An overview of select coastal ecosystem monitoring projects at GMRI

Graham Sherwood, Research Scientist, Fisheries Ecology
Gulf of Maine Research Institute
Portland, Maine

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Science. Education. Community.

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About GMRI

*GMRI catalyzes solutions to the complex challenges of ocean stewardship and economic growth in the Gulf of Maine bioregion through a dynamic fusion of **science**, **education**, and **community**.*

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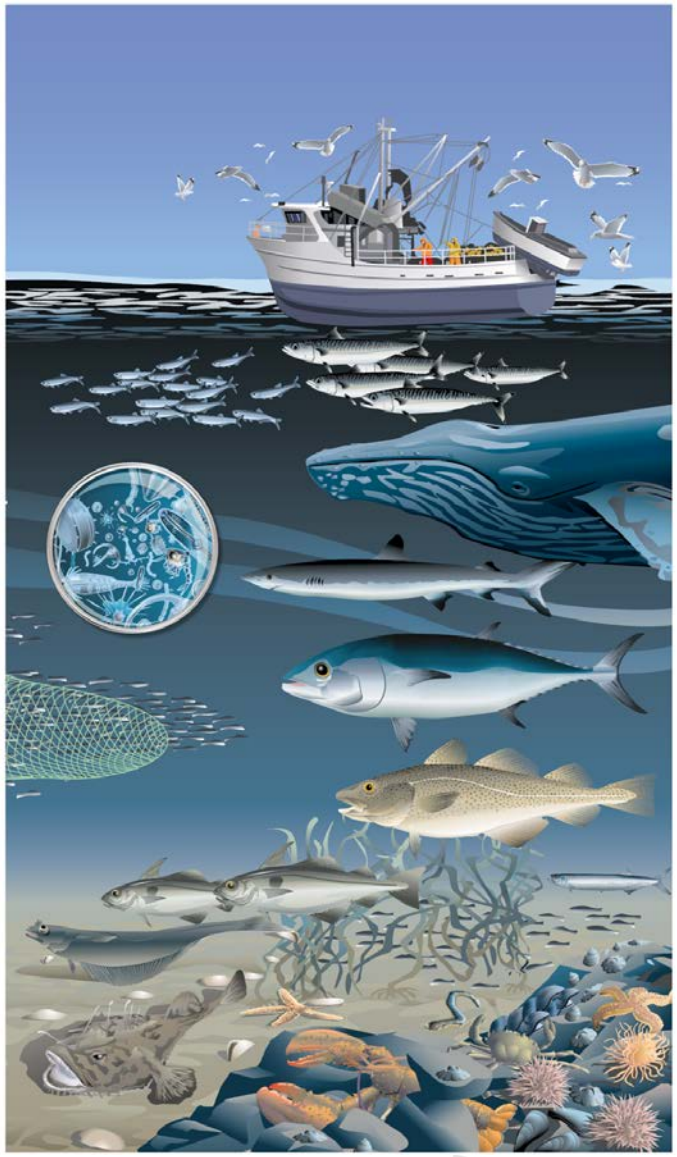
Taking an Ecosystem Approach



Linking…

- Ecology
- Oceanography
- Modeling
- Gear Technology
- Resource Economics
- Ocean Data

…to understand a changing Gulf of Maine

GMRI research in the coastal zone

- Maine inshore acoustic herring survey
- Penobscot River Restoration pre-dam removal food web monitoring
- Casco Bay Aquatic System Survey
- Snap-a-Striper

Maine inshore acoustic herring survey

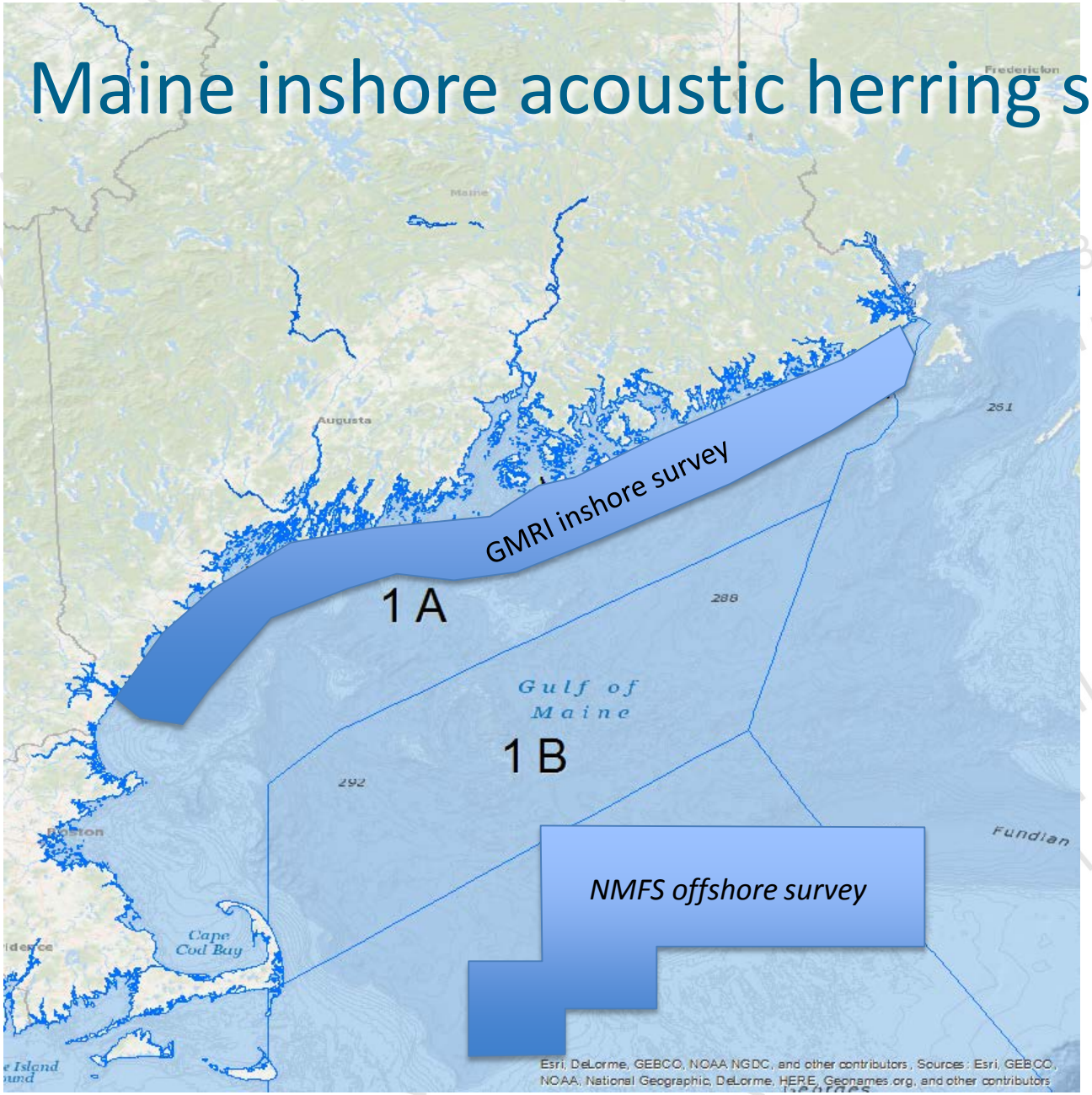
Originally designed to compliment offshore acoustic herring survey (NMFS) to provide information on relative biomass of inshore vs. offshore stock components.

Offshore survey was discontinued in 2012, the year we commenced inshore survey.

Inshore survey has been running for 5 years (2012-2016).

Survey is shedding light on spatial-temporal patterns of herring during fall spawning period.

Maine inshore acoustic herring survey



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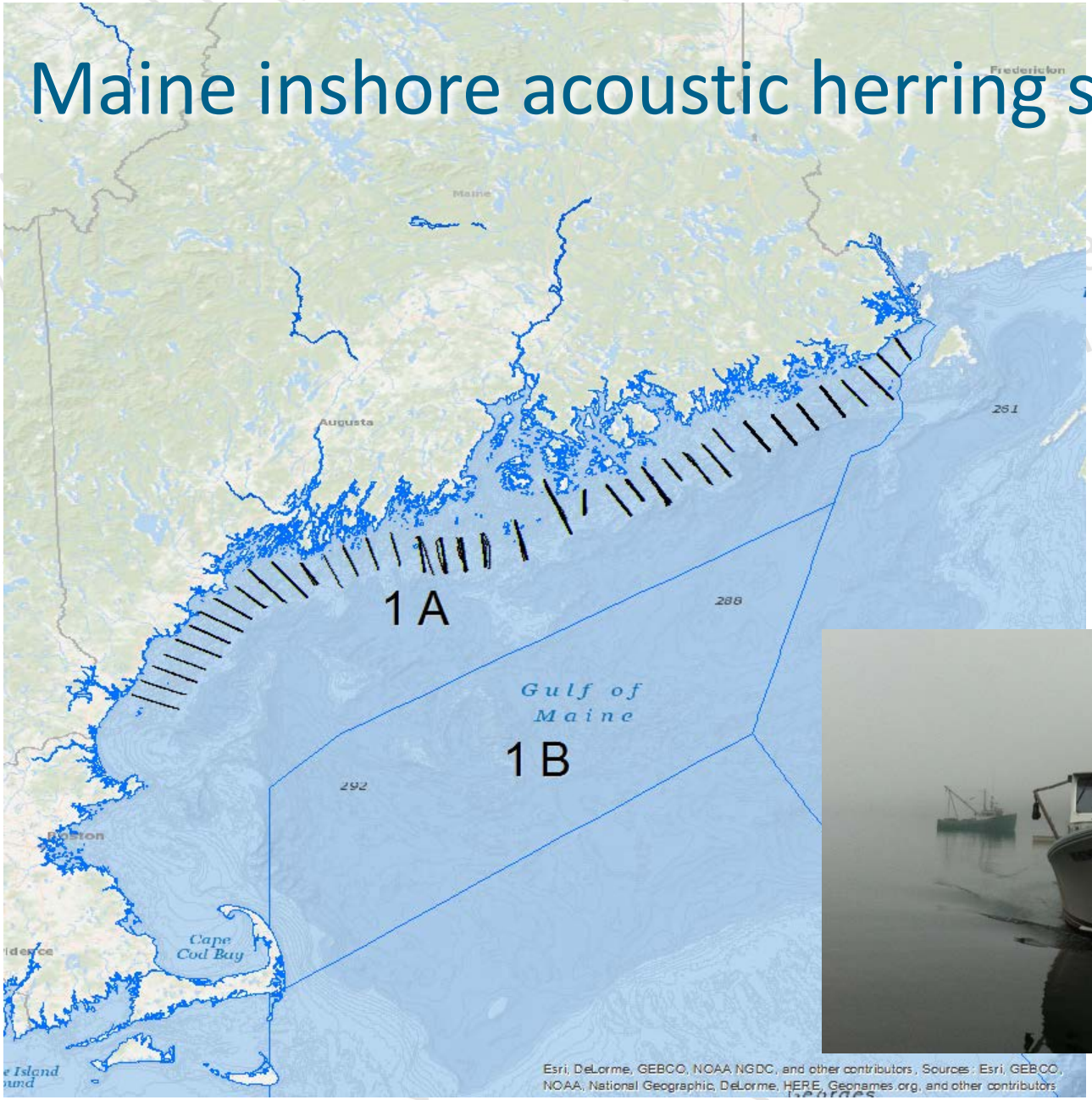
Maine inshore acoustic herring survey



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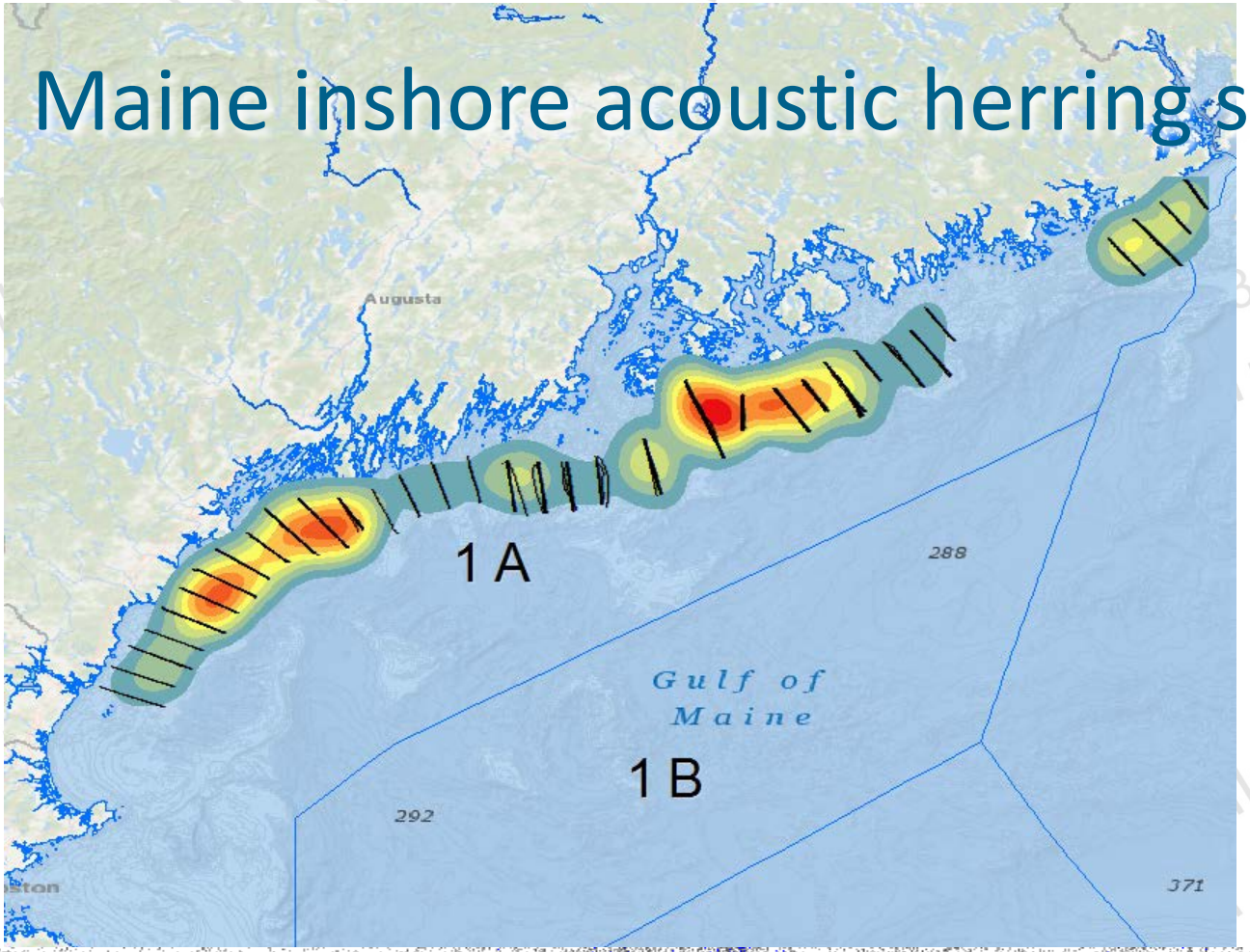
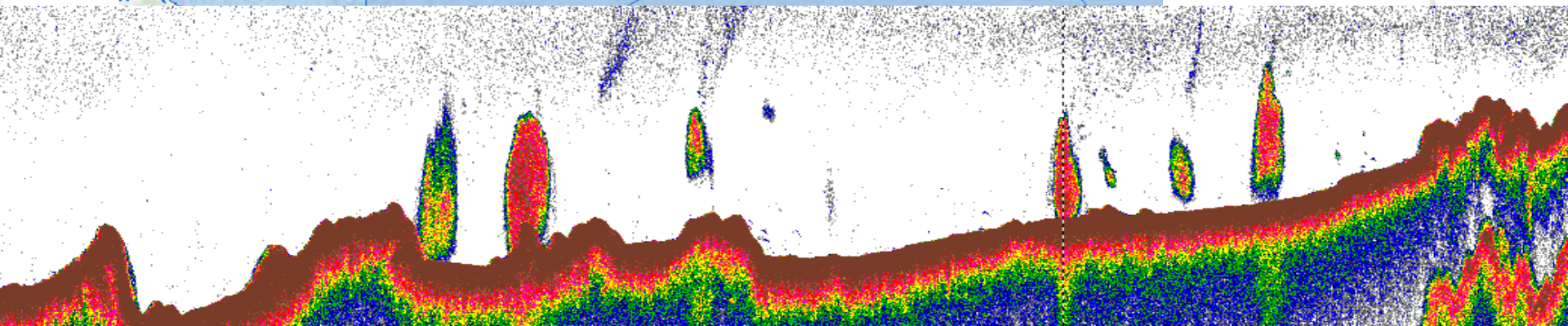
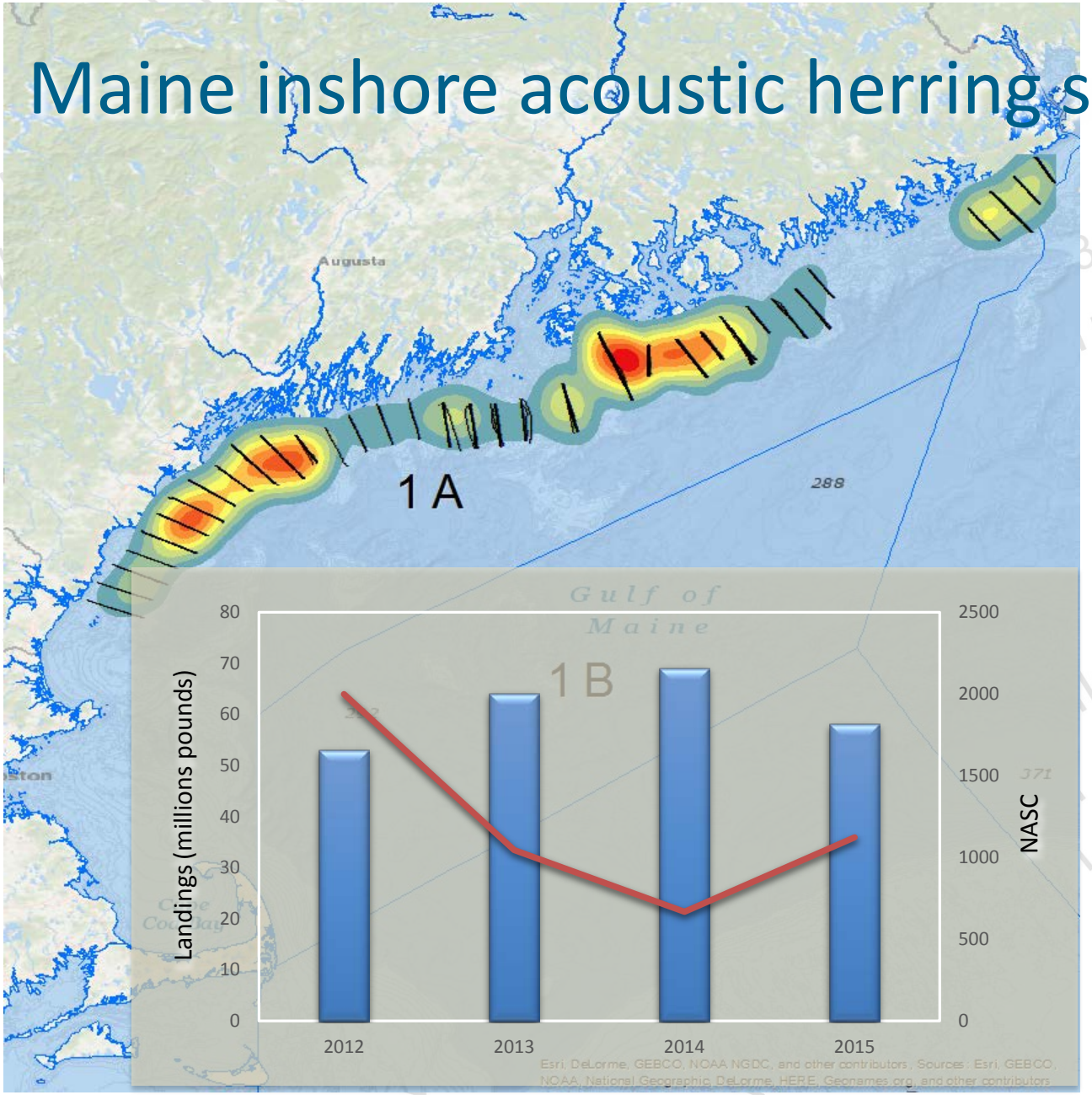
Maine inshore acoustic herring survey





Maine inshore acoustic herring survey



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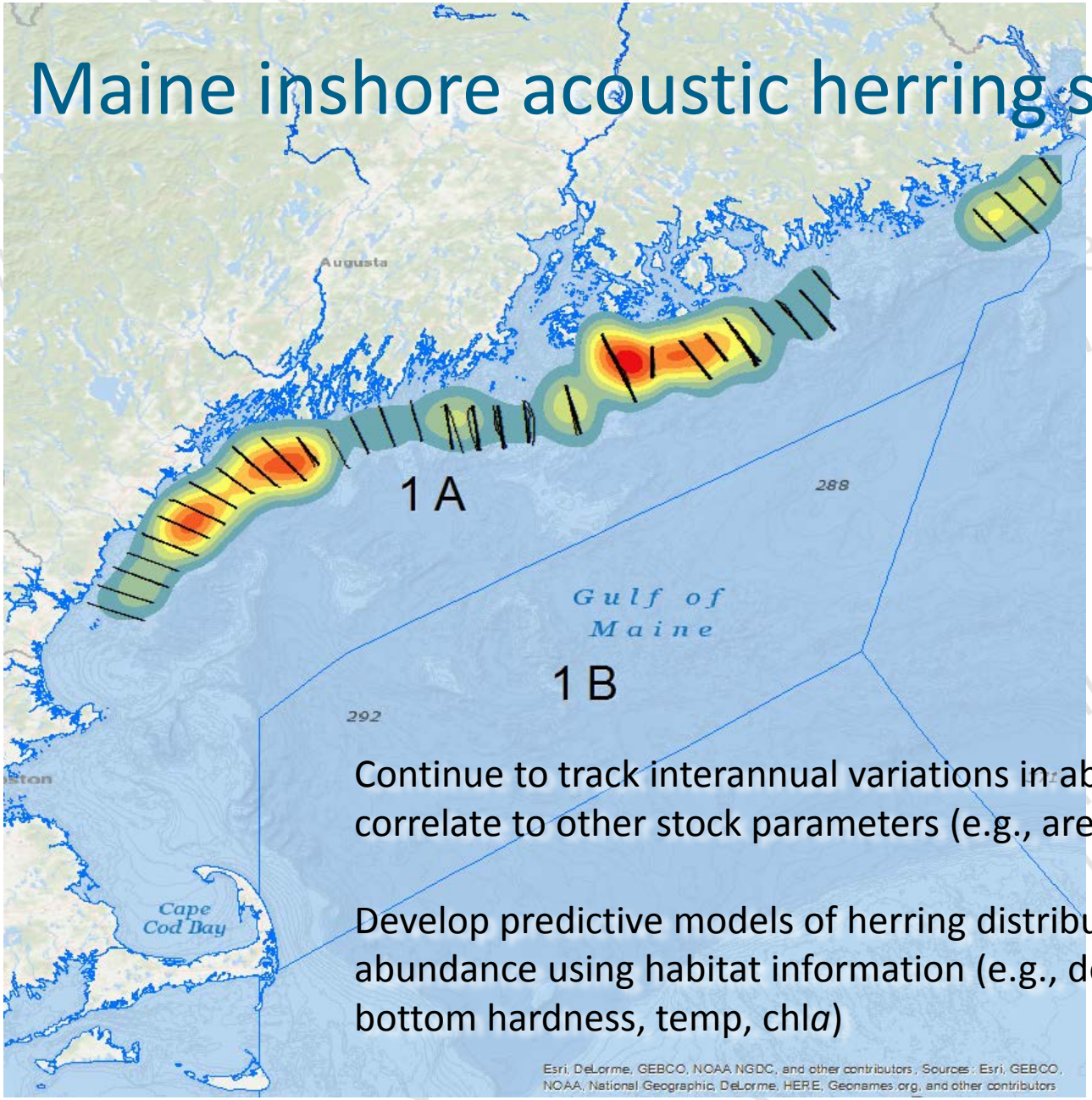
Maine inshore acoustic herring survey



Continue to track interannual variations in abundance and correlate to other stock parameters (e.g., area 1A landings)

Develop predictive models of herring distribution and abundance using habitat information (e.g., depth, bottom type, bottom hardness, temp, chl*a*)

Penobscot River Restoration

Monitoring freshwater/marine linkages before and after dam removal (with Karen Wilson and Theo Willis, USM; funded by TNC).

Before monitoring: how much carbon (via fish) was being transferred among systems (i.e., between river and bay)?

How did this compare to system where river passage was much greater (the Kennebec)?

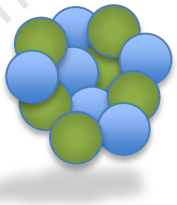
We applied a stable isotope approach to observe carbon flow.

Penobscot River Restoration

With stable isotopes, you are what you eat.

If you eat heavy carbon, you yourself will be made up of heavy carbon.

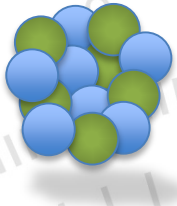
Common
Light
Carbon-12
^{12}C



6 protons
6 neutrons

Freshwater consumers

Rare
Heavy
Carbon-13
^{13}C



6 protons
7 neutrons

Marine consumers

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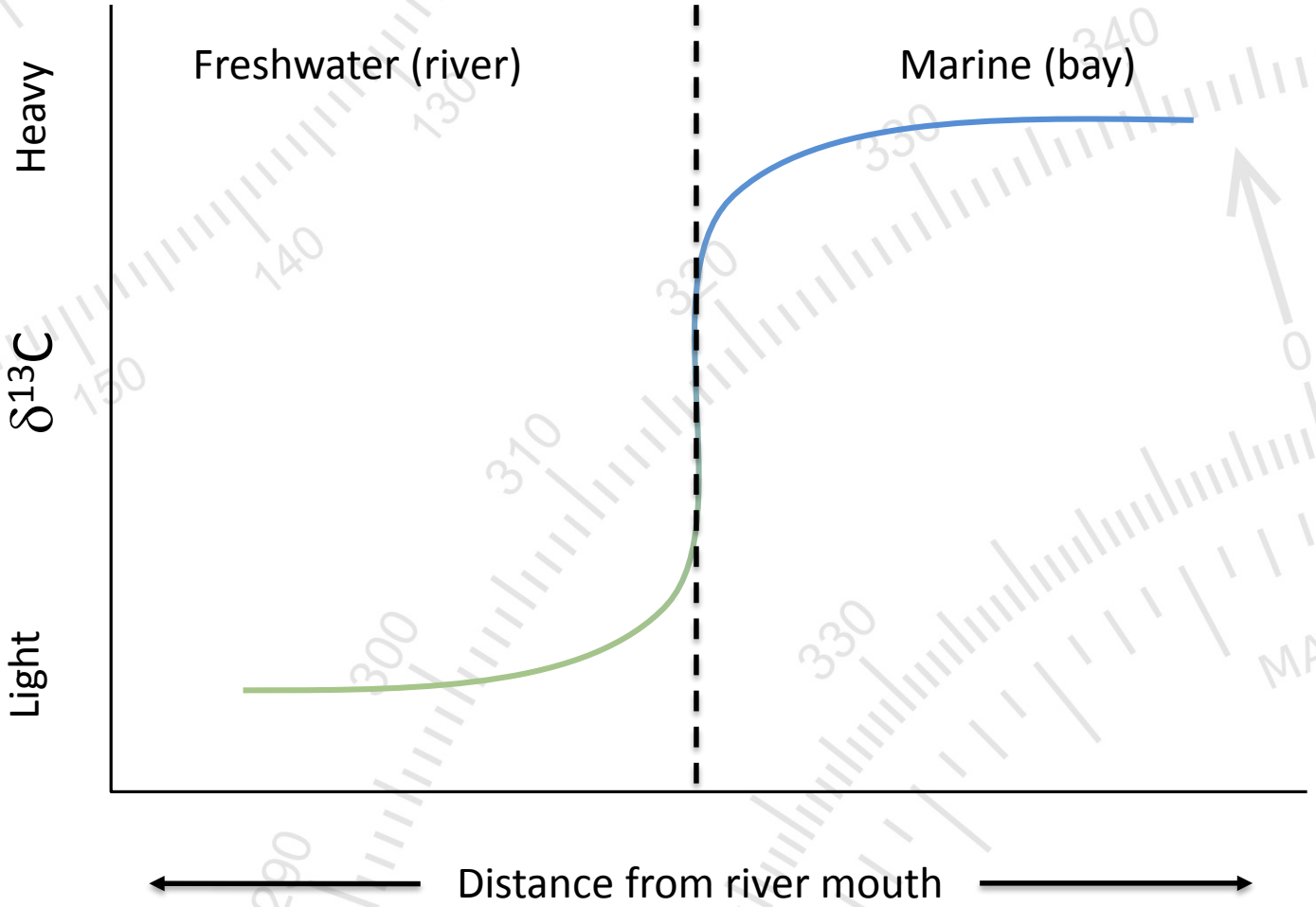
Penobscot River Restoration



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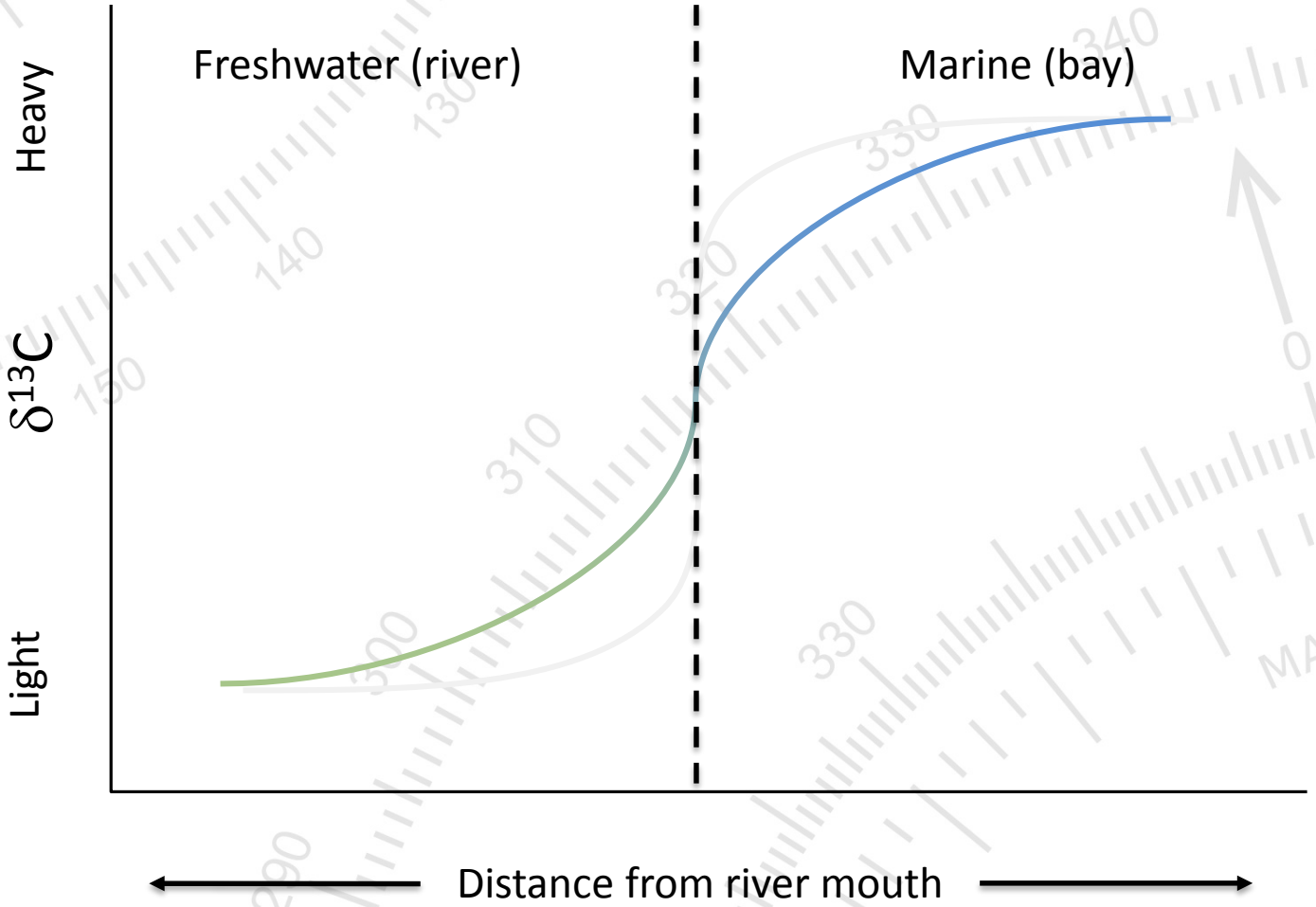
Penobscot River Restoration



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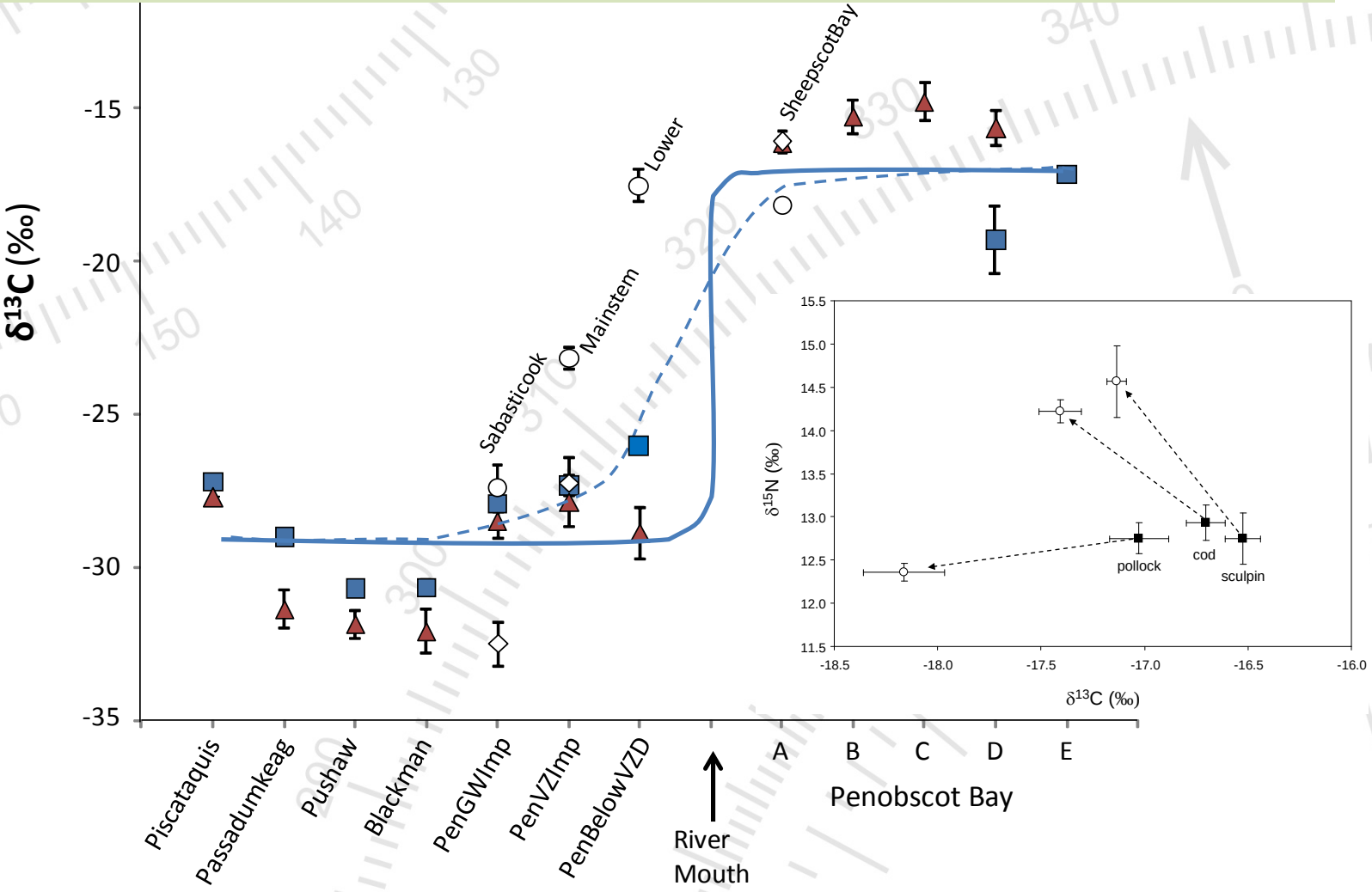
Penobscot River Restoration

What do carbon signatures look like now in Pen Bay/River?



Casco Bay Aquatic Systems Survey (CBASS)

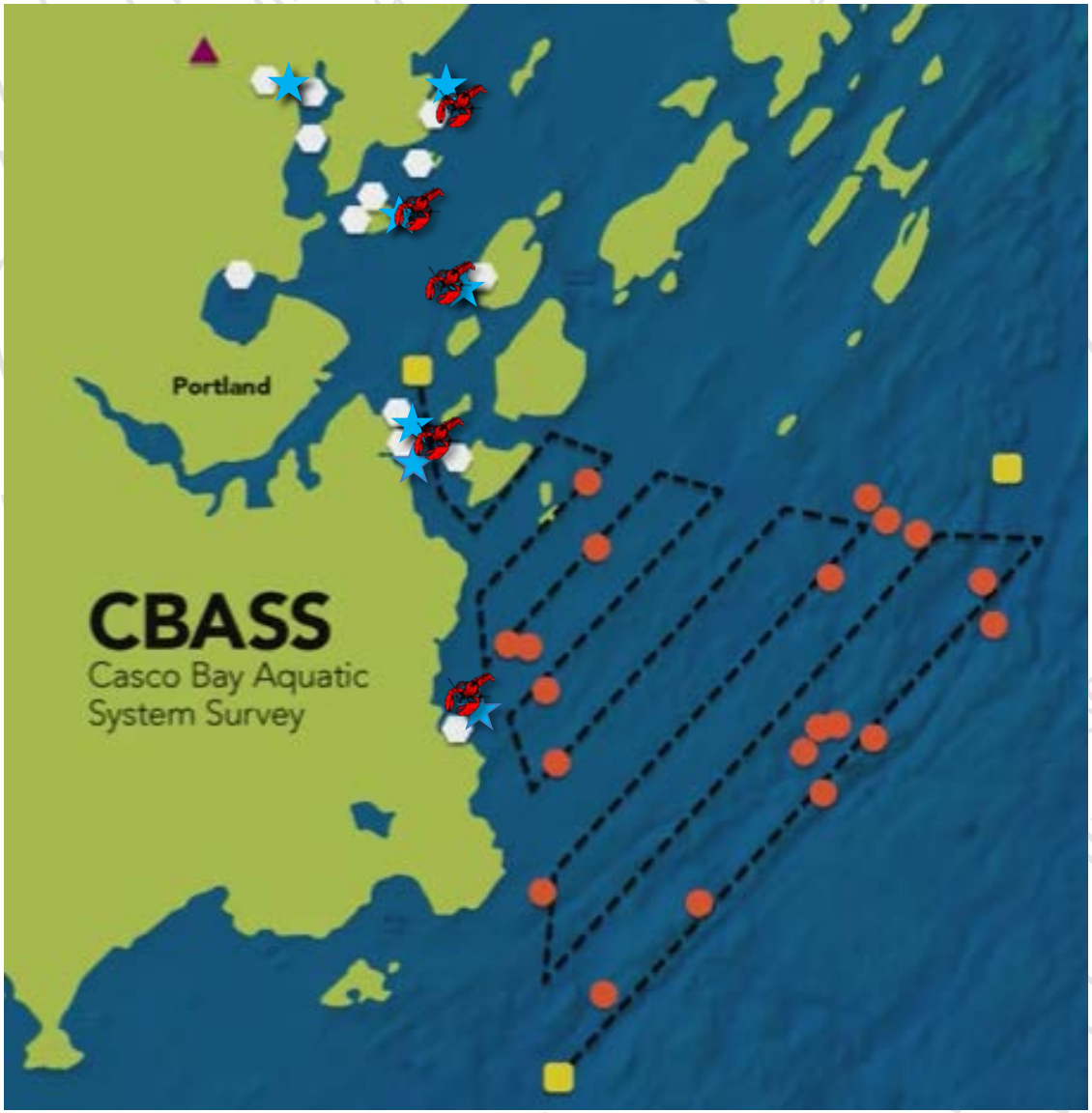
What is CBASS?

10 year project to monitor change in the Casco Bay ecosystem, a sentinel system for change in southern coastal Maine.

Why CBASS?

Rapid warming of GOM; arrival of southern species with possible reordering of nearshore food web; pending changes in fish passage on Presumpscot River.

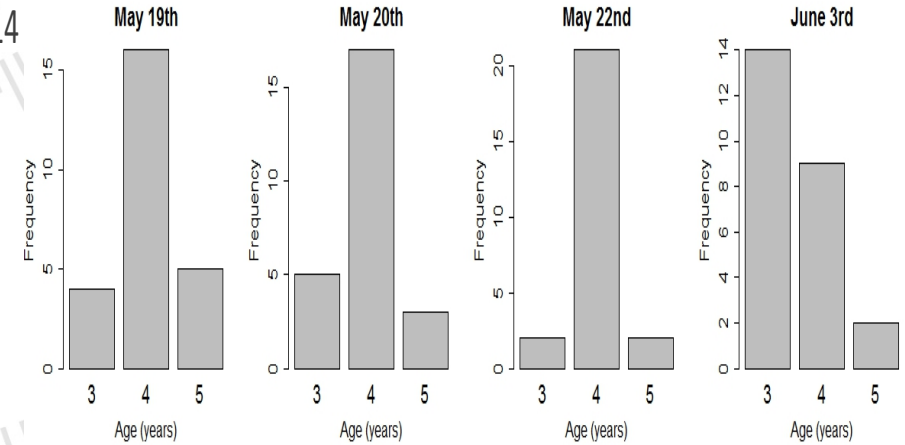
CBASS footprint and parts



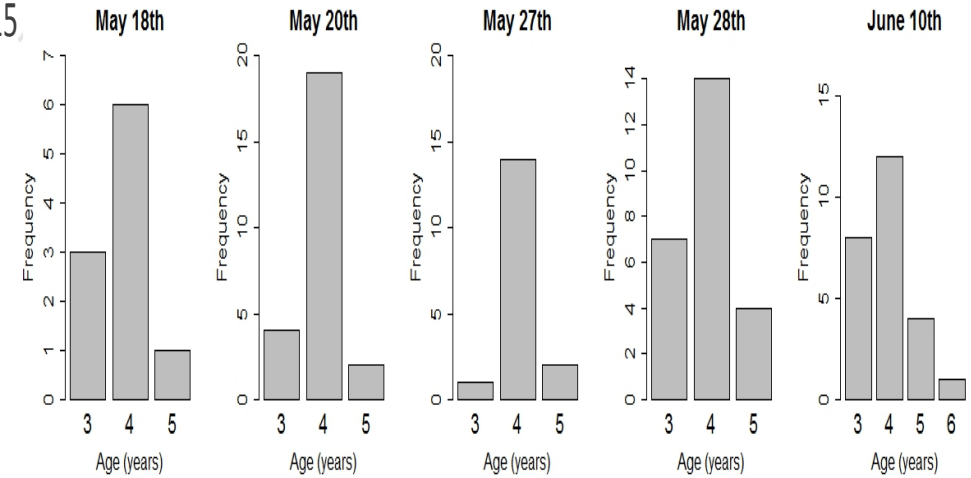
- River sampling
- Seine sampling
- Jig sampling
- Acoustic survey
- Oceanographic sampling
- Trap sampling
- Temperature monitoring

River sampling

2014



2015



Trophic linkages?

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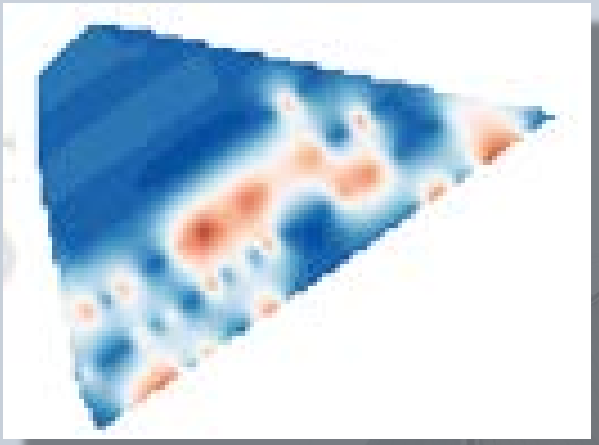
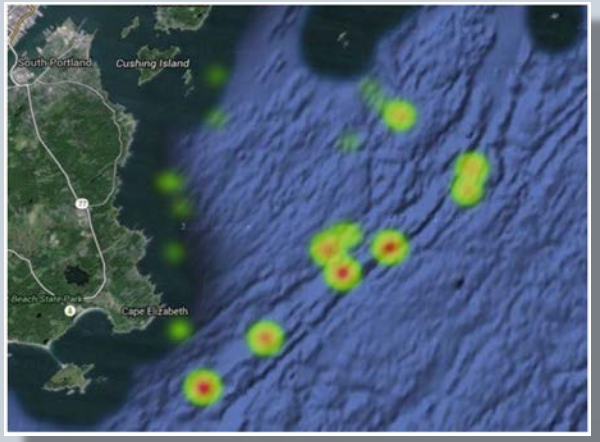
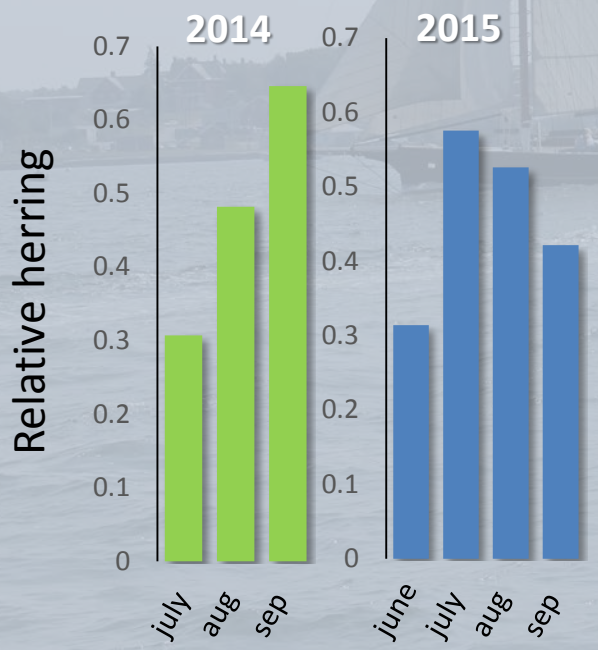
Acoustic survey



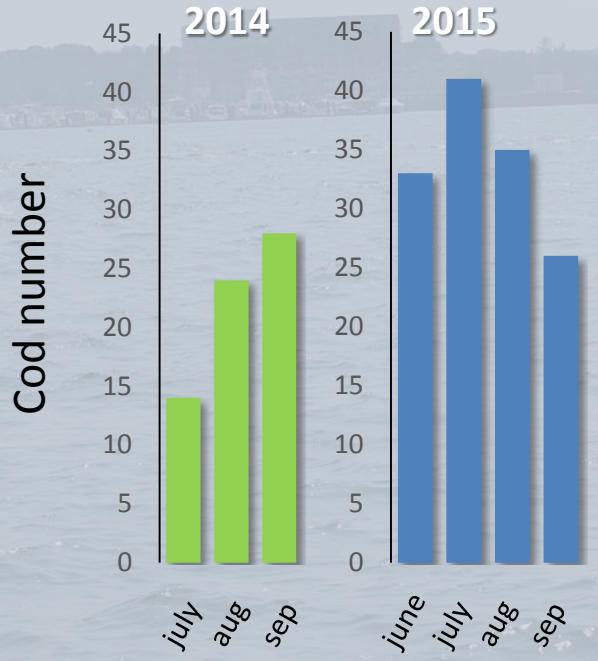
There was strong temporal and spatial overlap with herring and cod at the West Cod Ledges

Jig survey





An early indication of linkage between trophic levels?



Snap-a-Striper

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Maine striped bass fishery is seasonal recreational fishery made up of migratory (southern origin) and resident (Kennebec) fish.

What is the relative proportion of these?

What is the spatial footprint of the resident population?

How do we test this?...

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Snap-a-Striper

For catch and release, we ask anglers to take a photo of their catch and email to GMRI; with photos we can conduct morphometric (body shape) analysis.

For keepers, we ask them to take photo and to save head; with heads, we can extract otoliths for micro-chemical analysis (origin of fish).

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Snap-a-Striper

Multivariate analyses using digital measurements

Supervised (*a priori* groupings using capture location); **discriminant function analysis**

Unsupervised (no *a priori* groupings); **cluster analysis**

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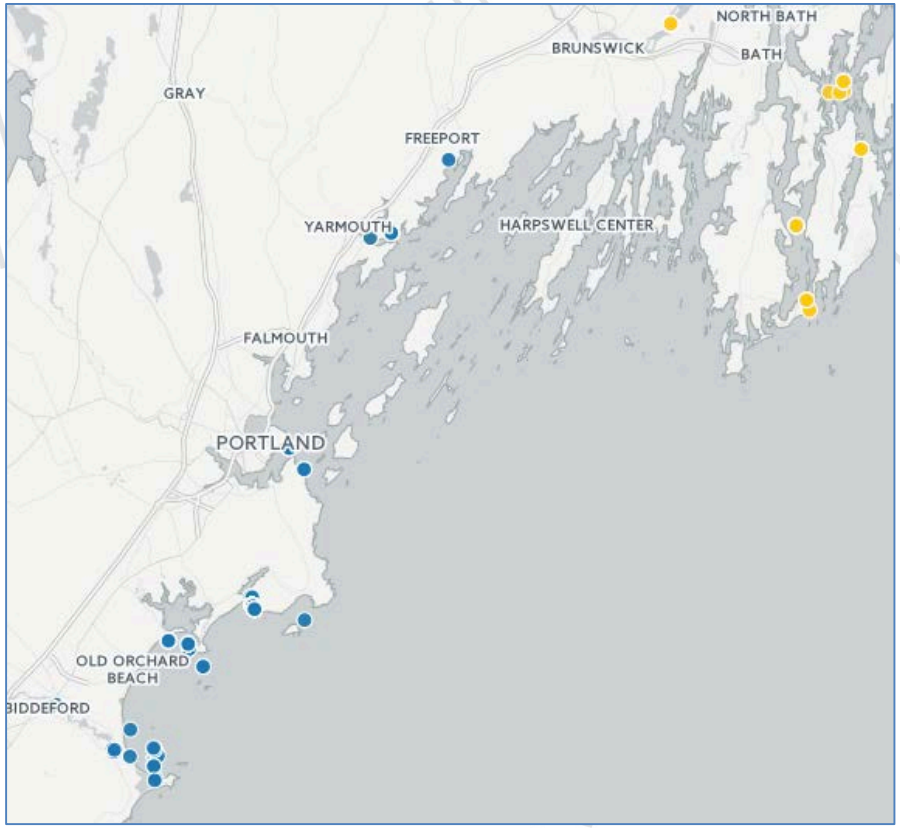
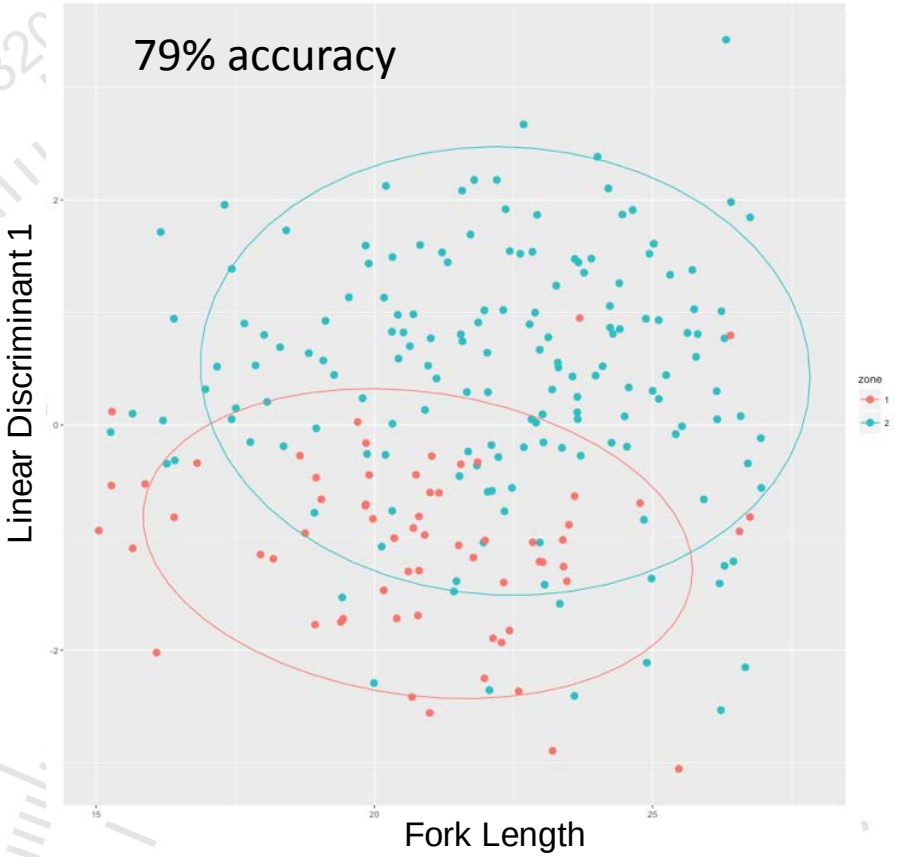
Snap-a-Striper

Discriminant Function Analysis



Residual Discrimination by Zonation



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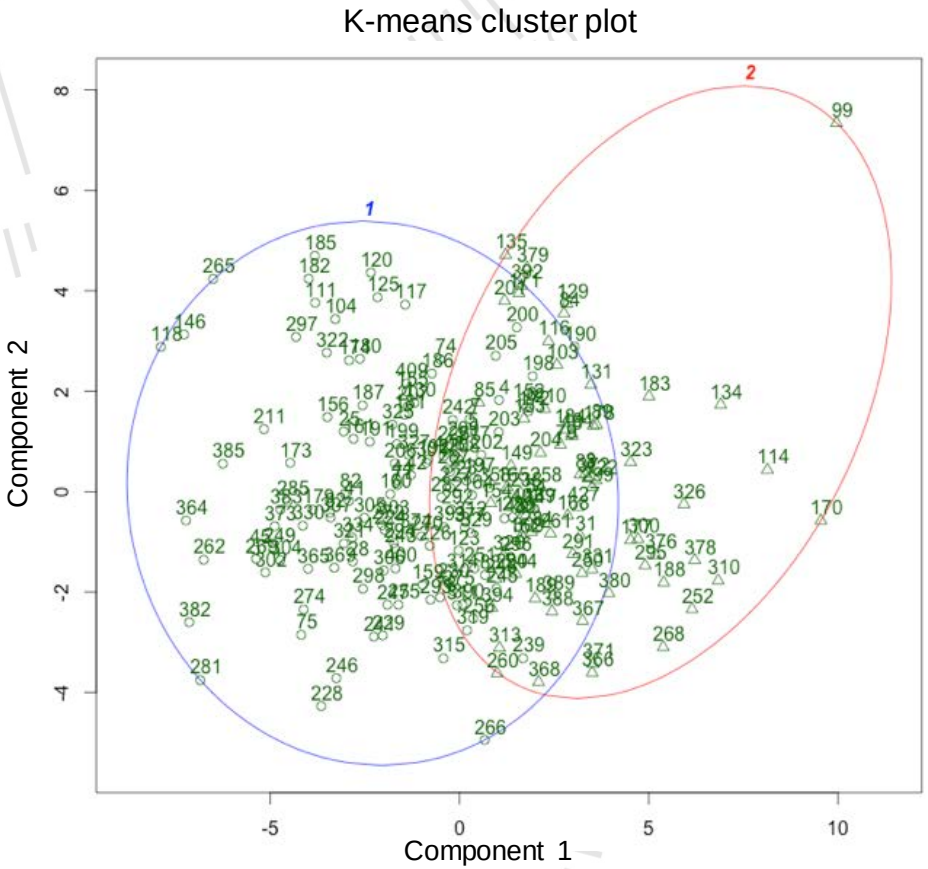
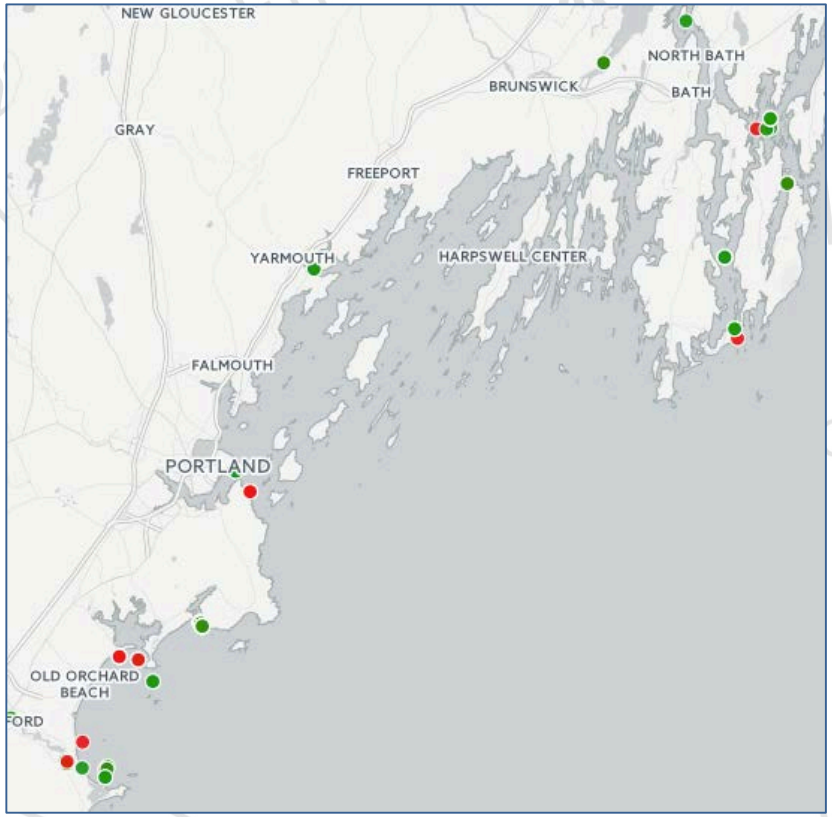
Snap-a-Striper

Cluster analysis





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Thank you!

Acknowledgements (coauthors, collaborators, funders)

Inshore herring survey: Adam Baukus, Curt Brown, Julek Chawarski, Katie Wurtzell, Mike Jech; Funding: NOAA, Maine Technology Institute

Penobscot Bay/River work: Karen Wilson, Theo Willis; Funding: TNC/NOAA

CBASS: Lisa Kerr, Kathy Mills, Walt Golet, Jeff Runge, Riley Young-Morse, Adam Baukus, Zach Whitener, Cameron Thompson, Kola Brown; Funding: internal

Snap-a-Striper: Lisa Kerr, Zach Whitener, Tyler Gagne, Duncan Barnes. Funding; unfunded

clf
conservation law foundation

Great Bay-Piscataqua WATERKEEPER ®

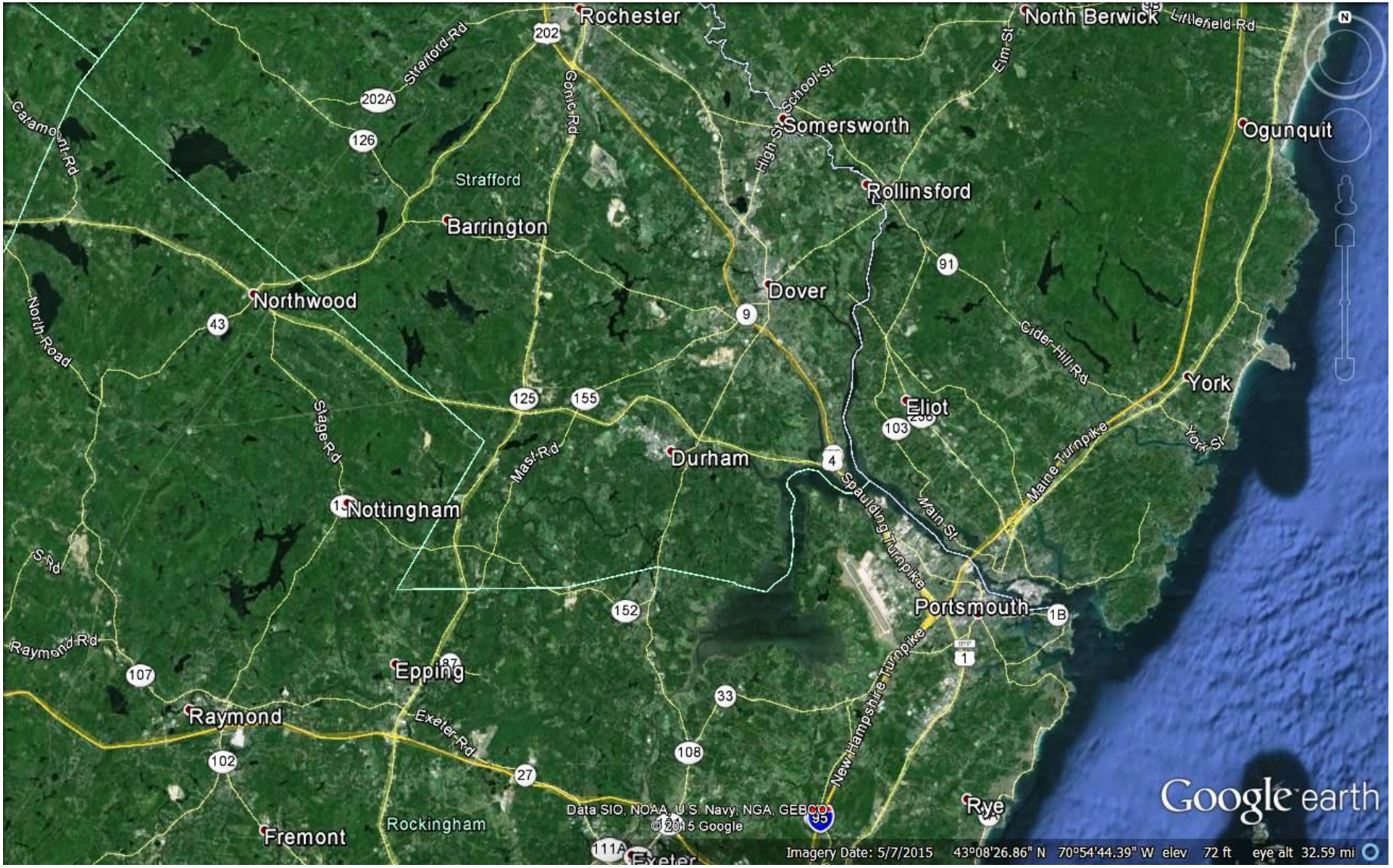
For a Thriving New England

Conservation Law Foundation

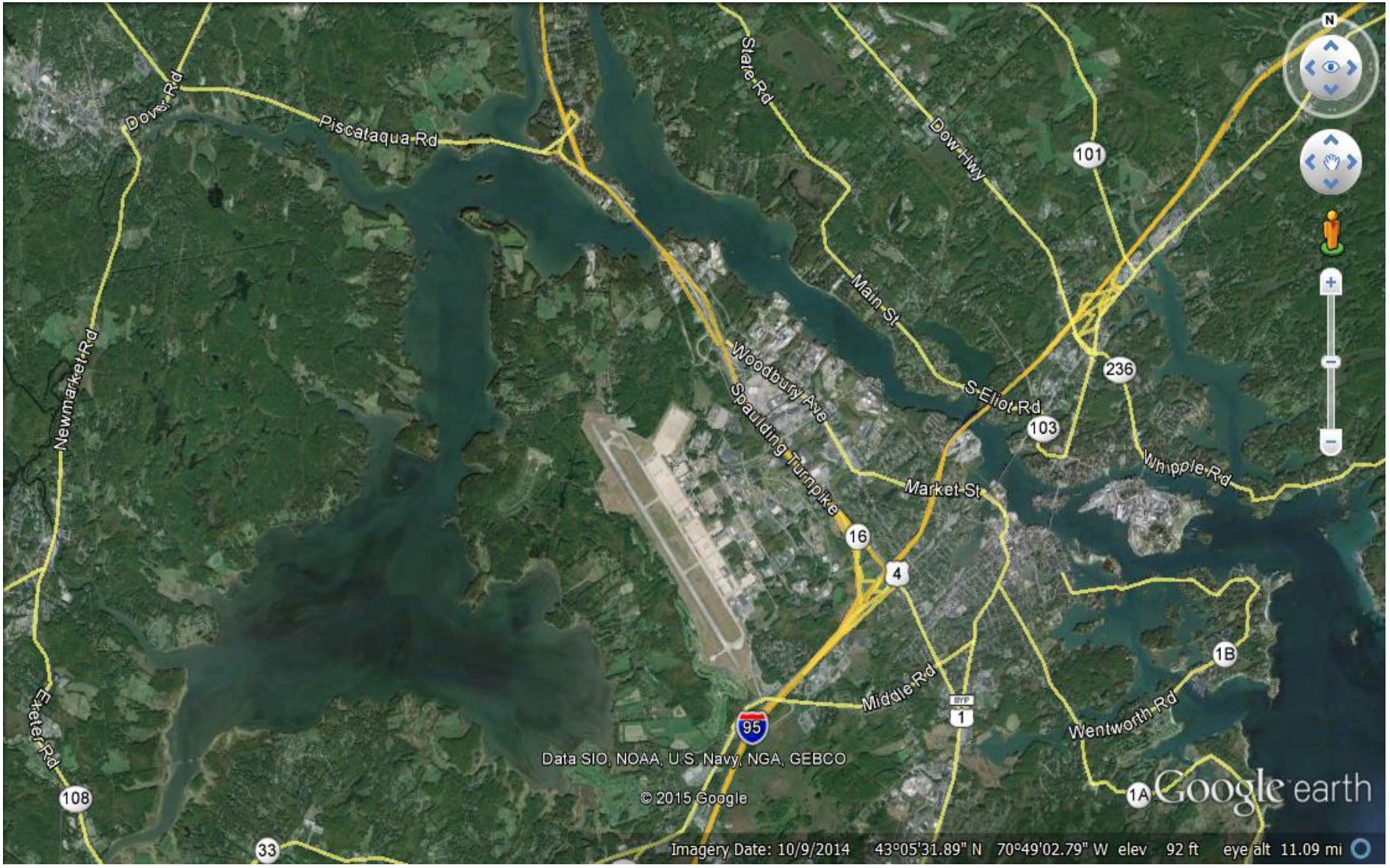
50 years in New England

- Ocean Program
- Climate Change
- Coastal Resiliency
- Clean Energy
- Clean Water
- Environmental Justice
- Modernizing Transportation
- Growing Our Local Food Economy

Great Bay Estuary and Seven Head-of-Tide Dams



Part of Great Bay-Piscataqua River Watershed

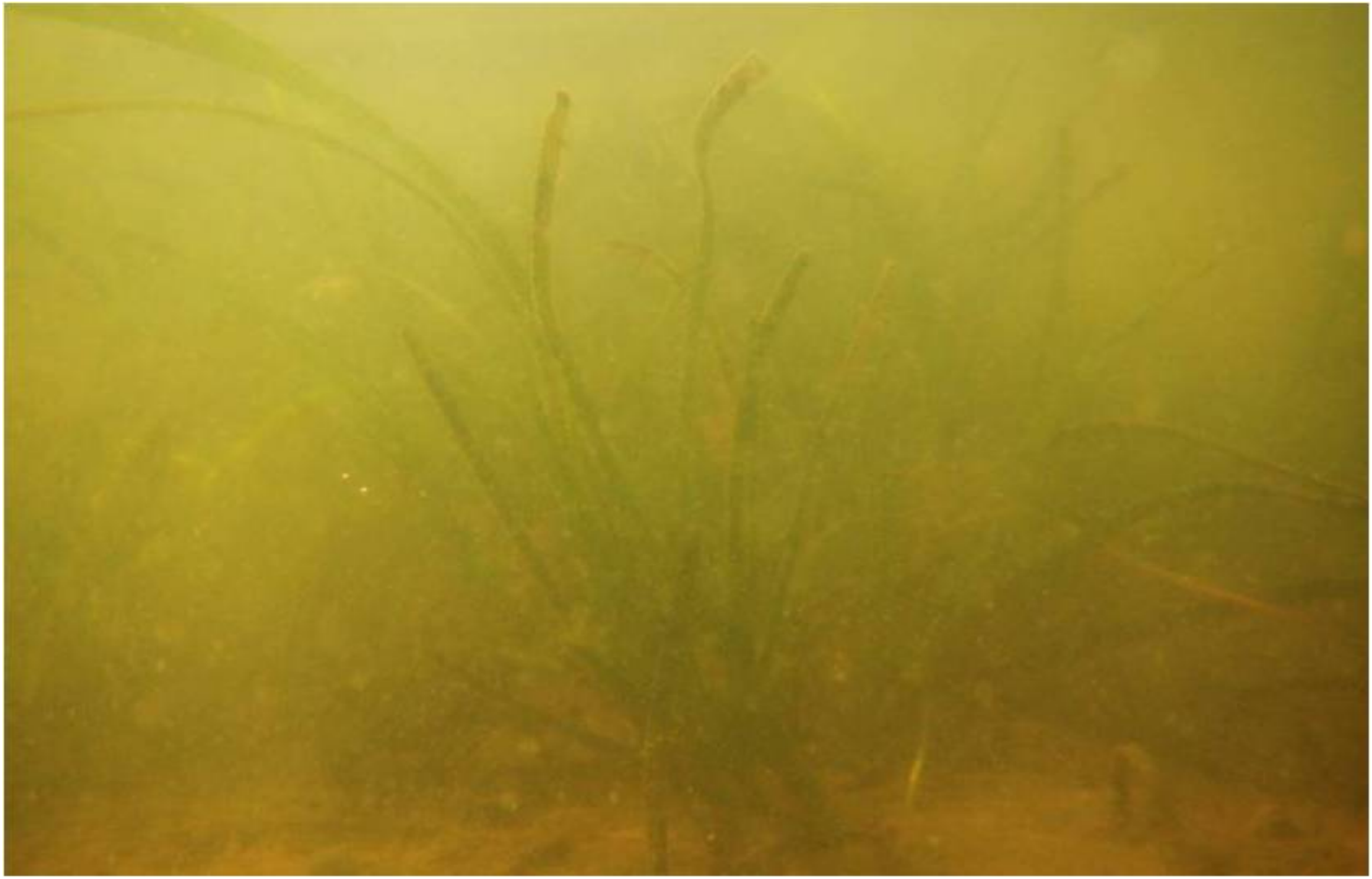


Eelgrass is the Foundation of the Ecosystem

Macroalgae and Sea Lettuce

Ulva Intestinalis

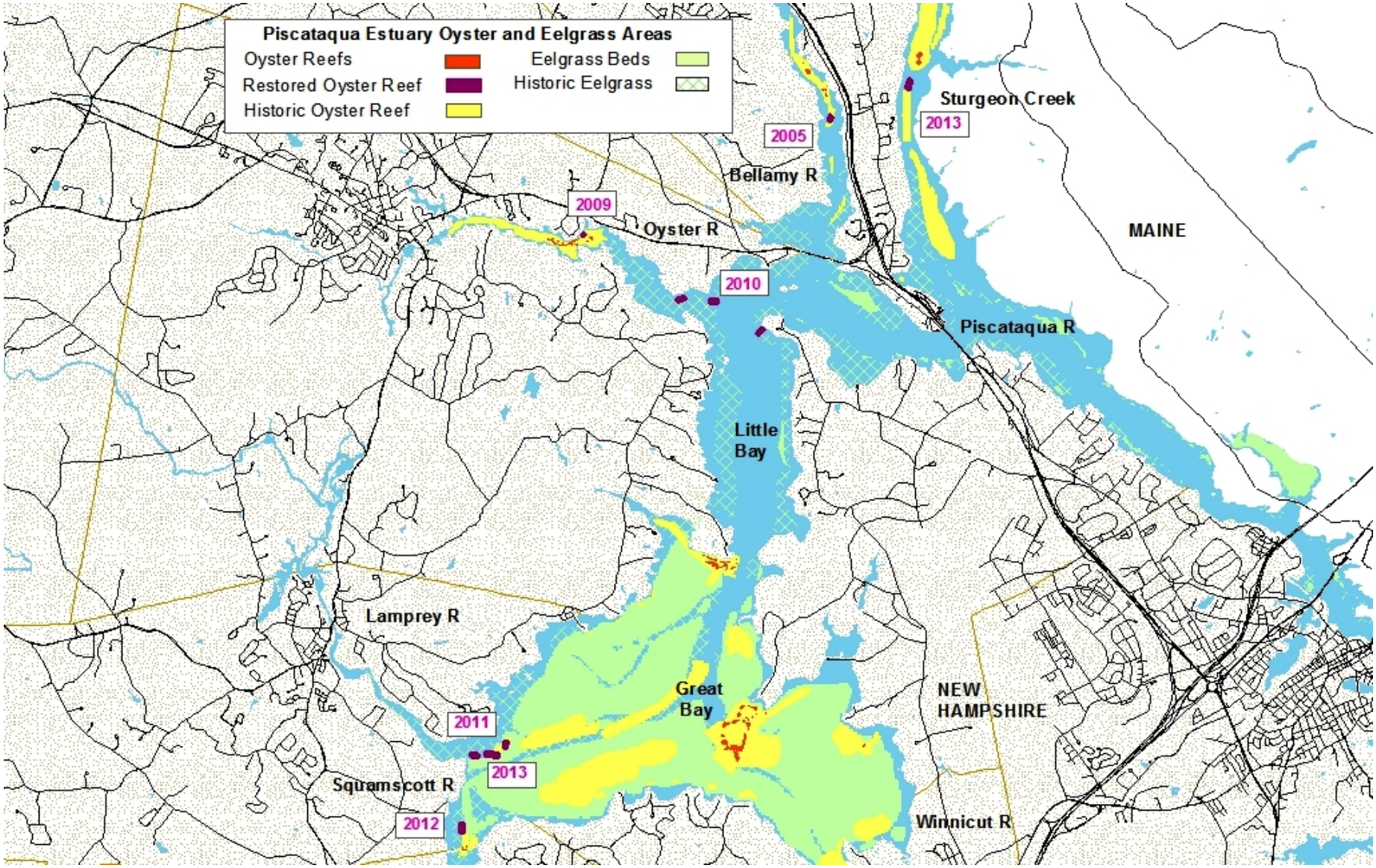
Turbidy affects photosynthesis



Oysters as filter feeders

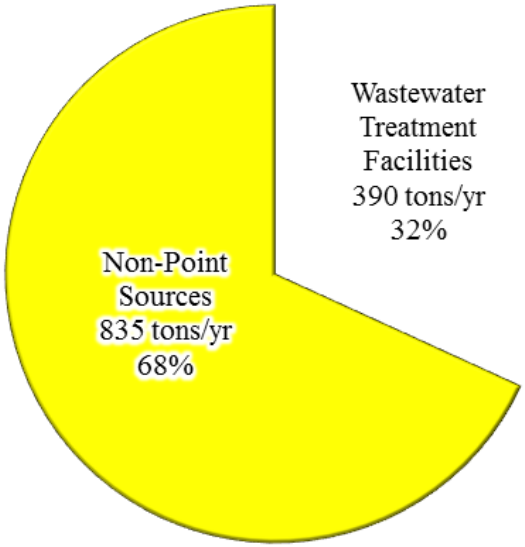
Oysters and Restoration

Eelgrass Lost since 1996 and Oyster Decline from 1993



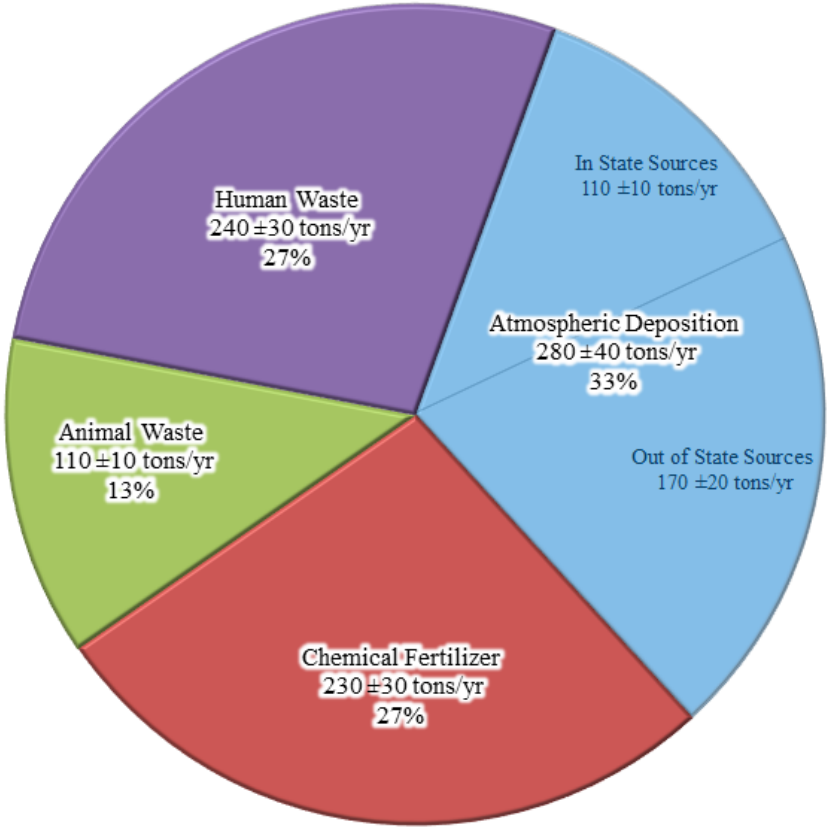
Brants and Blue Crabs

Point and Non-Point Source Nitrogen Loads to the Great Bay Estuary



Total Load
1,225 Tons/yr

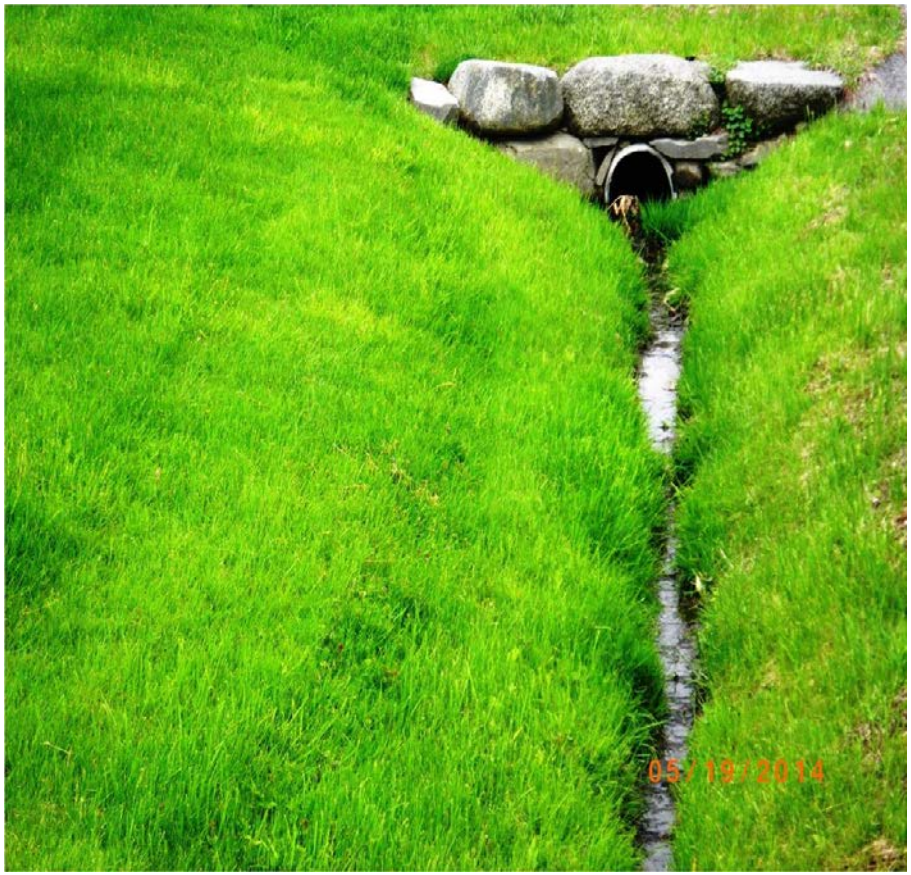
Nitrogen Loading Model



Non-Point Source Load
800 ±100 tons/yr

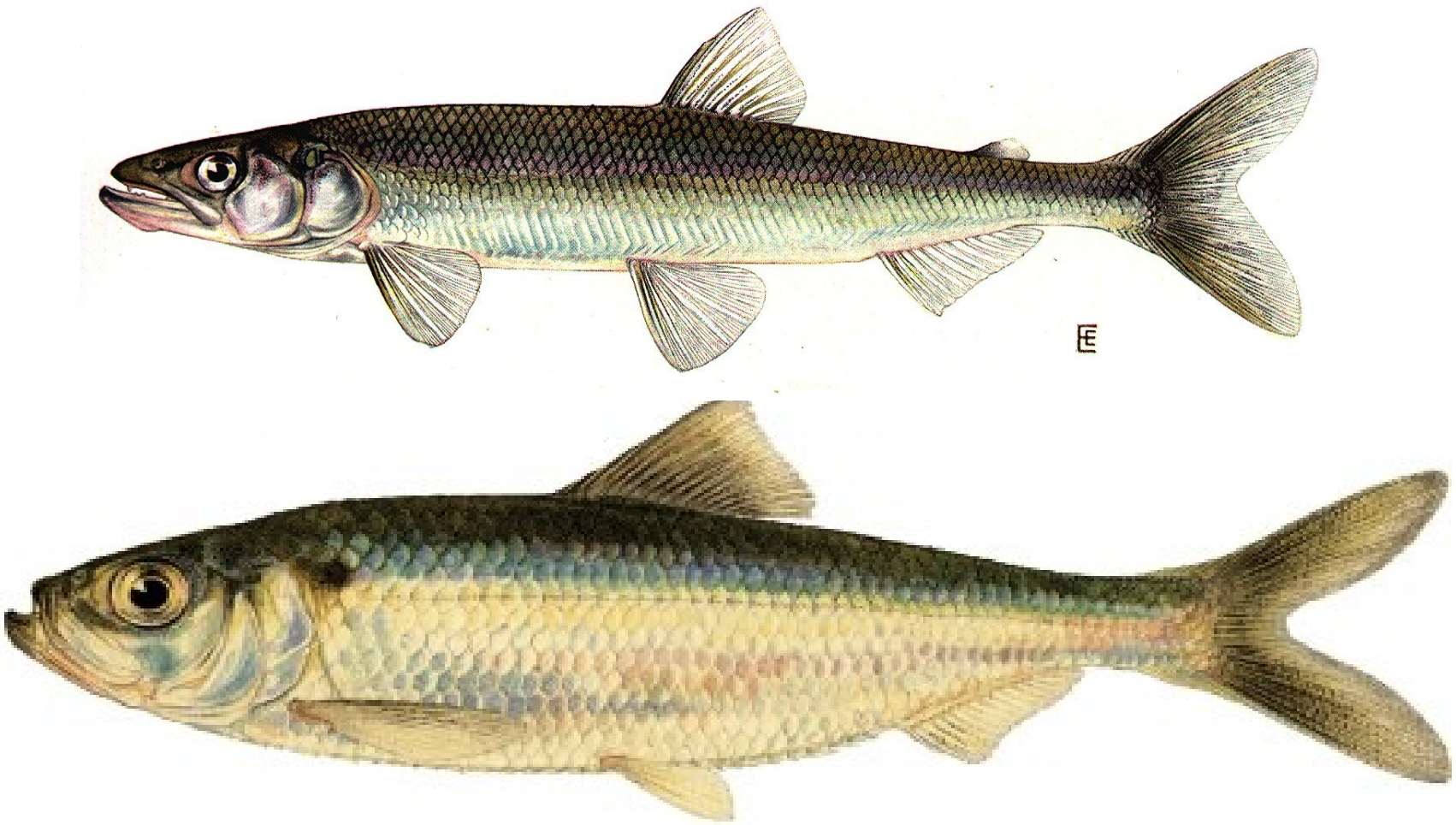
Portsmouth Wastewater Treatment Plant

Fertilizers and Buffers



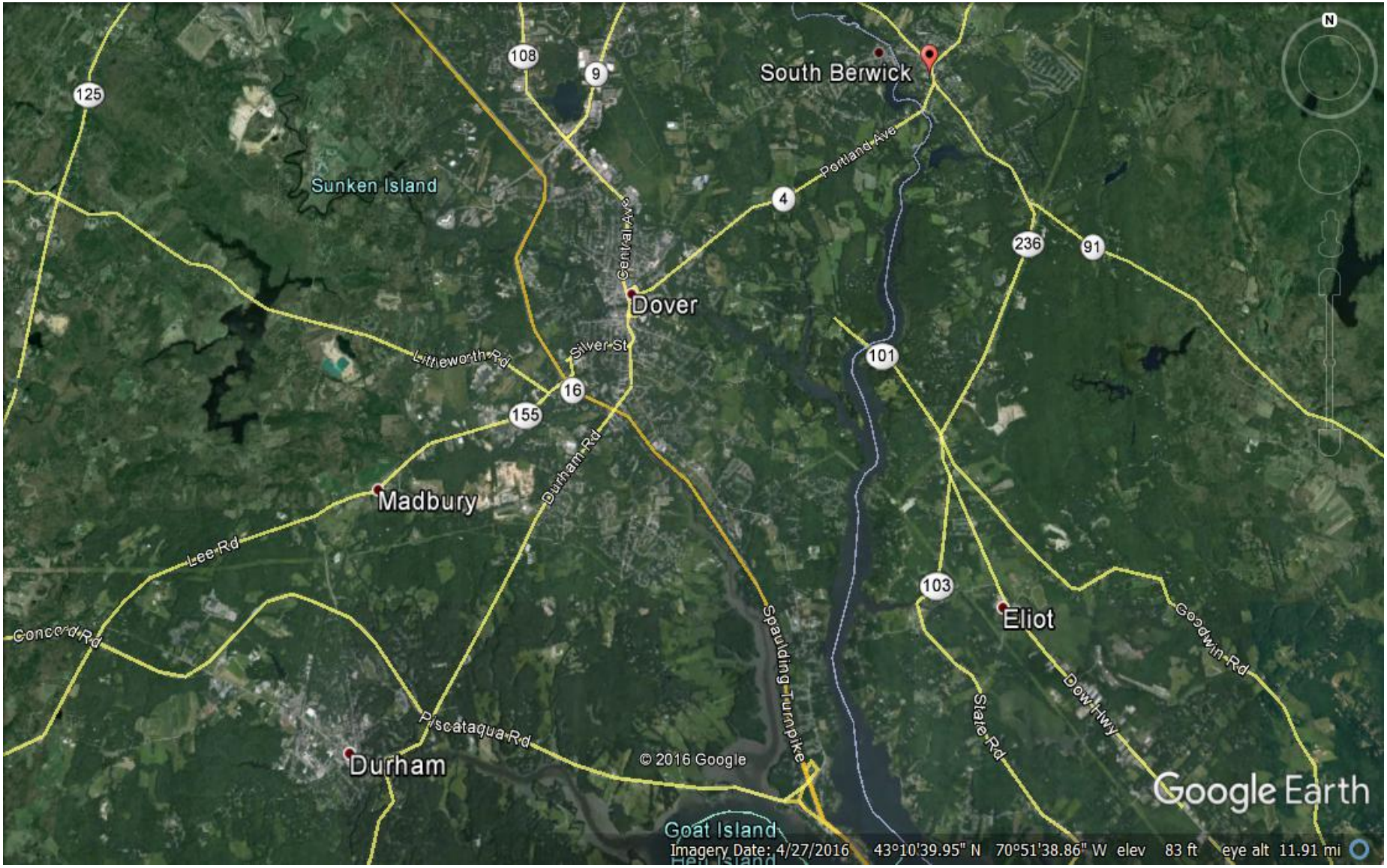
CLF, GBTU, CCA NH

Rainbow Smelt and Alewife

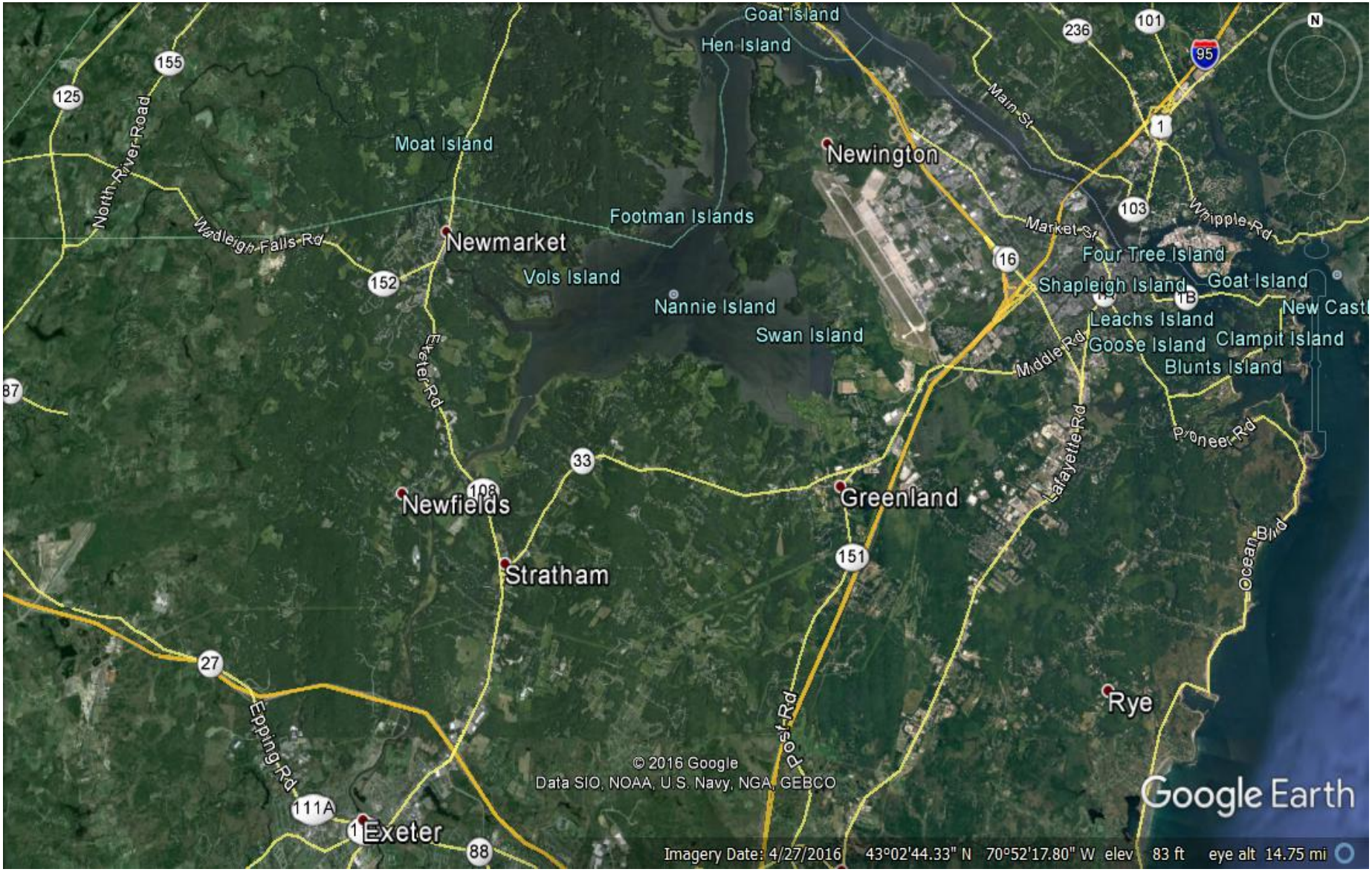


None and fewer

Great Bay Estuary and Watershed North



Great Bay Estuary and Watershed South



Exeter Dams and Impoundments

Exeter’s Great Dam 1638 to 2016

Winnicut Dam Removal and Fishway 2009

Thompson Brook: Tried and Failed

Oyster River Dam in Durham

Shorey's Brook, So. Berwick 2012

19 Removed on a Saco River Tributary 2016

Souhegan in Merrimack Village 2008

- **Winnicut:** 2009; fish passage unresolved
- **Exeter/Squamscott:** 2016
- **Bellamy:** 3 dams: first in 2004; 2 Sawyer Mill dams in 2018 ?
- **Lamprey:** 90K alewives in 2016
- **Oyster:** National Historic Register
- **Cocheco:** 90K alewives in 2016
- **Salmon Falls:** limited fish passage
- **Shorey's Brook:** 2012

Others: **Souhegan** 2008; **Thompson Brook** effort

Contact Information

Jeff Barnum

Great Bay-Piscataqua Waterkeeper

Conservation Law Foundation

27 North Main Street

Concord, NH 03301

(603) 770-3201

jbarnum@clf.org

@GBPWaterkeeper

www.clf.org/great-bay-waterkeeper/

Atlantic Coastal
Fish Habitat Partnership

On the Ground Conservation Subgroup

Atlantic Coastal
Fish Habitat Partnership

CSP Priority Threats

Goals

ACFHP goals are modeled after the goals outlined in the National Plan, which highlight the protection, prevention, restoration, and enhancement of fish habitat.

- Goal 1: Protect and maintain intact and healthy aquatic systems for native Atlantic coastal, estuarine-dependent, and diadromous fishes.
- Goal 2: Prevent further degradation of fish habitats that have been adversely affected.
- Goal 3: Restore the quality and quantity of aquatic habitats to improve the overall health of fish and other aquatic organisms (especially those habitats that play an important role in critical life history stages of fish species, e.g. nursery and spawning areas).
- Goal 4: Restore aquatic habitats to aid in recovery of threatened or endangered species (state and federal).
- Goal 5: Enhance the quality and quantity of aquatic habitats that support a broad natural diversity of fish and other aquatic species.

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CSP Objectives & Strategic Actions

How does ACFHP achieve these goals?

The 2012-2016 CSG developed a series of objectives aimed at protection, restoration, science and data, communication and outreach and financial needs and activities.

Strategic actions were then developed to achieve these objectives.

ACFHP considered human drivers, and key opportunities to address priority threats as well as the constraints and operational needs in developing both the objectives and strategies.

The strategic actions are intended to guide our activities.

To keep you paying attention:

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Objectives

Protection Objectives

Protection objectives were proactive initiatives that identify the need to address priority threats that are impacting aquatic habitats before the habitats are in need of restoration.

Restoration Objectives

Restoration objectives identify the need to restore habitats that have already been impacted.

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Color Coding

Green = highly consider keeping

Blue = completed in last plan or ongoing: remove

Red = suggest removing: not within our scope/no longer possible/already accomplished by another entity

Orange = discuss whether to keep and/or update

** = was in our Implementation Plan

Section A: Habitat ~~Protection~~ Conservation Objectives

**Protection Objective 1: Restore, enhance, and maintain adequate and effective fish movement past existing or potential barriers to maintain connectivity within Subregional Priority Habitats.

Threat: Obstructions to Fish Movement/Habitat Connectivity; Consumptive Water Withdrawal

Impacted Habitat Categories: Marine and Estuarine Shellfish Beds; Tidal Vegetation; Riverine Bottom; Coral and Live/Hard Bottom; SAV

- ✓ **A.1.1 Strategic Action: Coordinate with partners to synthesize existing information in order to identify and prioritize watersheds for conservation where fragmentation of, or barriers to, fish dispersal are a potentially critical threat to be addressed. *Short- term*
- ✓ A.1.2 Strategic Action: Coordinate with partners to develop and disseminate a "standardized toolbox" of fish passage technologies (techniques and methodologies) and guidance to assist ACFHP partners in the development and implementation of effective fish passage protocols designed to alleviate this threat for new projects. *Long-term*

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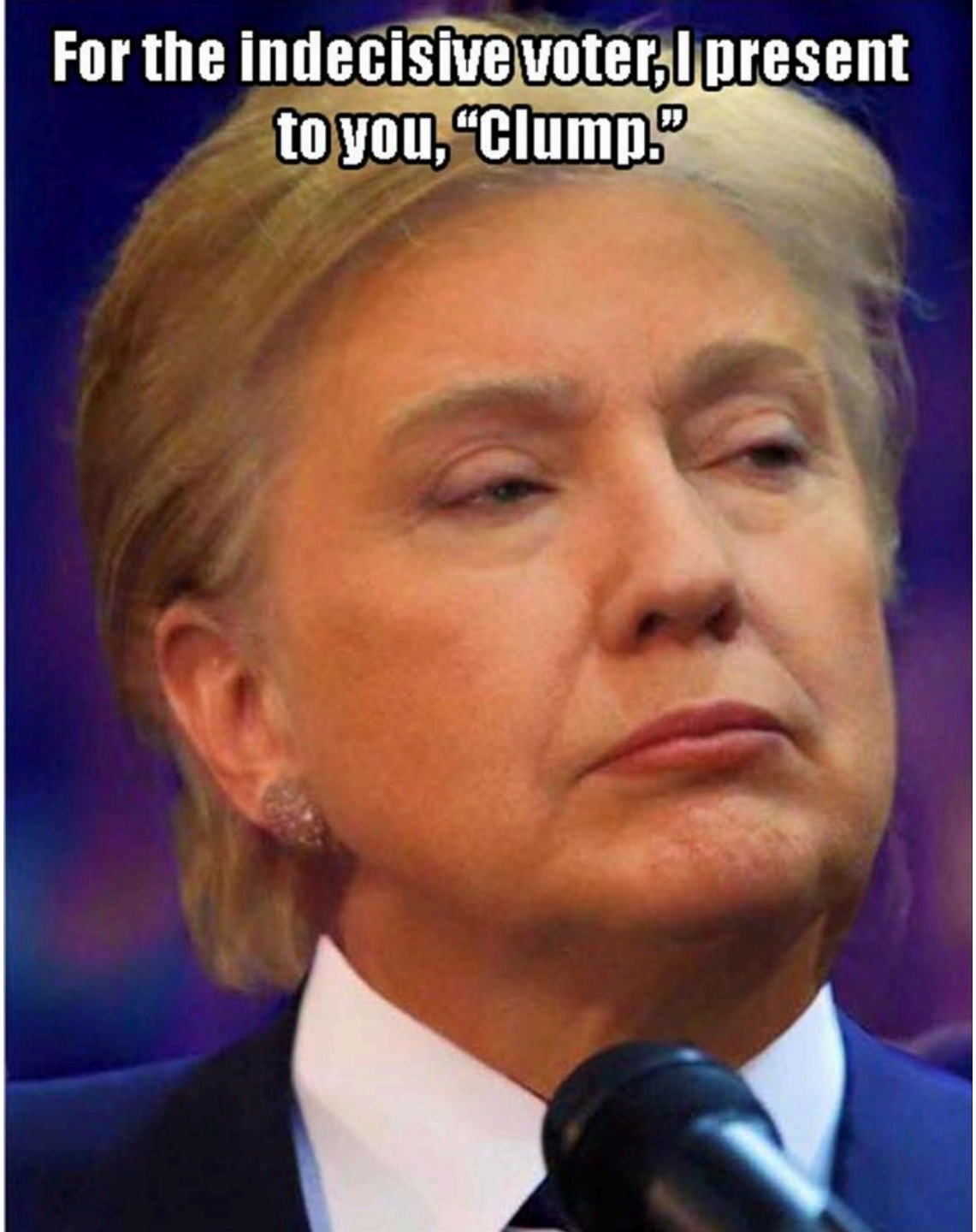
Subgroup decided to merge the Protection and Restoration Objectives into new **Conservation Objectives**

Objectives combined to be more:

- Streamlined, less duplicative, more focused
- Eliminates or at downplays areas where ACFHP has been constrained or where actions may be currently beyond "our reach" (e.g., regional water quality issues)
- Objectives more concentrated over next five years
- Does not mean these "down played" areas can't be revisited

Revised document…


For the indecisive voter, I present to you, "Clump."

Atlantic Coastal Fish Habitat Partnership Operations Budget Report
October 2016

July-December 2016	
Source	Cost
NFHP FY15	$5,880
MSCG FY16	$3,980
Wallop-Breaux FY16	$15,820
NOAA mapping projects	$22,814
TOTAL	$48,494

January-June 2017	
Source	Cost
NFHP FY16	$50,000
MSCG FY17	$7,000
Wallop-Breaux FY17	$20,000
TOTAL	$77,000

Communicate “outside the box” – a few thoughts

- Do NOT think like a scientist
  - Vast majority of people (10’s of millions) are not scientists
- Audience = disengaged general public
  - Fish habitat issues are not “on their radar”
  - Many have never thought about fish habitat
  - Many people would be hard pressed to name 3 or more fish habitats.
- Take the message directly to people
  - Out in public spaces
  - Easy & effortless learning
  - Make it fun, whimsical, enjoyable, humorous, etc.
  - Tactile and kinesthetic – bring out everyone’s “inner child”
- Not technical
  - <=6th grade level (I am serious)
  - Limit text to ~3-5 sentences

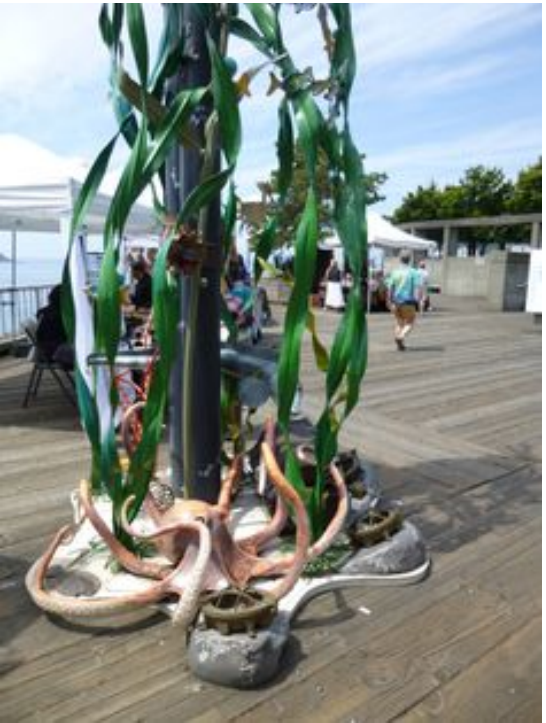
Rudolph Flesch Magazine Chart (1949)

Style	Flesch Reading Ease Score	Average Sentence Length in Words	Average No. of Syll. Per 100 Words	Type of Magazine	Estimated School Grade Completed	Estimated Percent of U.S. Adults
Very Easy	90 to 100	8 or less	123 or less	Comics	4th grade	93
Easy	80 to 90	11	131	Pulp fiction	5th grade	91
Fairly Easy	70 to 80	14	139	Slick fiction	6th grade	88
Standard	60 to 70	17	147	Digests	7th or 8th grades	83
Fairly Difficult	50 to 60	21	155	Quality	Some high school	54
Difficult	30 to 50	25	167	Academic	High school or some college	33
Very Difficult	0 to 30	29 or more	192 or more	Scientific	College	4.5

Outdoor wall sculpture

made from foam pool noodles

Free-standing sculpture



Chicago Cow Parade Art Exhibit - 1999

Video - Nature Rx Part 1

A spoof prescription drug commercial, Nature Rx "offers a hearty dose of laughs and the outdoors - two timeless prescriptions for whatever ails you."

3D sidewalk chalk drawing