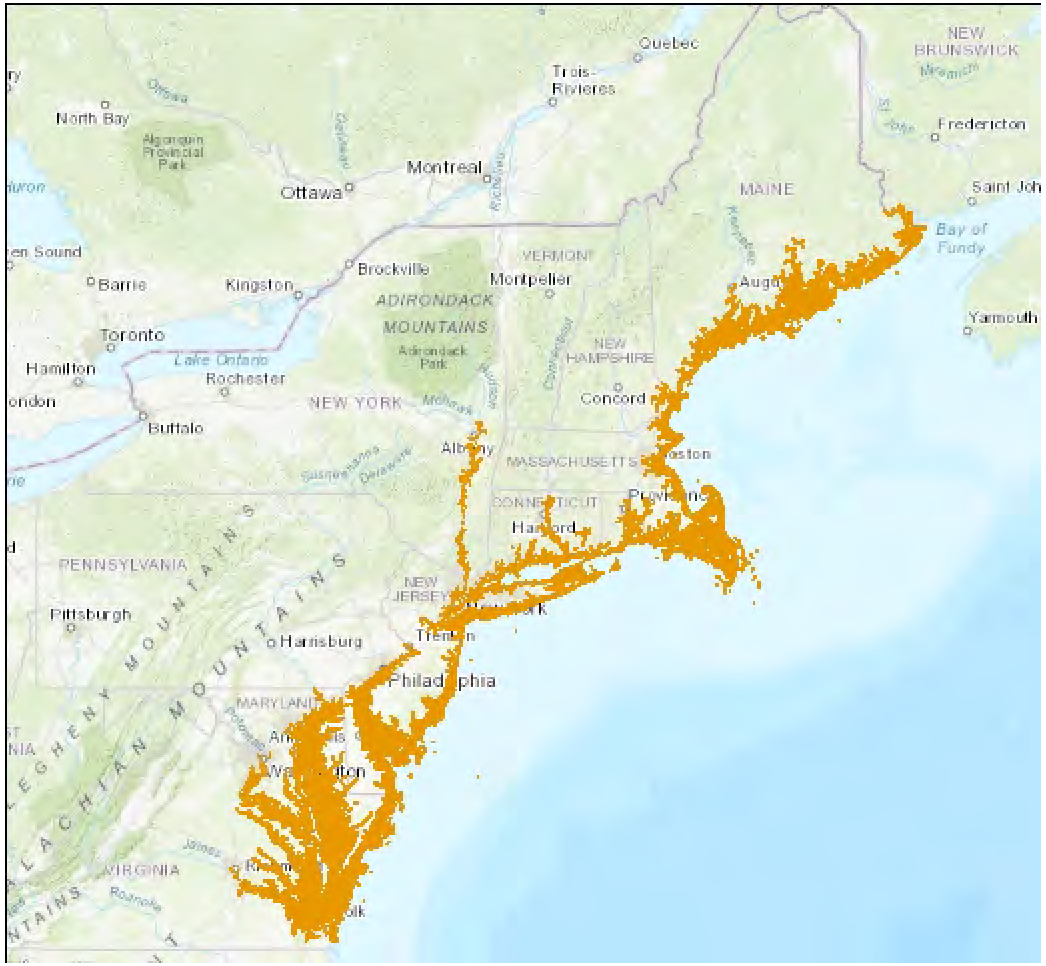
- Polygon falls in 303(d) listed water
  - US EPA
  - Excluding waters listed due to fecal coliform

- 10 points if hexagon does not overlap 303(d) listed waters



Hardened shoreline

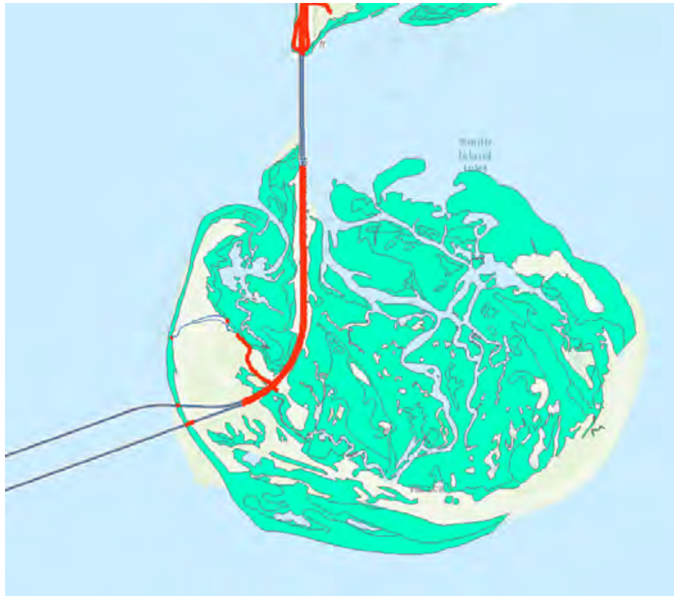
- Length of hardened shoreline within the polygon
  - NOAA ESI Shoreline
  - Hardened shoreline includes all classes with “Armored” (GENERALIZED_ESI_TYPE LIKE '%1%’)
  - Some classes are combinations (e.g. “Vegetated/Armored”)

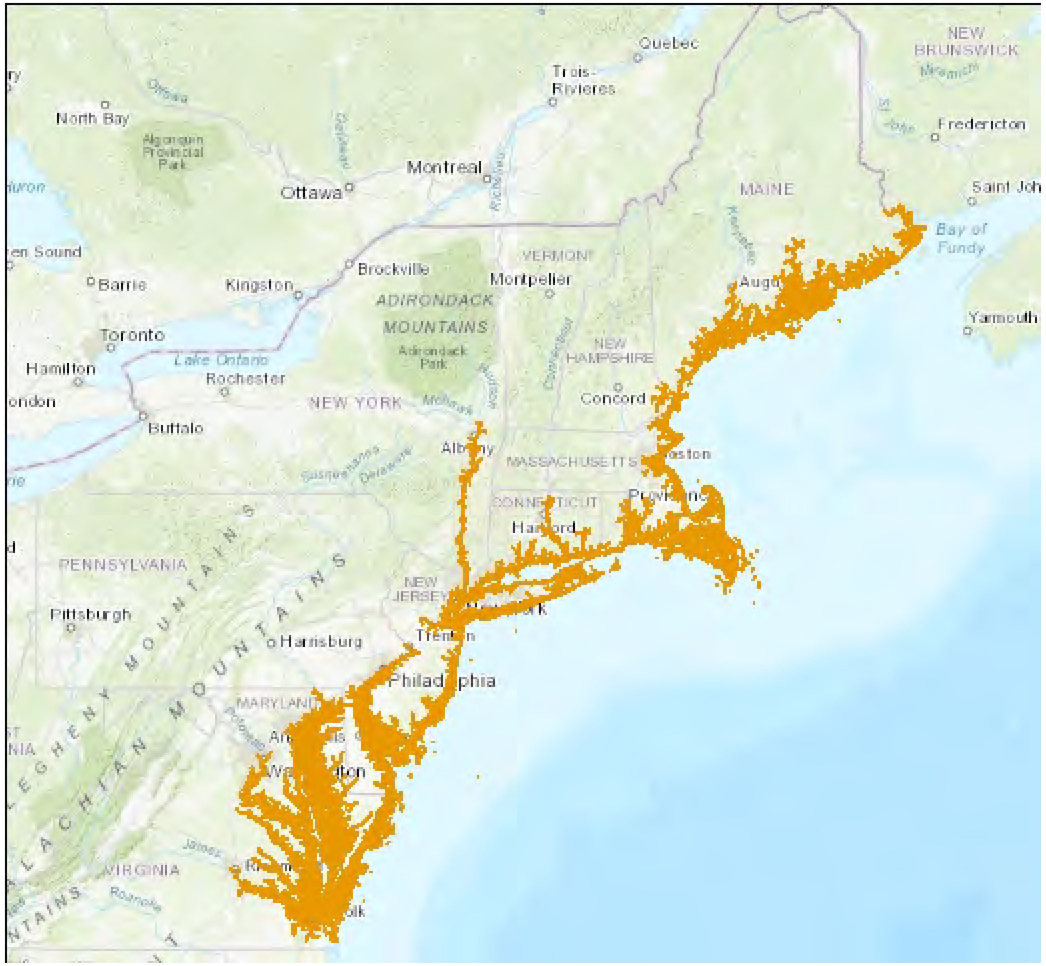


- 10 points for the 25% of hexagon with the least amount of hardened shoreline

Habitat fragmentation

- Linear ft. of causeway within a polygon
  - Causeways are defined as roads with tidal marsh on at least one side (50m buffer)
    - Roads: US Census Bureau TIGER
    - Wetlands: NWI tidal estuarine



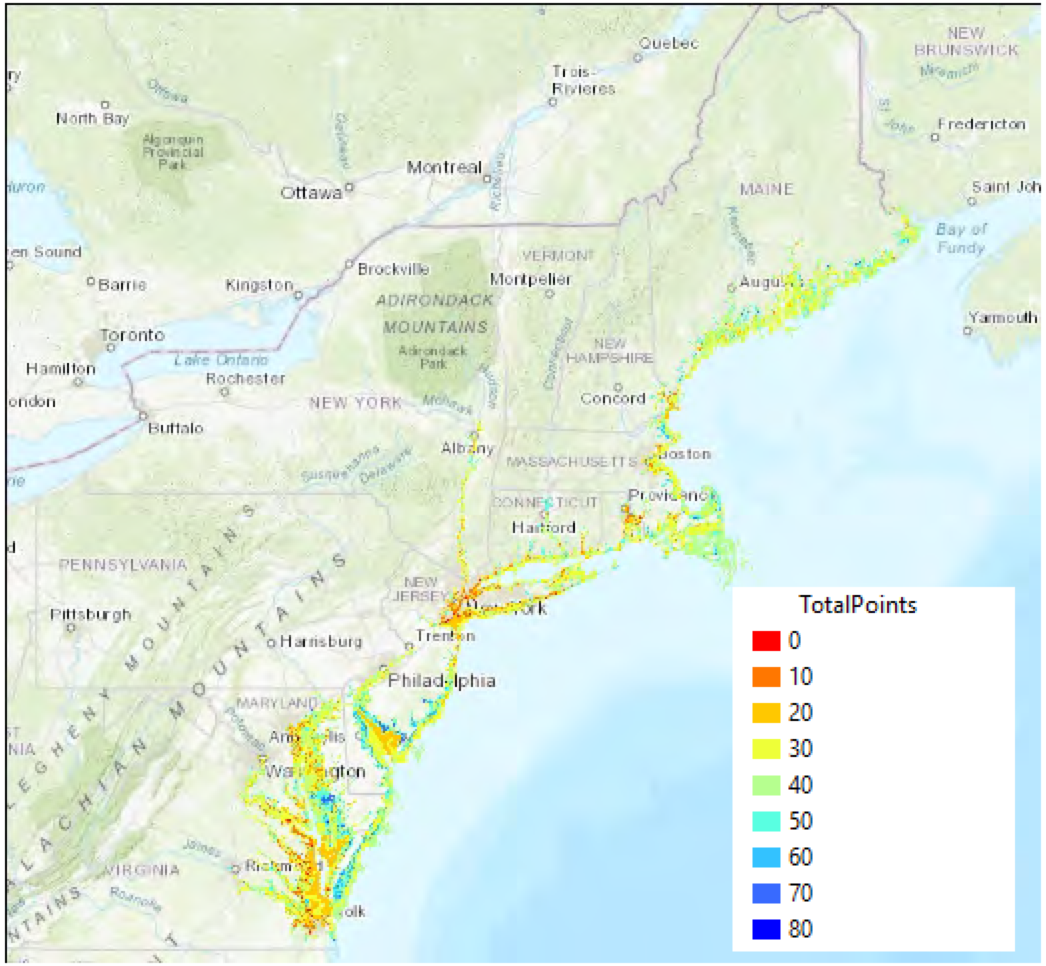


- 10 points if the hexagon has 0 ft. of causeways

The Nature Conservancy

Total Points

- Sum of all estuarine points



Questions / Discussion Points

- Estuarine water quality
  - 303(d): agreement on excluding waters listed due to fecal coliform?
- Additional sources of oyster reef data?
  - Currently using CMECs (Chesapeake Bay)
  - Oysters & Blue mussels from NE Ocean data portal
- Estuarine marsh (used in the wetlands and water-vegetation edge metric).
  - Currently using all estuarine intertidal (E2%). Is there a subset of these and/or additional

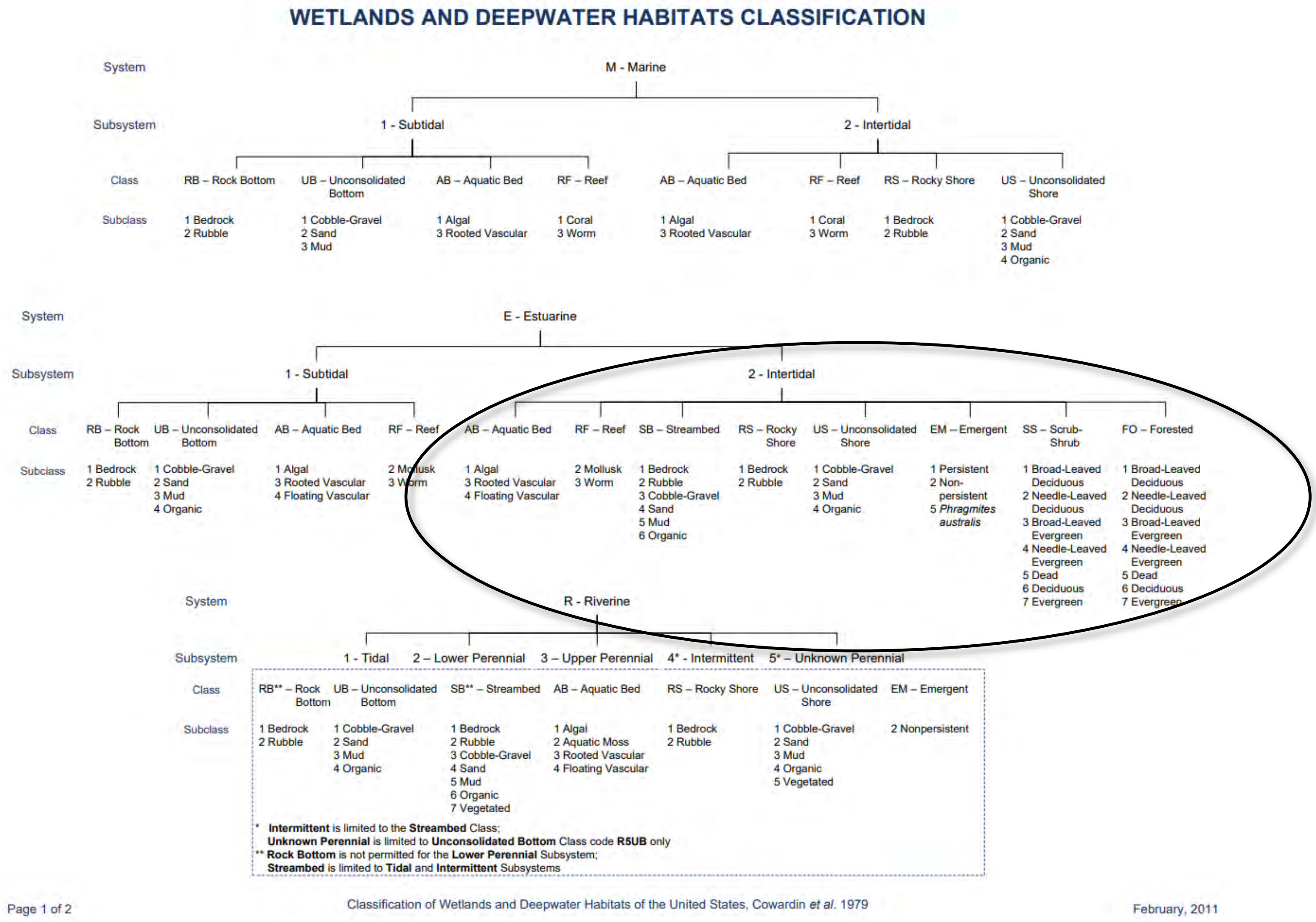


Photo: Romona Robbins

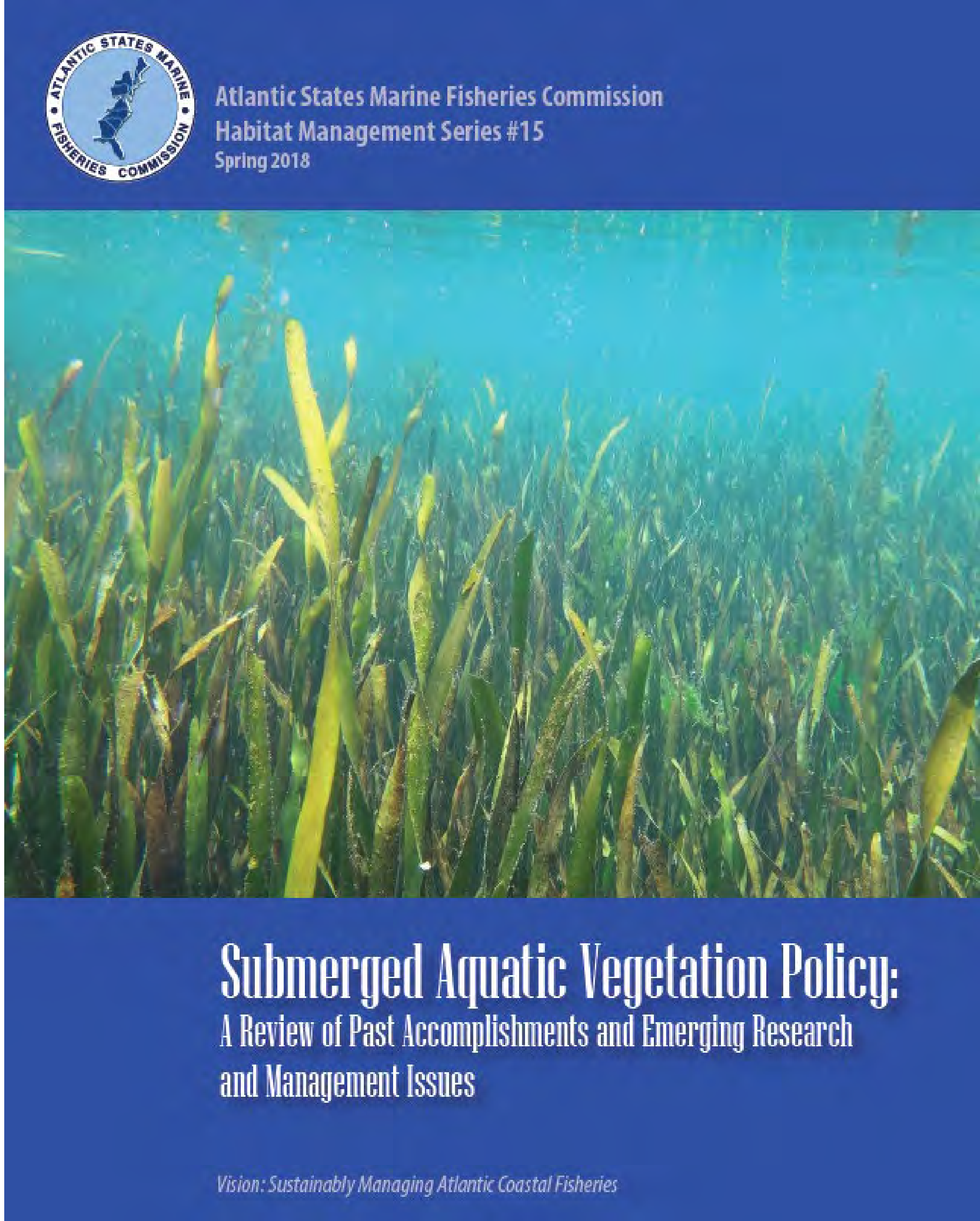
October 29, 2019

SAV Monitoring Protocols Discussion

ASMFC SAV Policy (2018)

Section I: Assessing the Resource:

"At a minimum, each member state should **ensure the implementation of an SAV resource assessment and monitoring program which will provide a continuing quantitative evaluation of SAV distribution and abundance and the supporting environmental parameters**. The optimal coast-wide situation would be a monitoring system which would establish **consistent monitoring techniques among regions so that the data are comparable**. For example, SeagrassNet is used at several locations along the Atlantic coast and other areas worldwide to assess trends in health of discrete SAV beds using comparable techniques. In addition to evaluating distribution and abundance, **monitoring should also evaluate trends in the overall health of existing SAV beds**."



ASMFC SAV Policy (2018)

Section I: Assessing the Resource – Actions:

ASMFC — Support (financially, politically, or through the sharing of resources and information) and **promote states to adopt an SAV mapping and monitoring plan**. Assessment/data collection should have relevant metrics and scales to inform specific management questions and goals. When possible, **promote universal metrics for monitoring along the coast to allow for inter-state comparisons**.

States — **ASMFC members should encourage their appropriate state agencies or departments to implement regular statewide or regional SAV monitoring programs which will identify changes in SAV health and abundance cumulatively** on a coast-wide basis if they are not already doing so. Surveys should minimally be on a five year basis, and preferably annually, for areas considered to be especially at risk of severe declines from anthropogenic activities, disease, or other factors. Aerial images captured from a plane allow for standard comparability across regions, if resources allow. A good map provides spatial extent and rough approximations of density. However, aerial-based assessment results can vary considerably based on image quality, SAV bed plant densities, visual signature interpretation and extent of surface level verification. Above ground biomass from sentinel beds can allow for a closer look at plant health and bed dynamics.

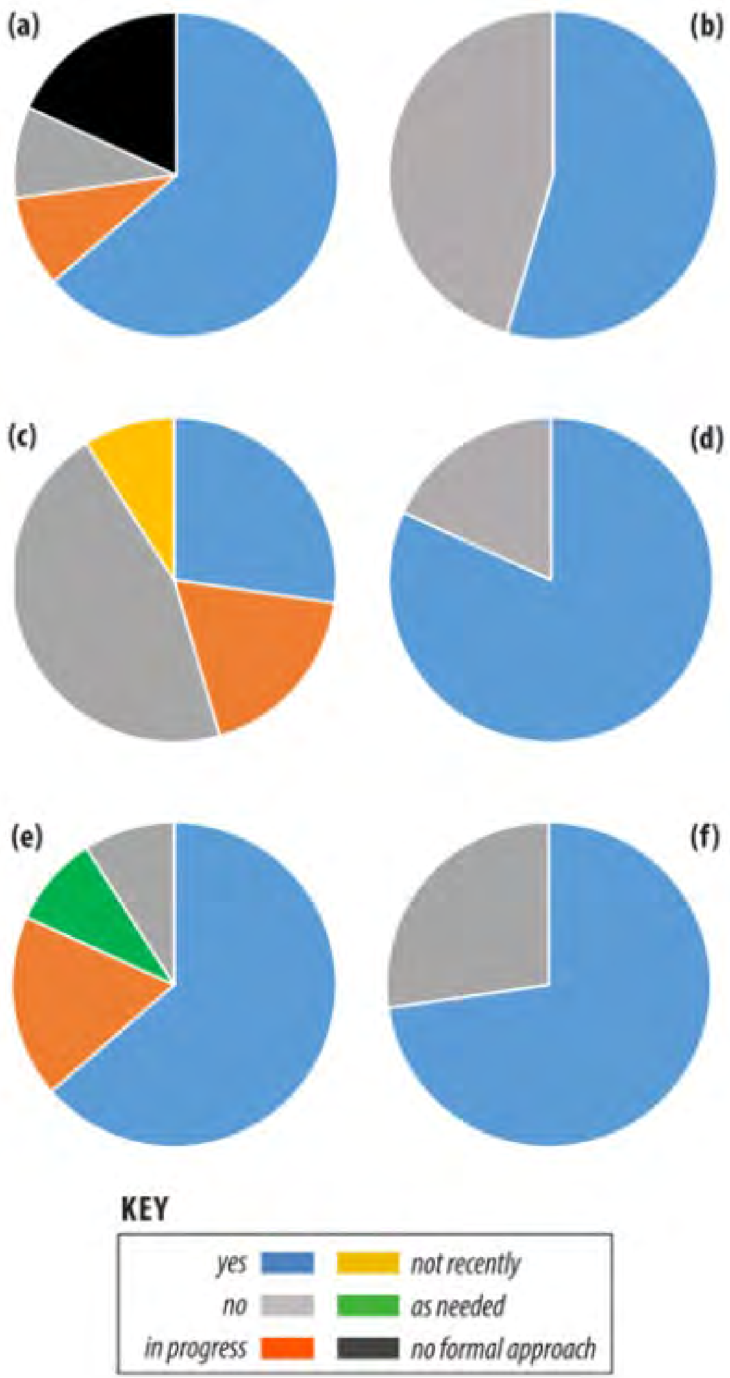


Figure 1. State responses to the following questions: (a) Has your state implemented an SAV resource management assessment and monitoring strategy? (b) Has your state set restoration goals? (c) Has your state reviewed the effectiveness of their assessment and monitoring programs? (d) Has your state identified reasons for loss and/or addressed the need for SAV improvement? (e) Has your state identified areas for protection or restoration? (f) Does your state follow specific Best Management Practices?

Gulf of Mexico Seagrass Community of Practice

… created to support the management, research, restoration, and conservation of seagrasses in the GOM. The intent of the Seagrass CoP is to facilitate collaboration and coordination among seagrass experts and practitioners. The intent is to connect seagrass monitoring, mapping, research, and management efforts; share and leverage resources and information; and compile and implement best practices recommendations.

Goals:

- **Facilitate information exchange and maximize collaboration potential by providing a mechanism for connecting experts and practitioners throughout the Gulf of Mexico. This includes a broadcast email address and a spreadsheet of contacts with affiliations, and areas of expertise.**
- **Improve advocacy efforts for seagrass mapping/monitoring.**

CoP Seagrass Monitoring Approach for the Gulf of Mexico (June 2018)

Developed by:

- Lawrence Handley (Scientist Emeritus, USGS)
- Catherine Lockwood (Geographer, CNL World)
- Kathryn Spear (Ecologist, USGS)
- Mark Finkbeiner (GISP, NOAA)
- W. Judson Kenworthy (Retired NOAA)

***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.

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:

Handley, L. 1994. Submerged Aquatic Vegetation Mapping Working Group Report, pp. 30-36. In: Hilary A. Neckles (ed.), Indicator development seagrass monitoring and research in the Gulf of Mexico. U. S. Environmental Protection Agency, Office of Research and Development, Environmental Research Laboratory, Gulf Breeze, Florida. EPA/620/R-94029.

Hilary A. Neckles, Blaine S. Kopp, Bradley J. Peterson, Penelope S. Pooler. 2012. Integrating Scales of Seagrass Monitoring to Meet Conservation Needs. Estuaries and Coasts 35:23–46.

Gulf-wide Seagrass Monitoring and Needs Assessment Workshop 2017, Gulf Breeze, FL. Gulf Alliance Gulf-Star Award Project.

CERF 2019 Conference Workshop

Sharing & Applying Best Practices for Mapping/Monitoring Coastal SAV

Mark Finkbeiner (GISP, NOAA)

Goal: advance the awareness and application of best practices related to SAV mapping and monitoring

Topics:

- Mapping and monitoring methods, the indicators that can be measured at various scales or tiers, and the technologies useful at each tier
- Results of a case study mapping/monitoring project will be presented and how the SAV CoP contributed to that effort
- Participants will learn how to join/engage with the CERF SAV CoP

6 Reasons to Protect Eelgrass

1. Protects coastlines

Eelgrass helps stabilize the shore in addition to furnishing habitat for a variety of marine wildlife.

2. Mitigates climate change

Eelgrass absorbs carbon dioxide and methane—climate-warming greenhouse gases—and stores them in its root system.

3. Nurtures fish

Eelgrass beds provide shelter and foraging areas for rockfish, salmon, and Dungeness crabs.

4. Feeds birds

Migratory waterfowl, including the Pacific black brant, eat eelgrass.

5. Improves water quality and clarity

Eelgrass beds absorb pollutants and help prevent harmful algal blooms.

6. Strengthens the coastal economy

Eelgrass supports fish and shellfish that are integral to the commercial and recreational fishing industries.