CATHERINE CUTLER INSTITUTE

Casco Bay Estuary PARTNERSHIP

UNIVERSITY OF SOUTHERN MAINE

State of Casco Bay

CURTIS C. BOHLEN

CASCO BAY ESTUARY PARTNERSHIP

Jerry Monkman, Ecophotography

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

Maquoit Bay Eelgrass

Photos: Hilary Neckles USGS

Casco Bay Estuary Partnership

One of 28 National Estuary Programs

Hosted by USM's Catherine Cutler Institute

A 24-member local advisory board

Implement the "Casco Bay Plan"

Bring people together, build consensus, coordinate efforts

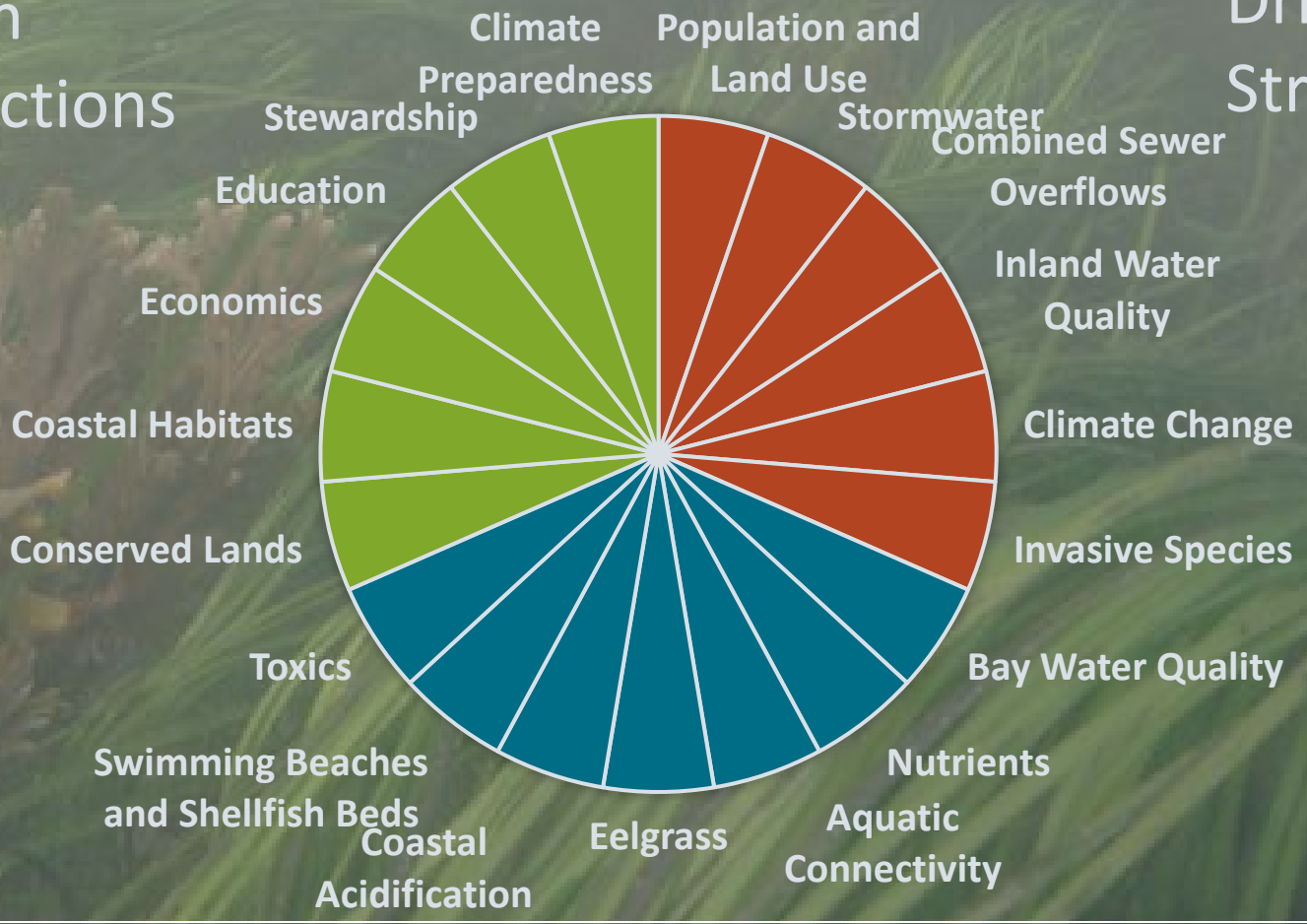
A clearing house for information about the Bay

Habitat restoration and climate resilence

STATE OF CASCO BAY

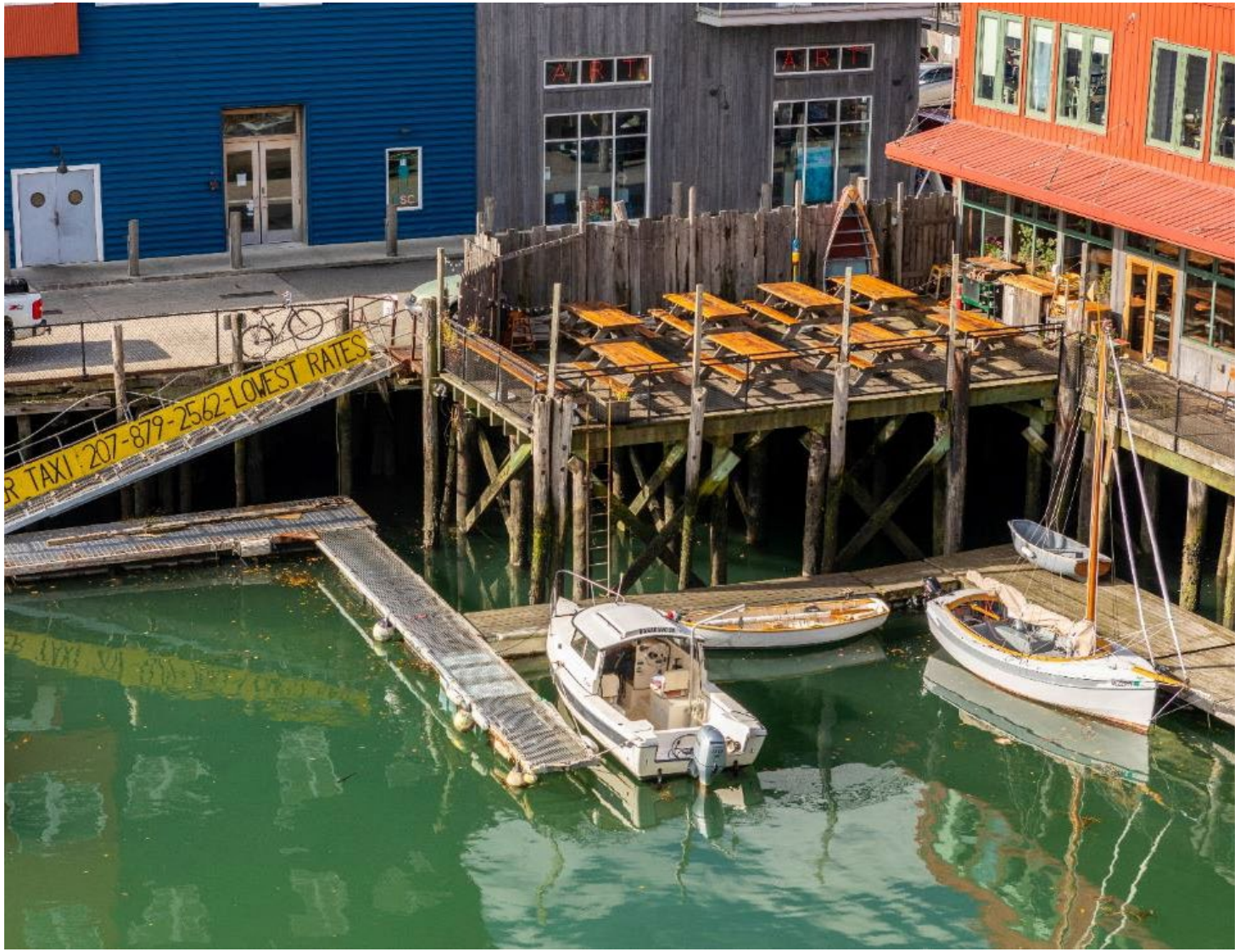
Human Connections

Drivers and Stressors



Condition of the Bay

https://github.com/CBEP-SoCB



Jerry Monkman, ecophotography.com

Bottom Line

Conditions in Casco Bay continue to be better than in many estuaries in the U.S. northeast

Our largely forested watershed and strong tides help protect water quality

But the Bay has changed, and warning signs persist

Emerging Themes

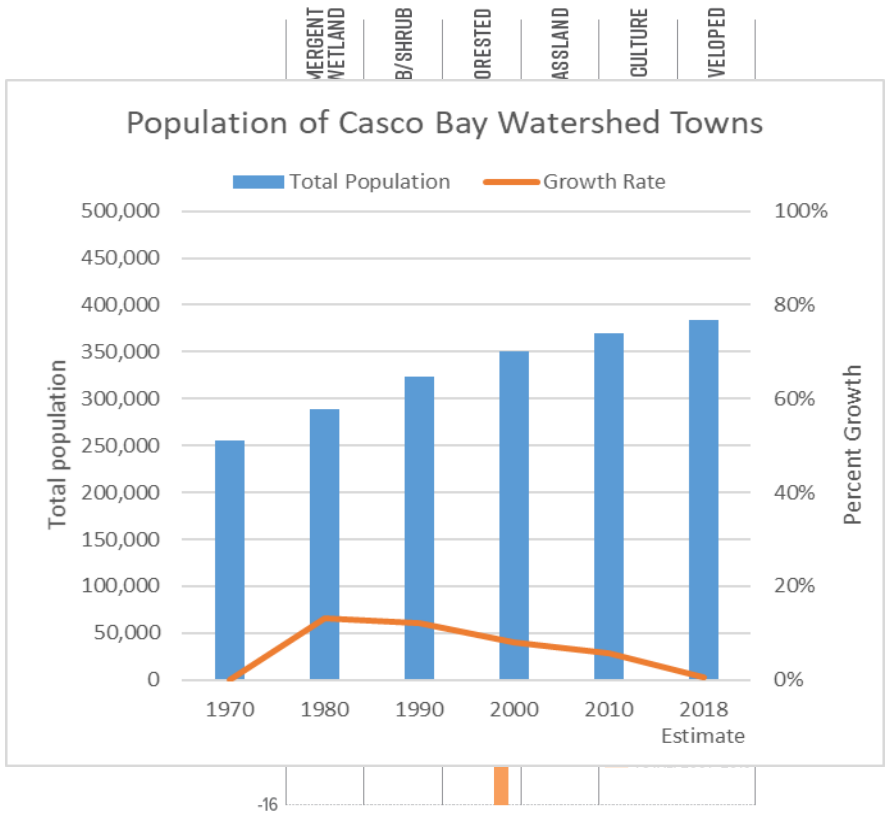
- What we do on land matters
- Investments in clean water help
- Location matters – a lot
- Nutrients – good news and bad
- Climate change is already here

Land Use Matters

Changes: Population and Land Use

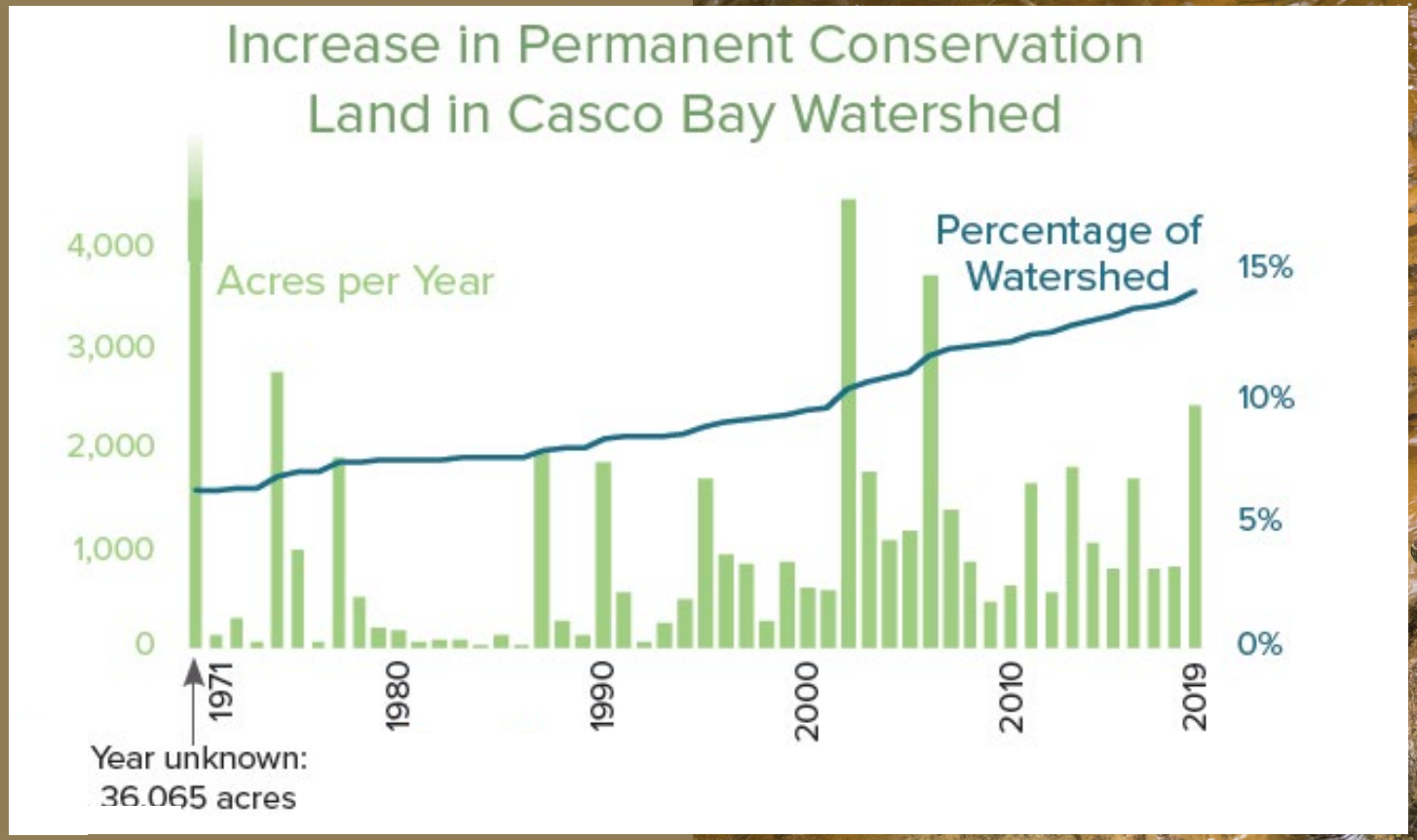
- 2018 Population of watershed towns was about 385,000 people
- Population grew ~ 10% from 2000 to 2018
- Population growing ~ 0.5% annually
- Exurban communities growing fastest

- Loosing forests and agricultural land
- Net loss of about 2 ½ % of forest in 20 years
- Rate of change lower in recent periods
  - But data from before recent construction boom



Data: National Land Cover Database, US Census Bureau

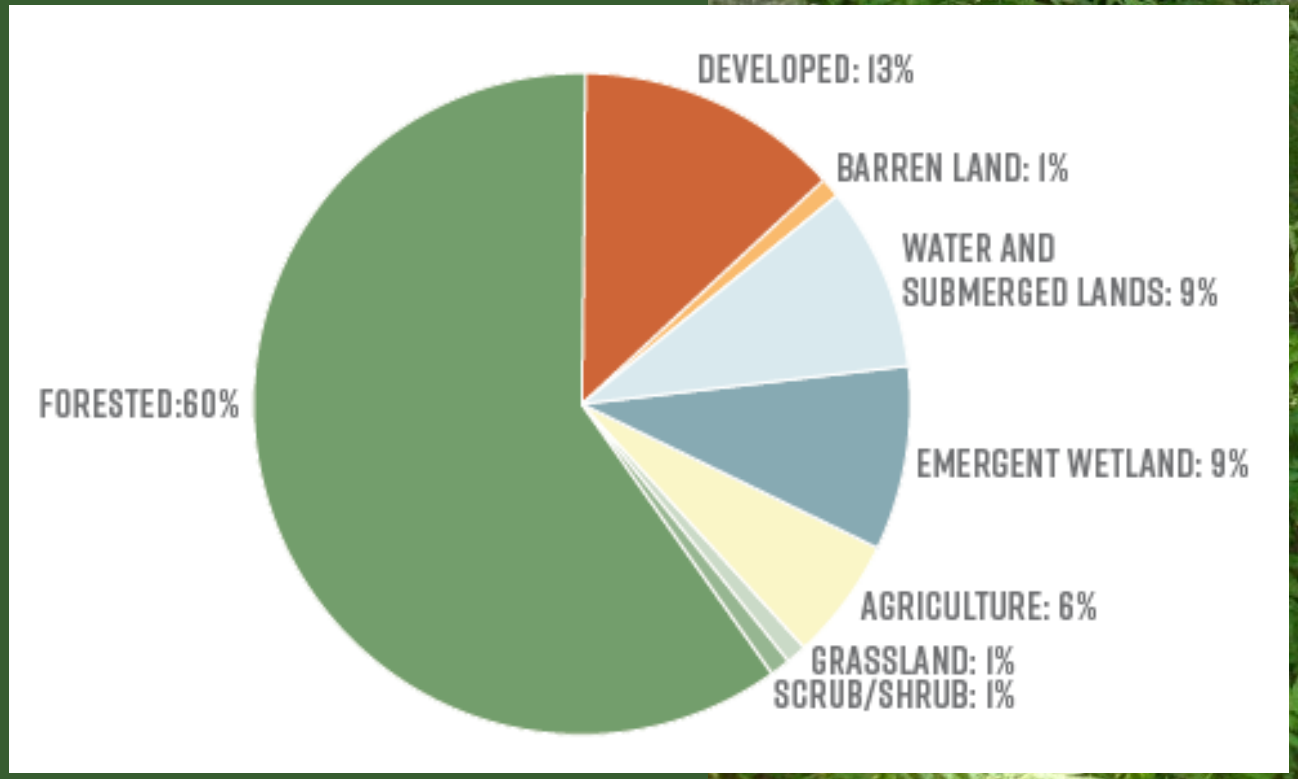
14% of the Watershed Protected



Data: Maine DACF

Jerry Monkman, ecophotography.com

Upstream From Casco Bay



Data: National Land Cover Database

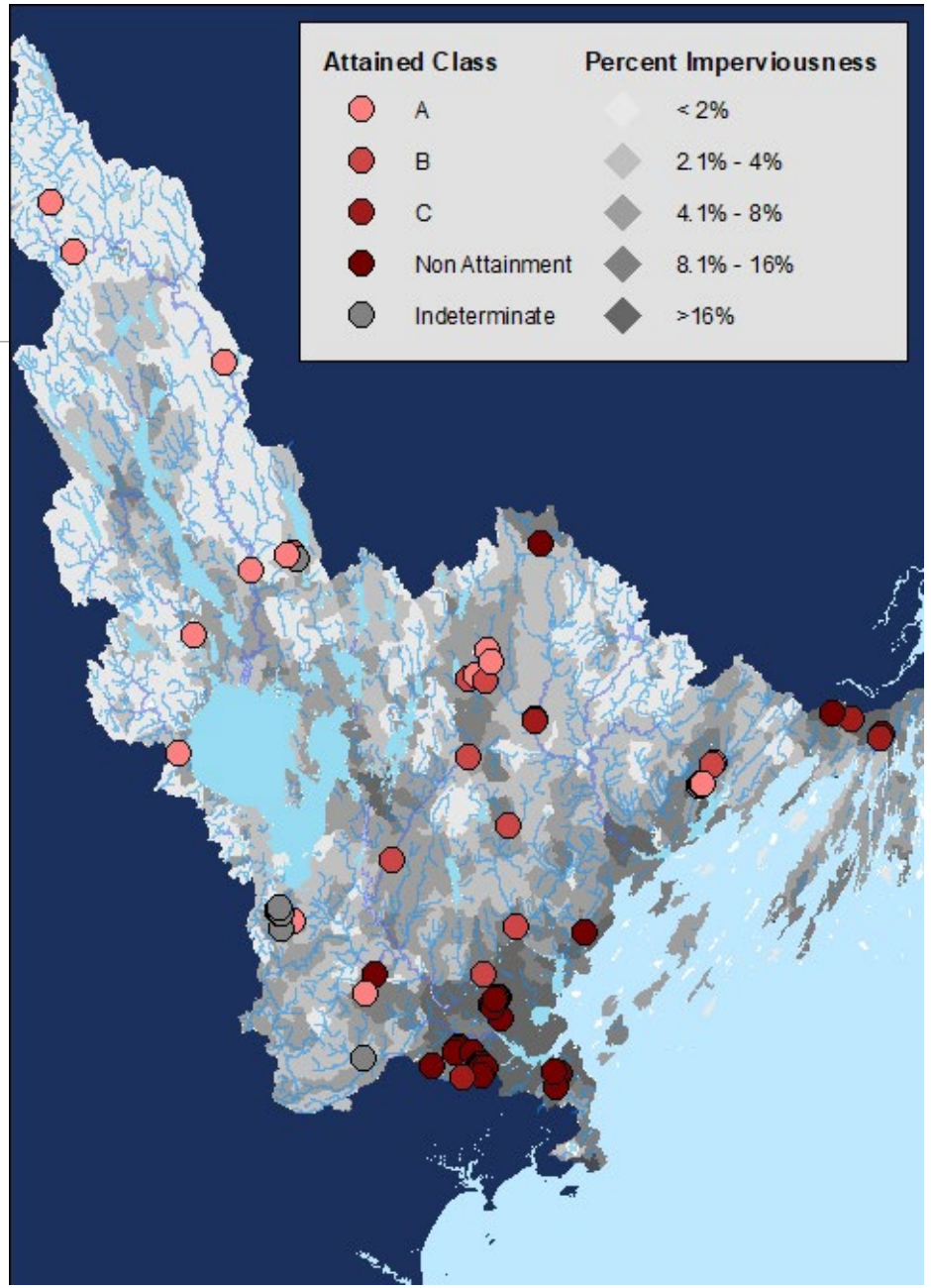
Water Quality and Land Use

Maine biomonitoring data

What stream insects and other invertebrates live in the stream?

Used as an indicator of water quality

Higher impervious is associated with less healthy streams

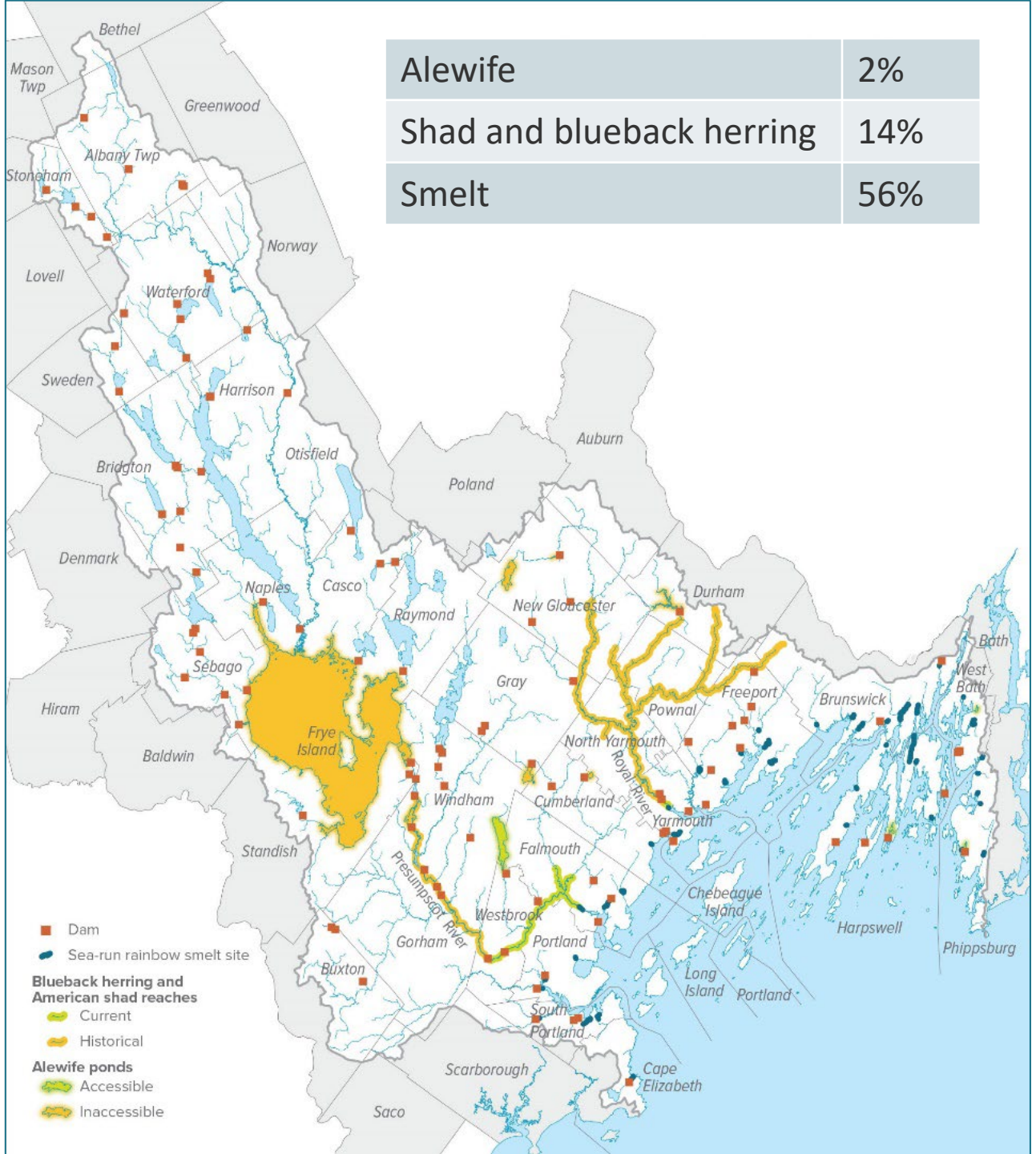


Data: Maine DEP, NHD+ V2, Maine IF&W

Historical Habitat Inaccesible

Dozens of dams and hundreds of road crossings block access for migratory fish

Alewife	2%
Shad and blueback herring	14%
Smelt	56%



Data: U.S. Fish and Wildlife Service, Gulf of Maine Coastal Program

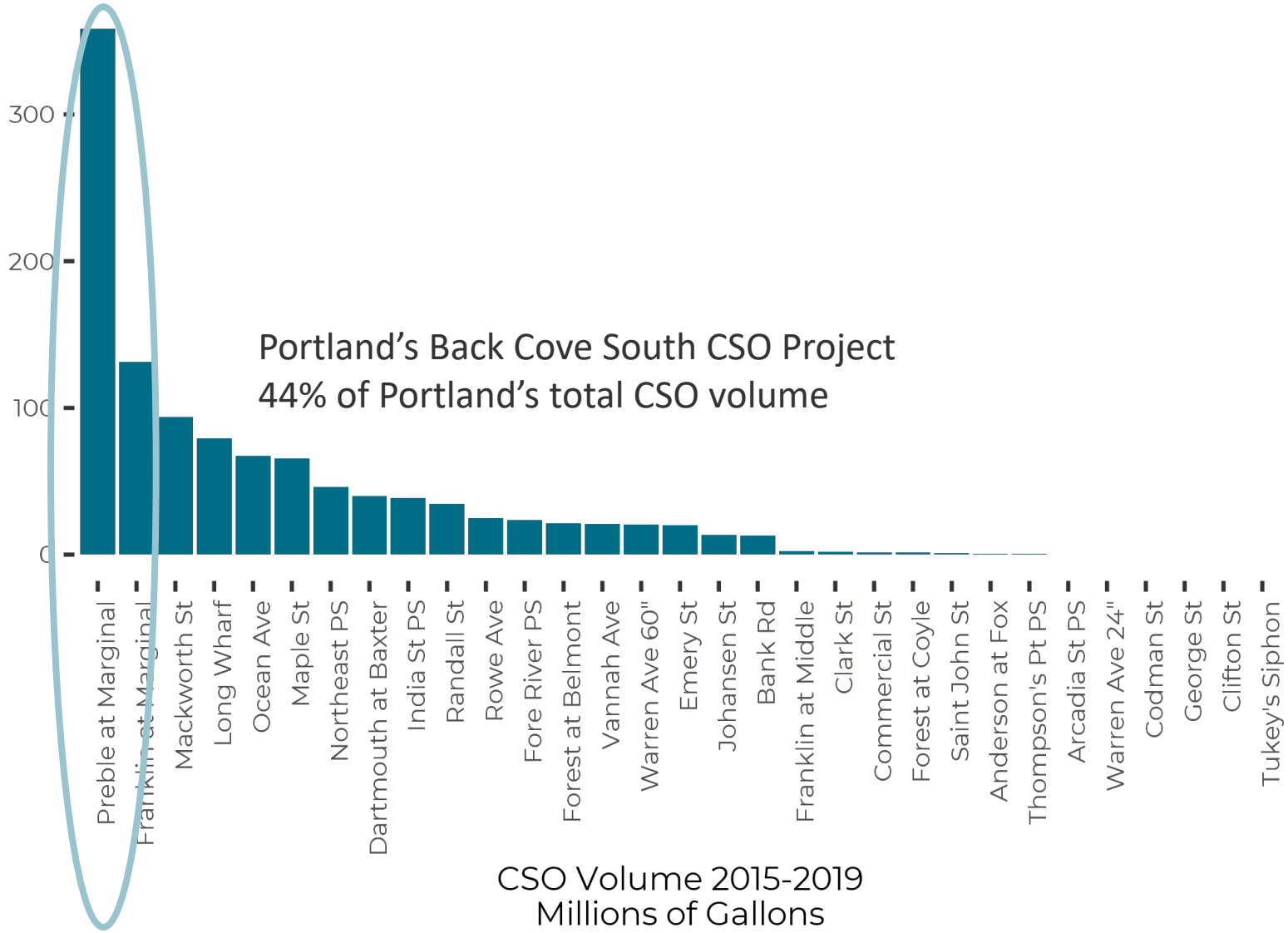
Casco Bay Estuary PARTNERSHIP

Water Quality Investments Pay Off

AND SO DO REGULATORY PROGRAMS

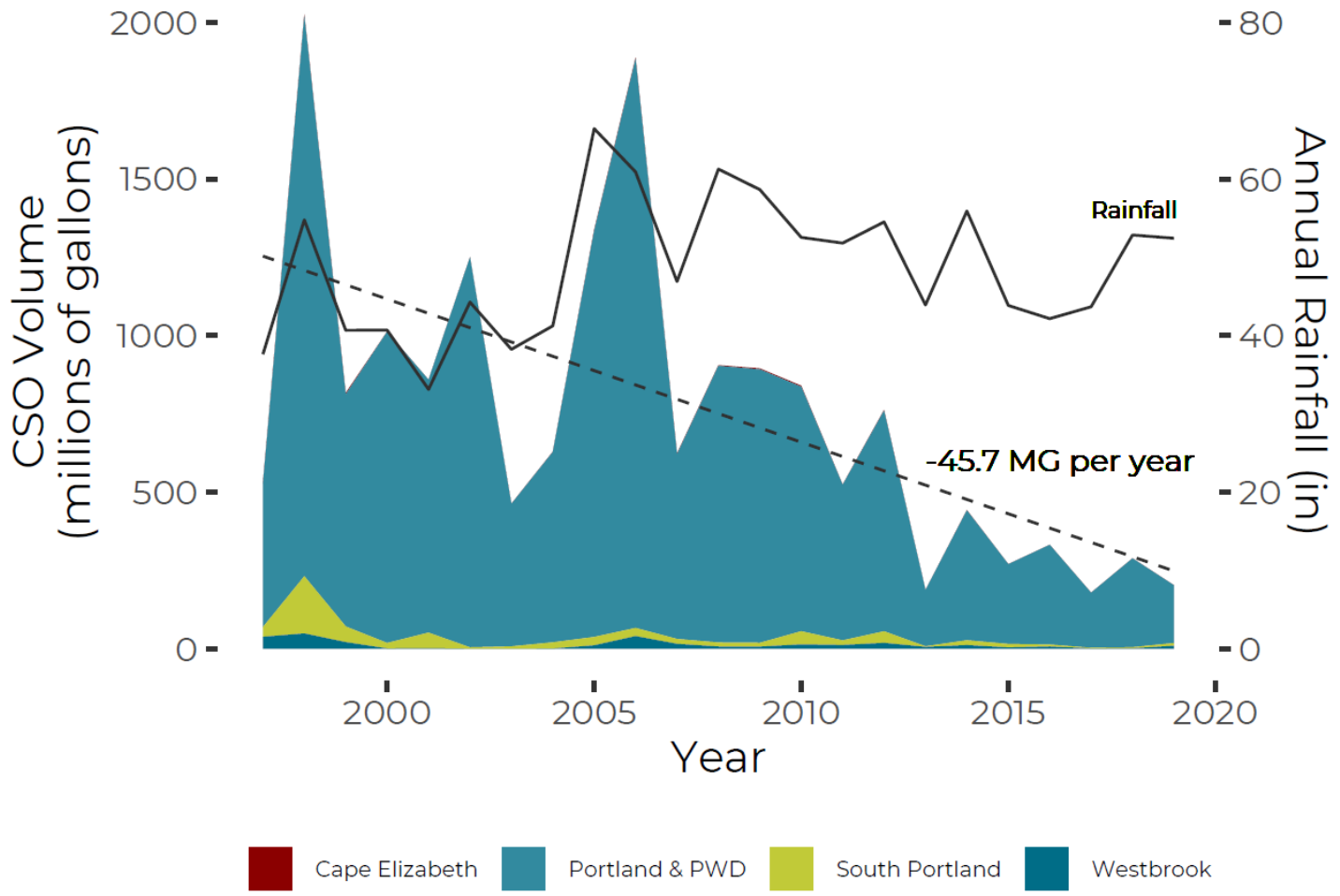
Portland CSO Volumes

- Sewers often built before wastewater treatment plants
- Carry both runoff and human wastes
- Spill into the Bay after heavy rains



Data: Portland Water District

Casco Bay Estuary Partnership



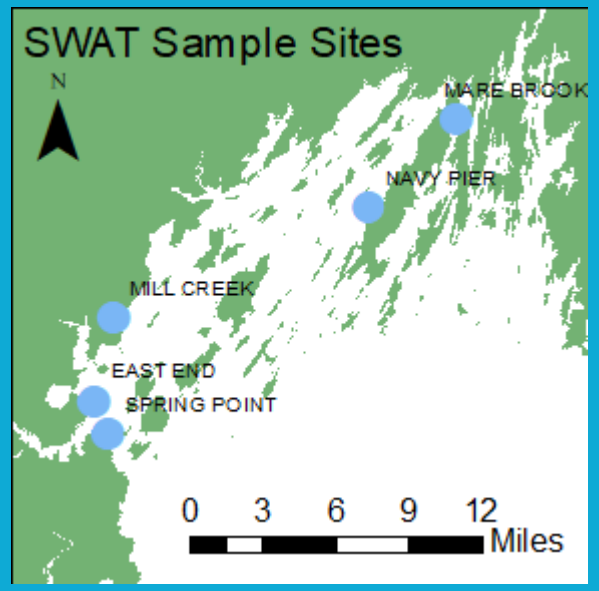
Combined Sewer Overflows

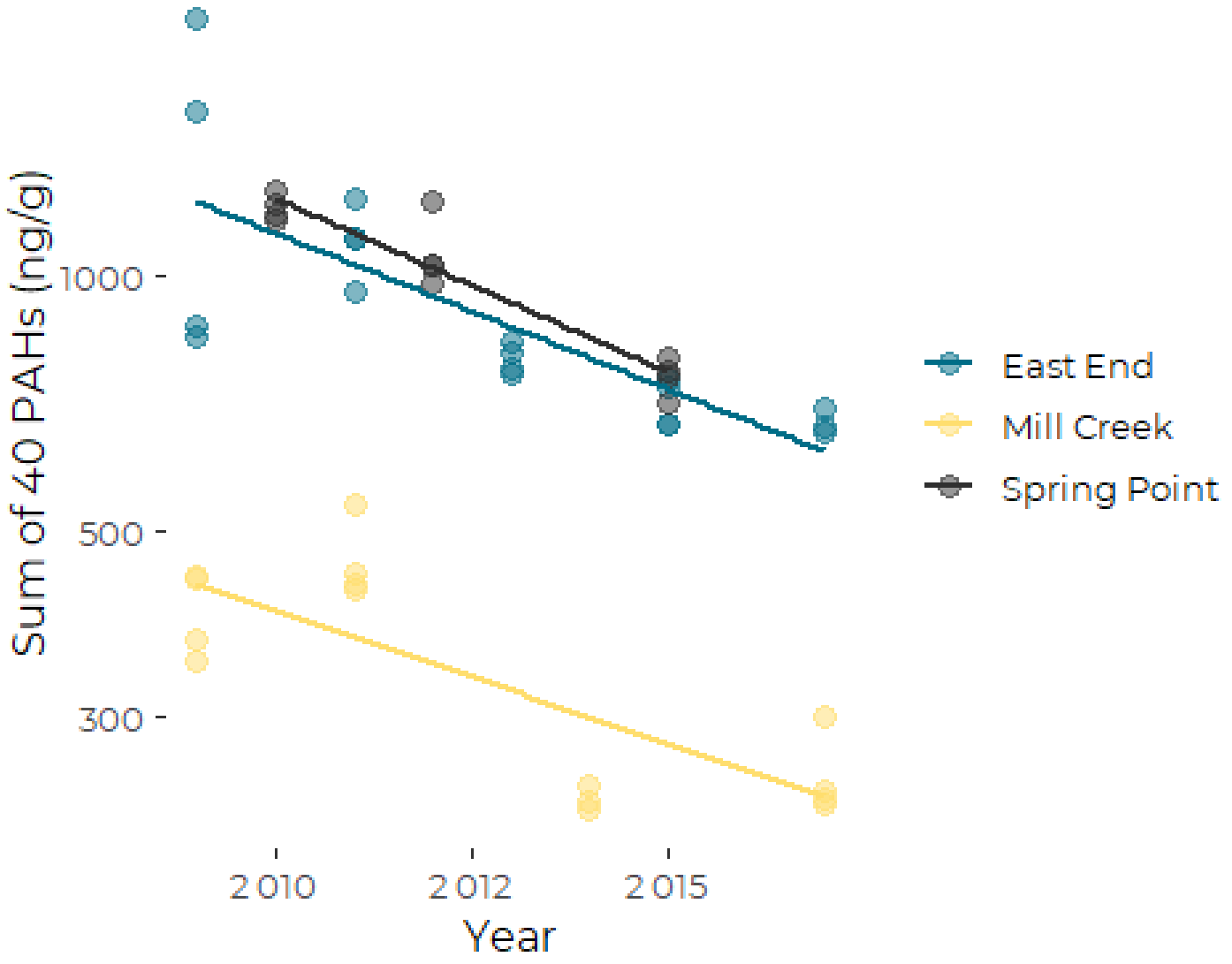
Discharges declined almost 50 million GPY annually over 20+ years

Steady or increasing rainfall and storm intensity

Data: Maine DEP

Organic Contaminants in Blue Mussels



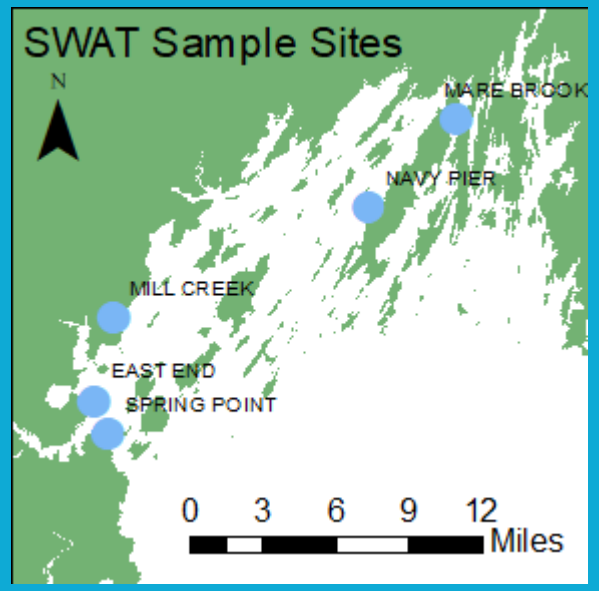


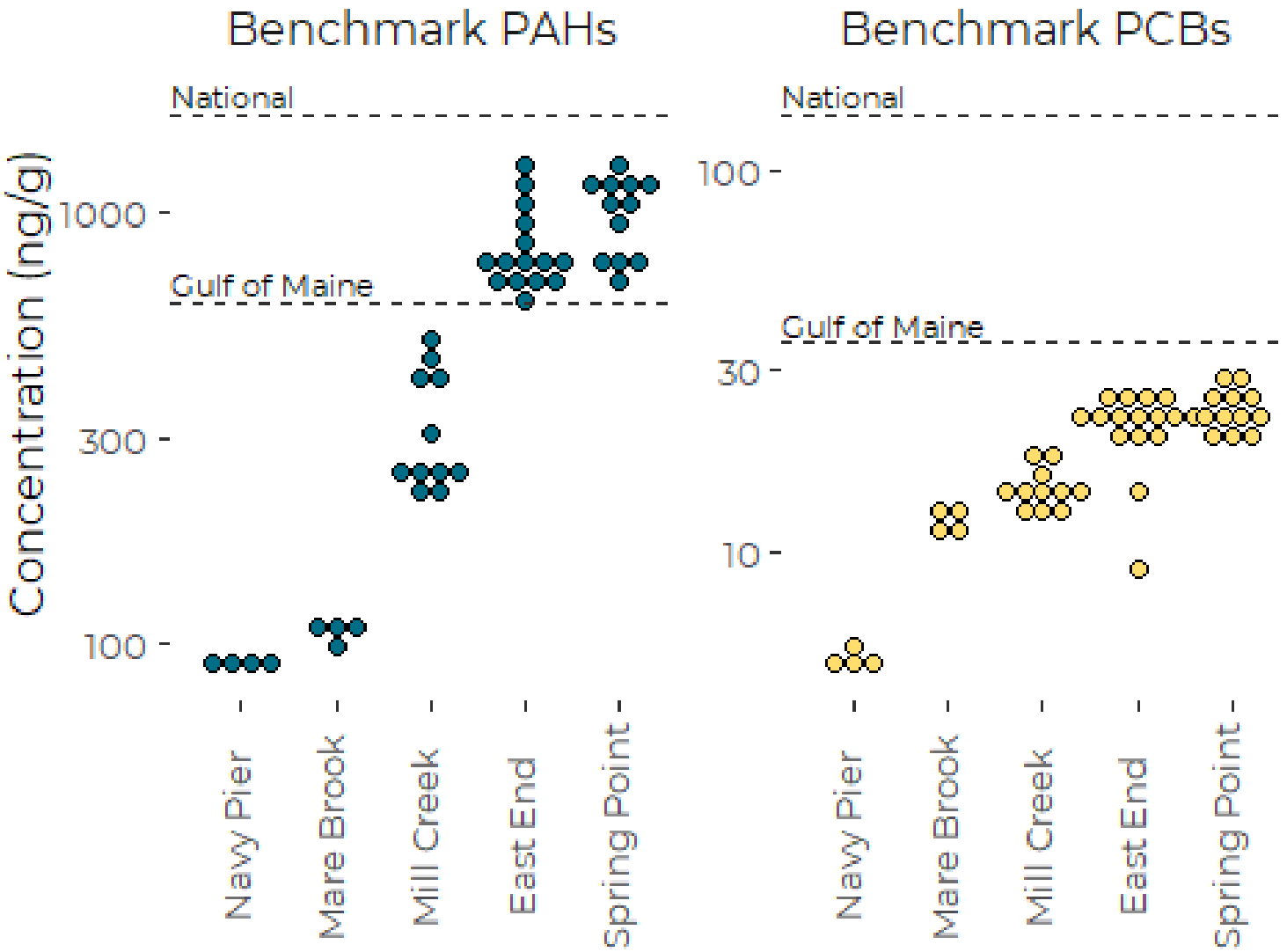
Data: Maine DEP

Location, Location Location

URBANIZATION AND HYDRODYNAMICS

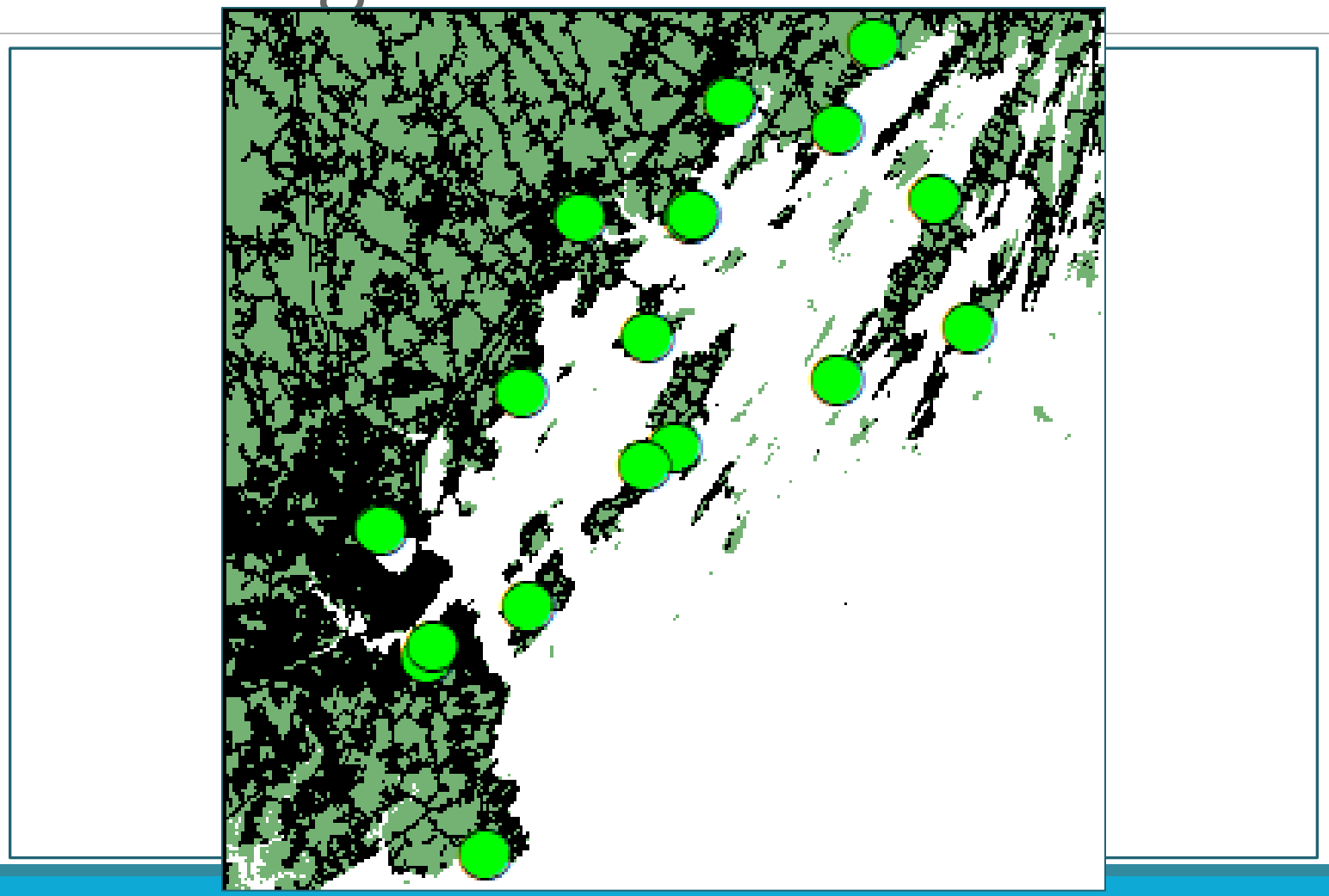
Organic Contaminants in Blue Mussels





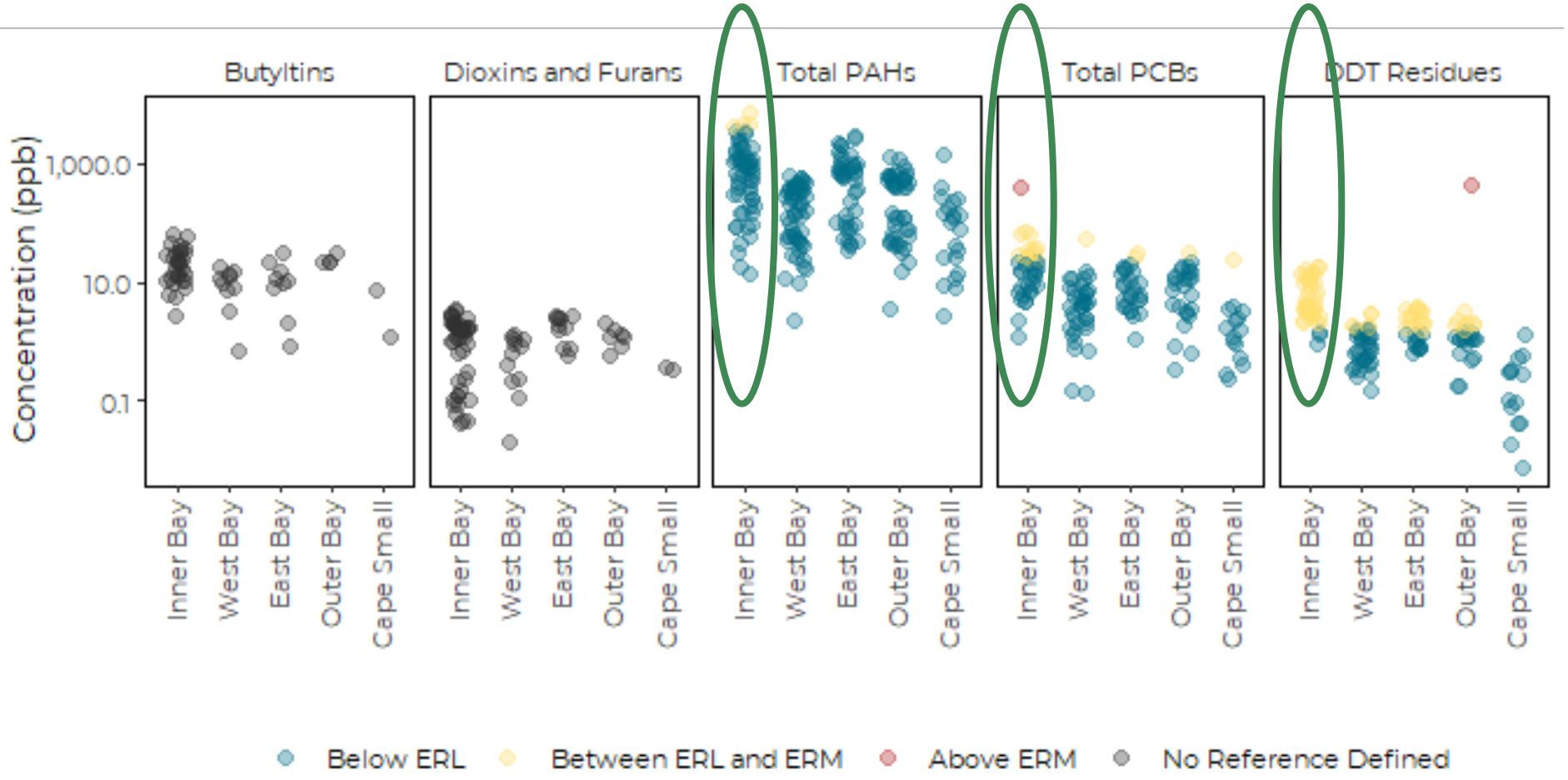
Data: Maine DEP

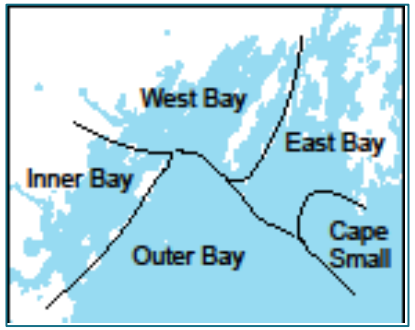
Bifenthrin Higher Near Urban Areas



Data: Maine Board of Pesticide Control

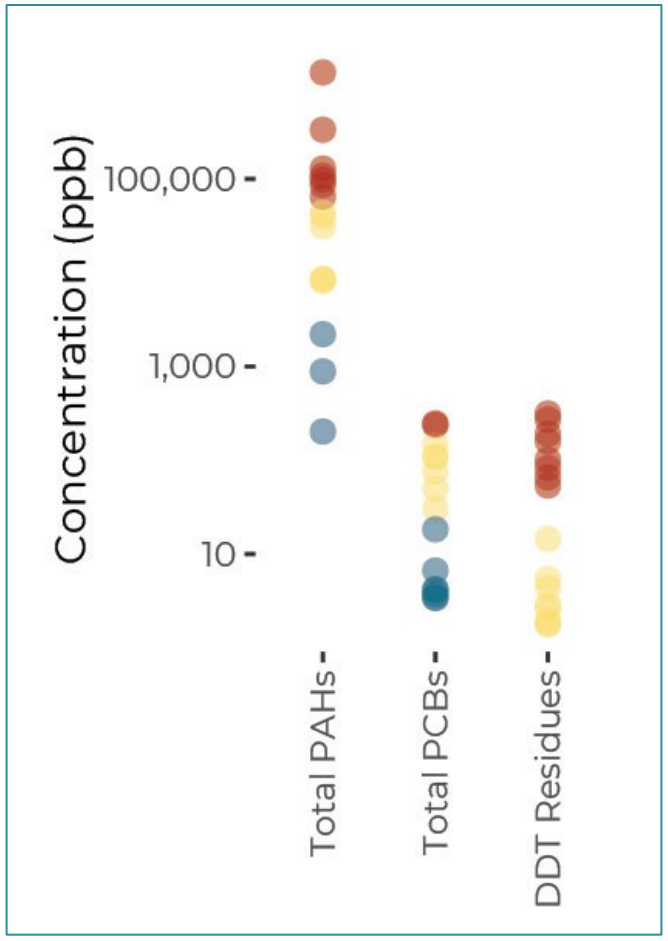
Sediment Contaminants Higher Near Portland





Data: CBEP

Portland Harbor Deep Sediments

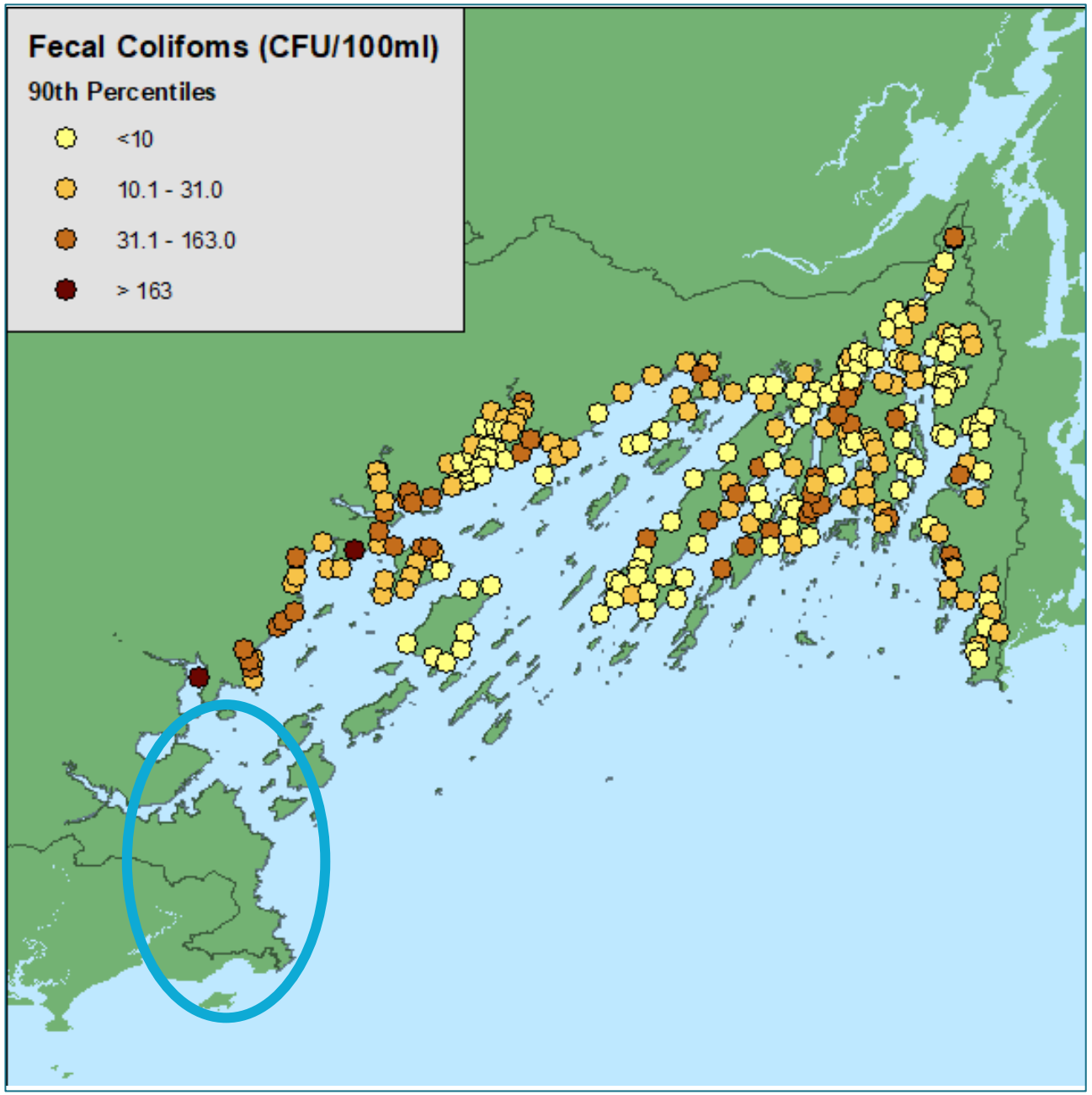


Deep sediments act like a time capsule, preserving contaminants released decades ago

Levels in Portland deep sediments are much higher than surface sediments

Investments in clean water benefit the Harbor

Data: Portland Harbor Commission / Stantec / Campbell Scientific



Data: Maine DMR

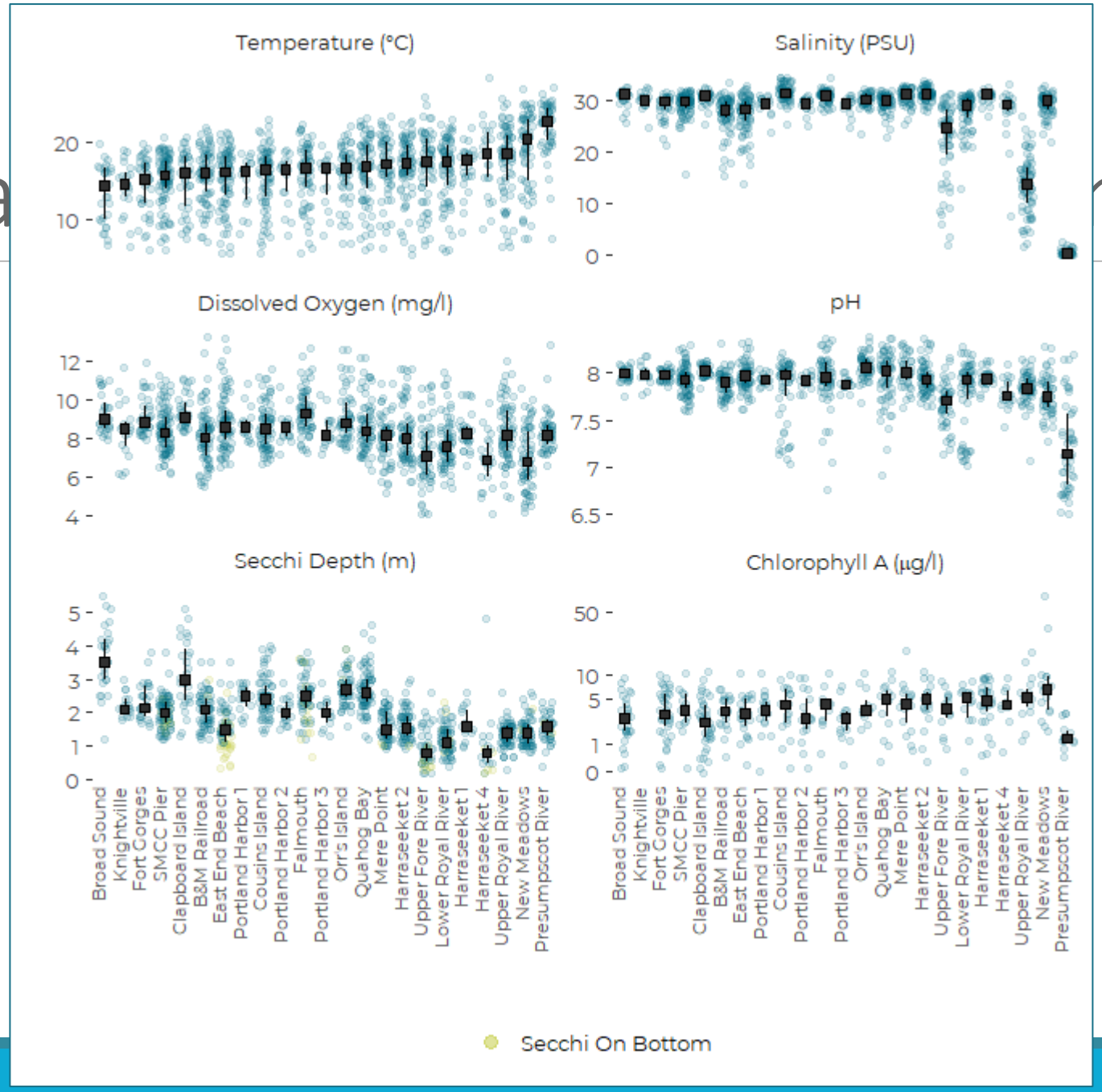
Bacteria at Shellfish Harvesting Areas

CONDITIONS WORSE ALONG SUBURBAN SHORES

NO DATA ALONG URBAN SHORES

STORMWATER MANAGEMENT HELPS

Bay Wa mics



Data: FOCB

The Casco Bay Model

Community Workshops

Using ocean models in Portland Harbor

November 15, 16 and 17

https://www.cascobayestuary.org/casco-bay/modeling-casco-bay/

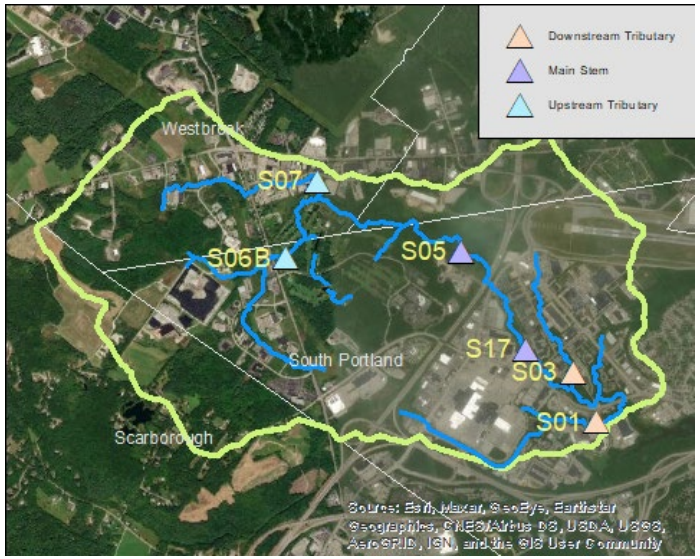
Depth (m)

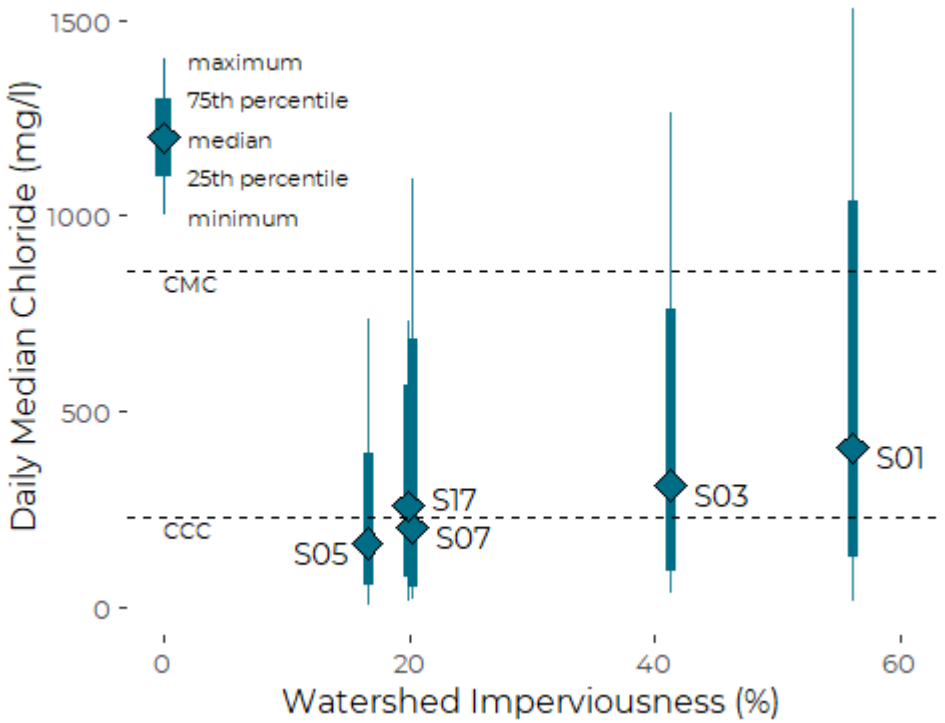
Chlorides in Long Creek

Conditions are worse in the lower watershed

Often above chronic exposure thresholds

Chlorides reflect IC





CMC: Criterion Maximum Concentration
CCC: Criterion Continuous Concentration

Nutrient Pollution

BAD NEWS AND GOOD NEWS ON NITROGEN

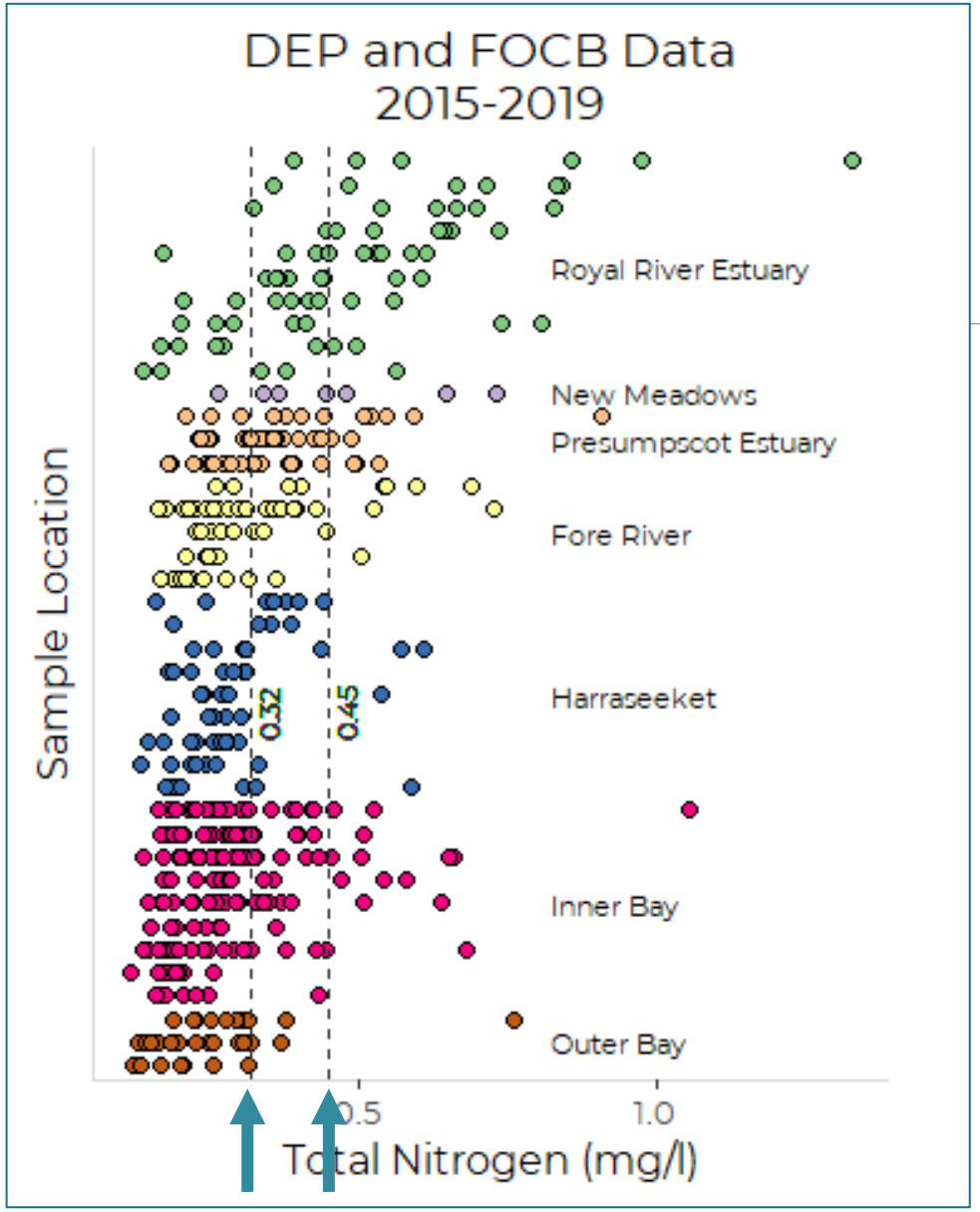
Nutrients: Too Much of a Good Thing?

Coastal Eutrophication

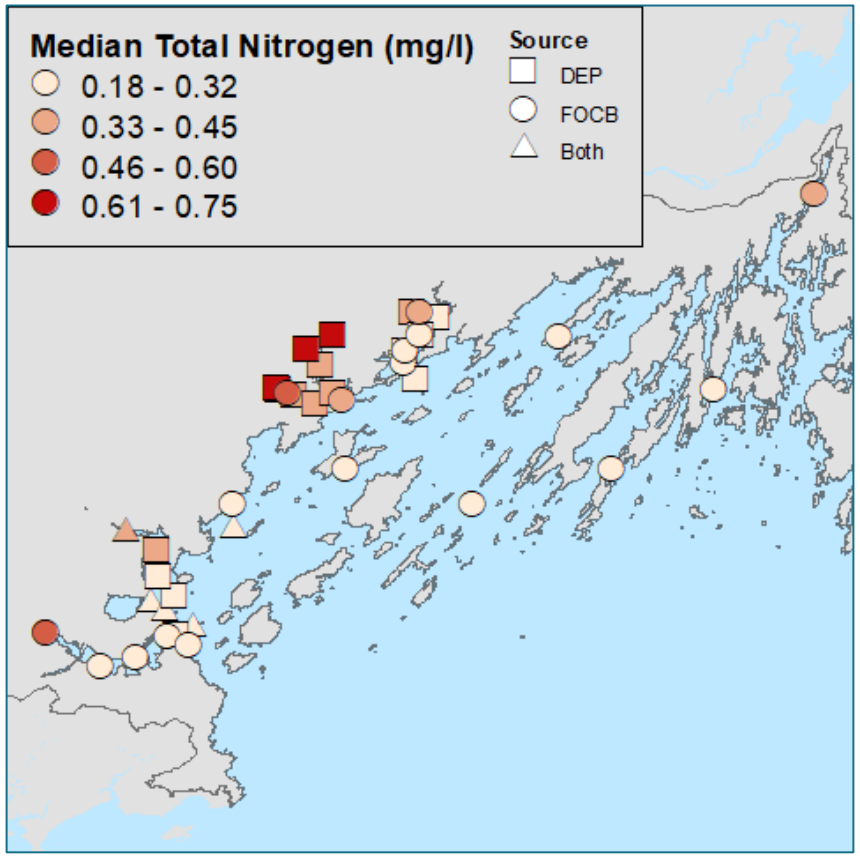
- Low or no dissolved oxygen
  - Fish kills
  - Reduction in accessible habitat
- Algal blooms
  - HABs
  - Water clarity
  - Loss of eelgrass
- Coastal Acidification
- Odors, etc.

Jerry Monkman, ecophotography.com

Nitrogen Often High



DEP Benchmarks



Especially in Casco Bay's Subestuaries

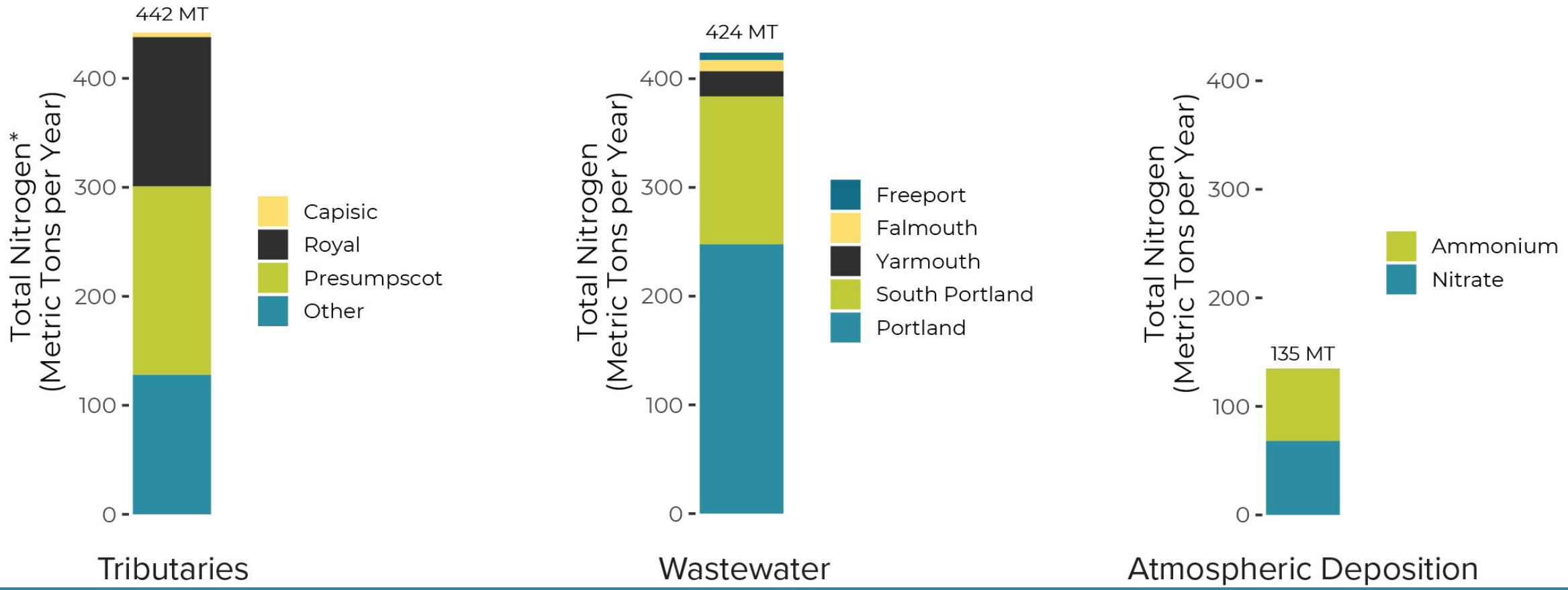
Data: FOCB

Nitrogen Sources

Not Included:

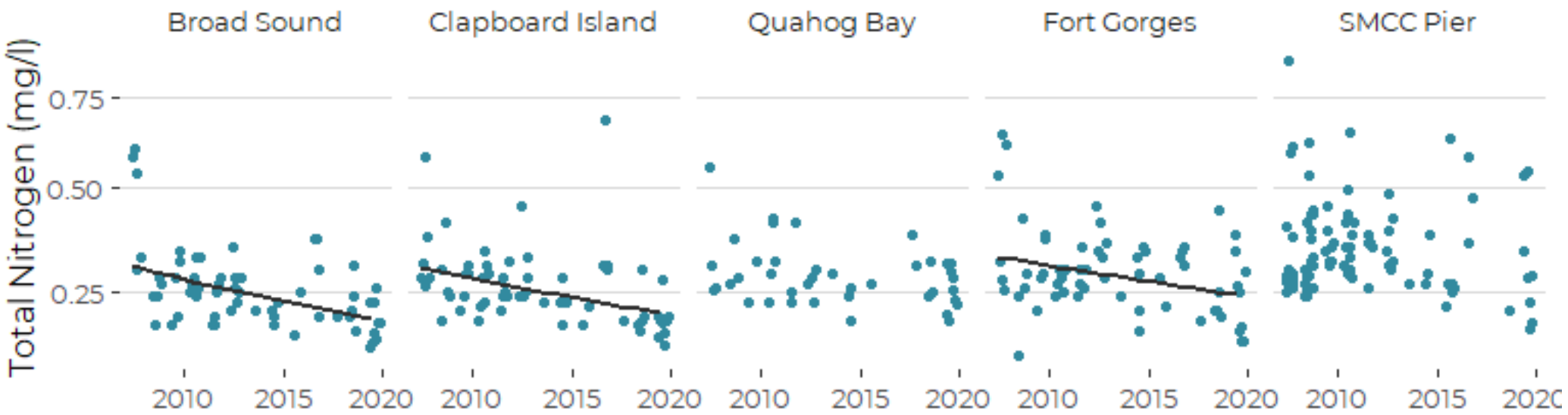
- Combined sewers
- Direct stormwater discharges
- On-site wastewater (septic tanks)

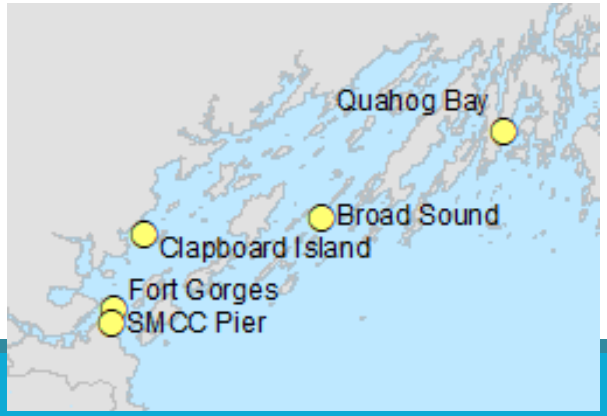
Documented Nitrogen Loads from Three Sources



Data: UMaine, DEP, NADP

Total Nitrogen in the Bay is Declining





Data: FOCB

Data: FOCB

Portland Water District Efforts

Updated the aeration system at the East End Wastewater Treatment Facility in 2017

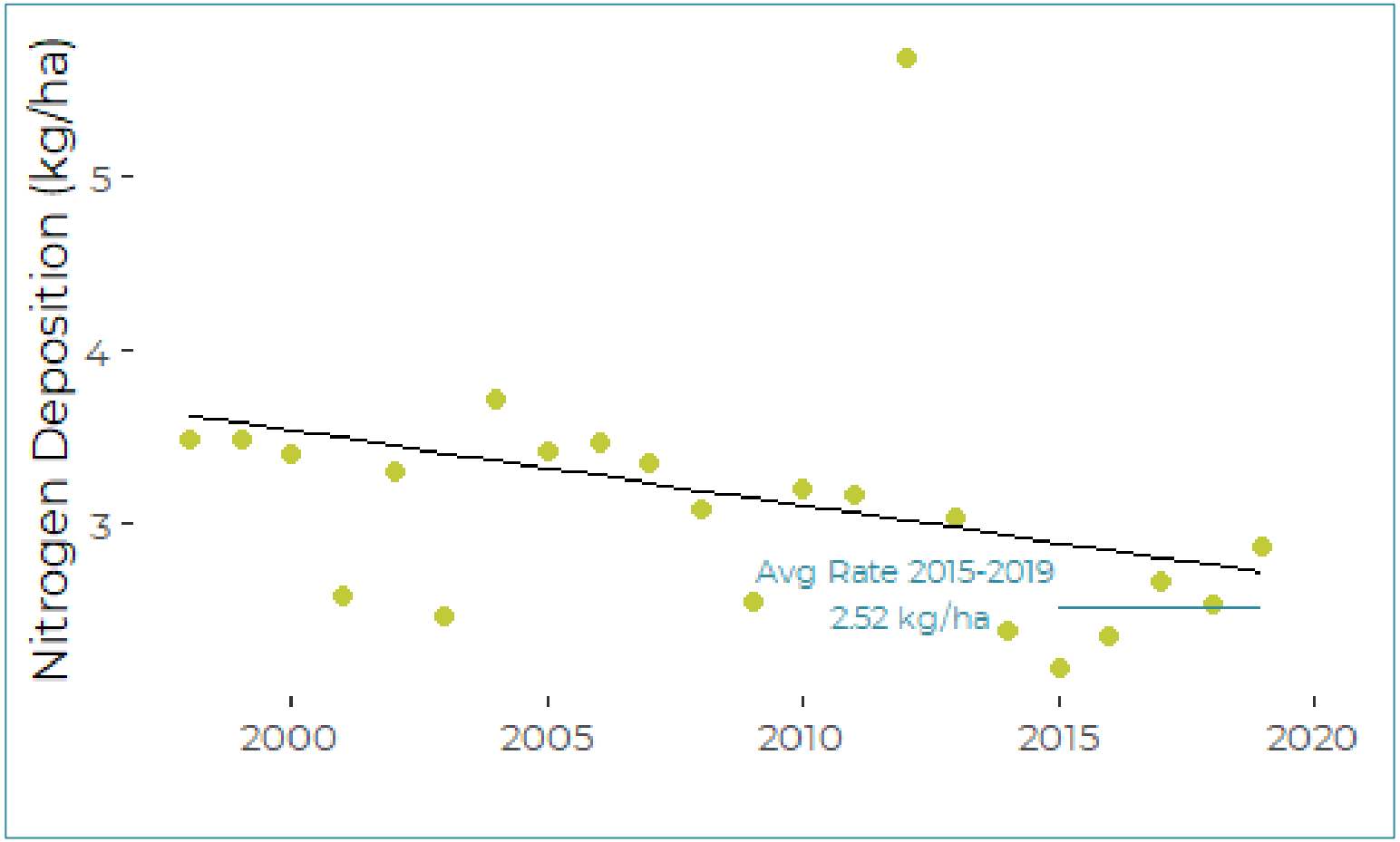
Manage the plant to optimize removal of nitrogen

Summer discharges of nitrogen have dropped by nearly three quarters

Jerry Monkman, ecophotography.com

East End WWTF, Portland, ME

Atmospheric Deposition Declining



Data: NADP, National Trends Network;
Site managed by Maine DEP

Climate Has Already Changed

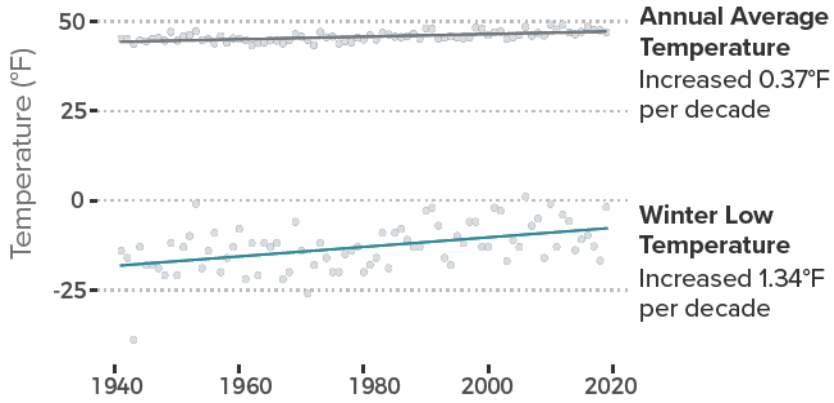
TEMPERATURE

PRECIPITATION

RISING SEAS

Winters are Warmer and Shorter

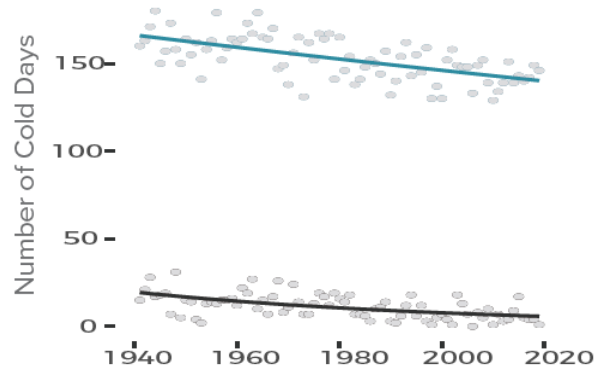
Warmer Years and Winters



Annual Average Temperature
Increased 0.37°F per decade

Winter Low Temperature
Increased 1.34°F per decade

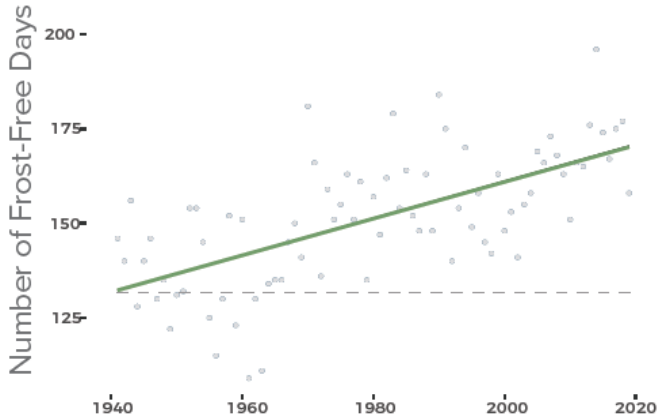
Fewer Cold Days



Days Below Freezing
Decreased from 164± in the 1940s to 141± in the 2010s

Days Below 0°F
Decreased from 18± in the 1940s to 6± in the 2010s

Longer Growing Season



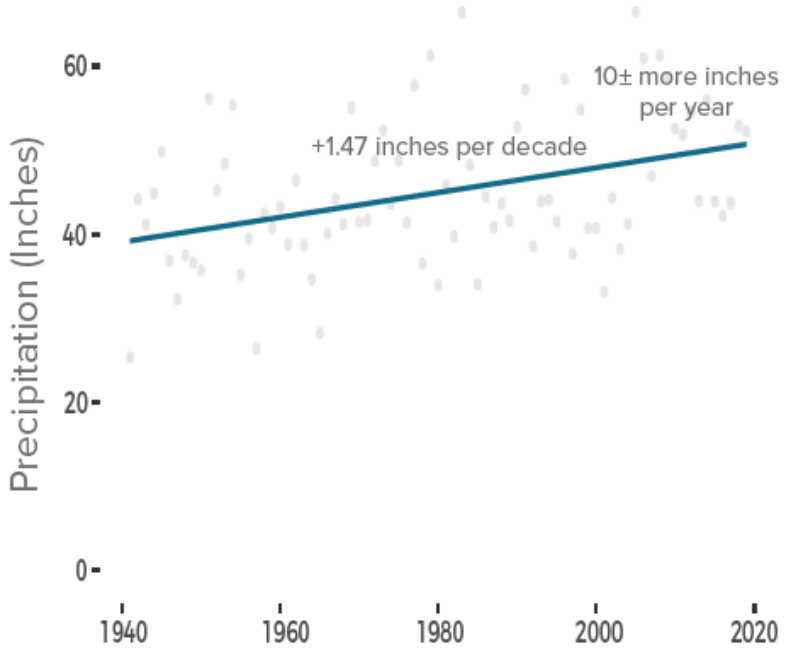
Growing Season
Increased to 168± days in the 2010s

from 134± days in the 1940s

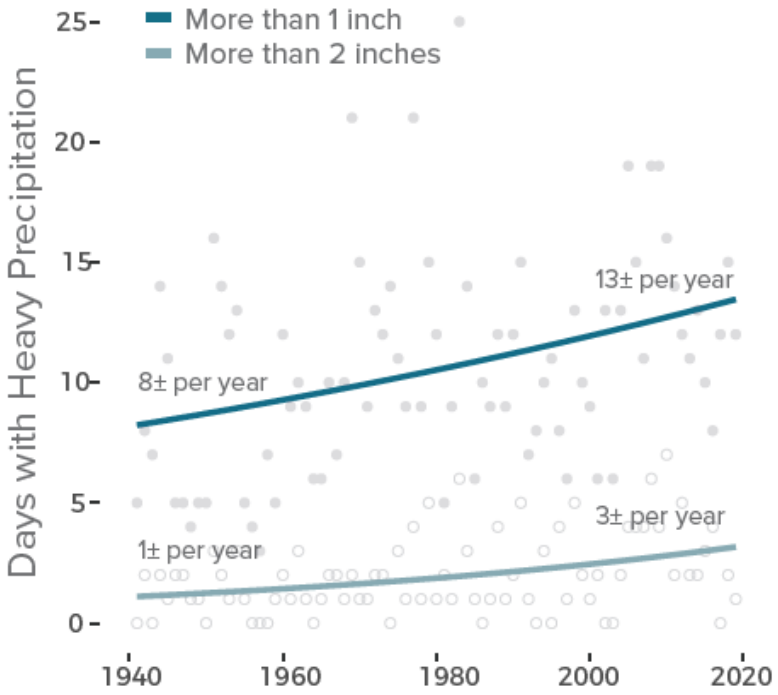
Data: Portland Jetport, via NOAA

More, and More Intense Rain

More Annual Precipitation



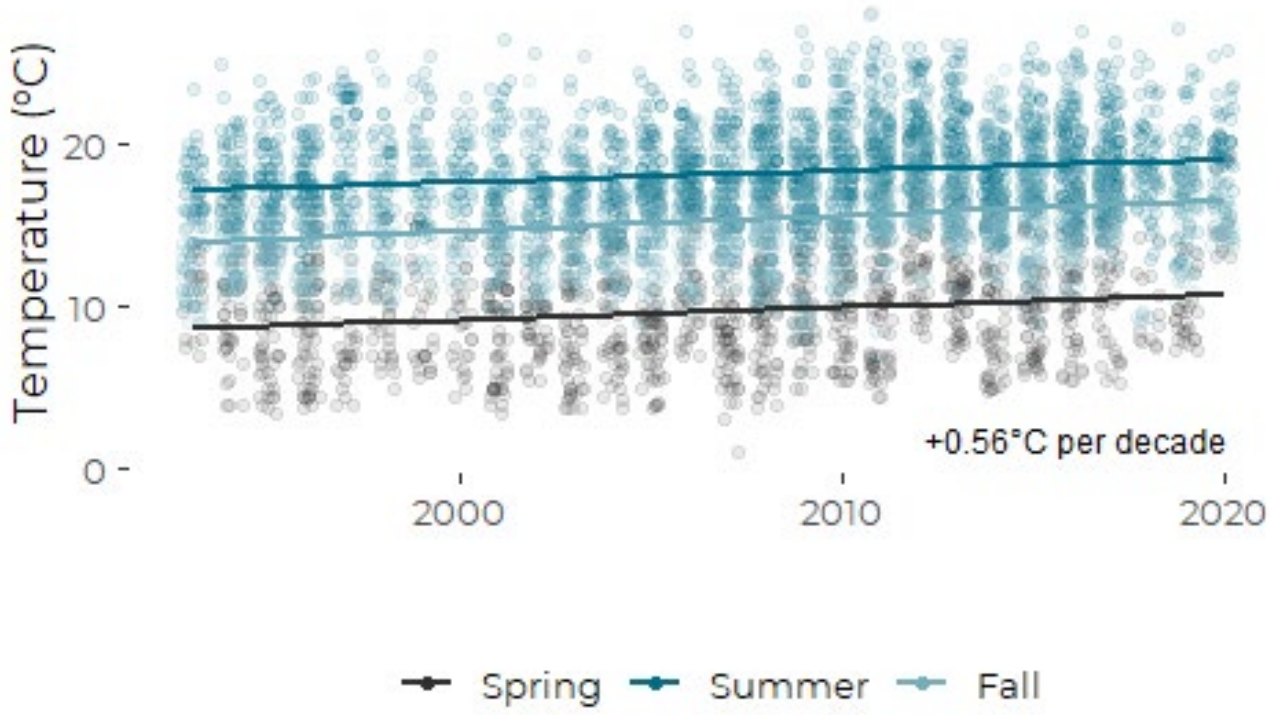
More Days of Heavy Precipitation



Data: Portland Jetport, via NOAA

Bay Water Temperatures

Has increased ~ 1.5 ºC since 1993

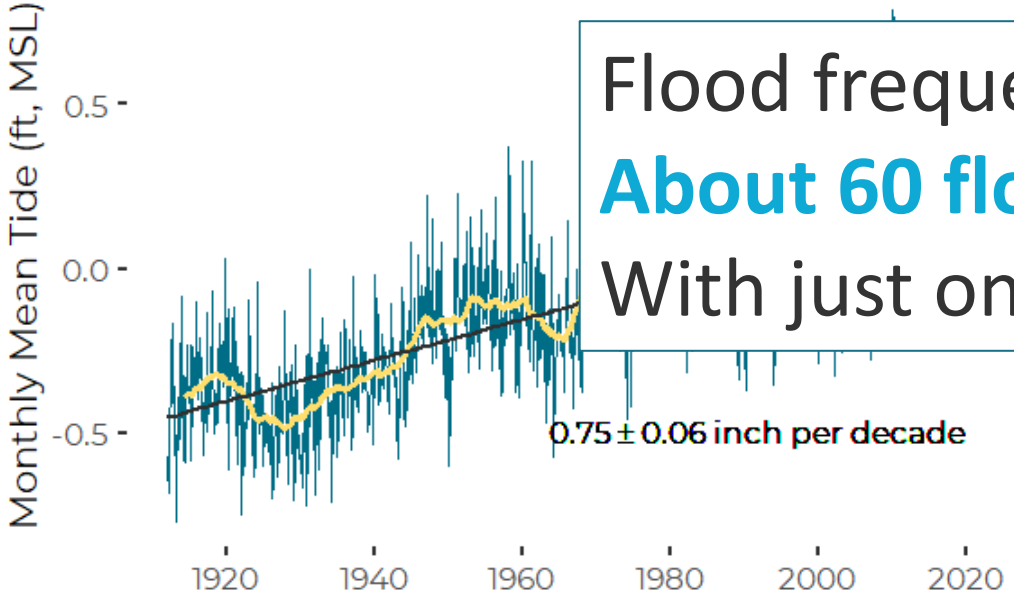


Spring = April, May
Summer = June, July, August
Fall = September, October

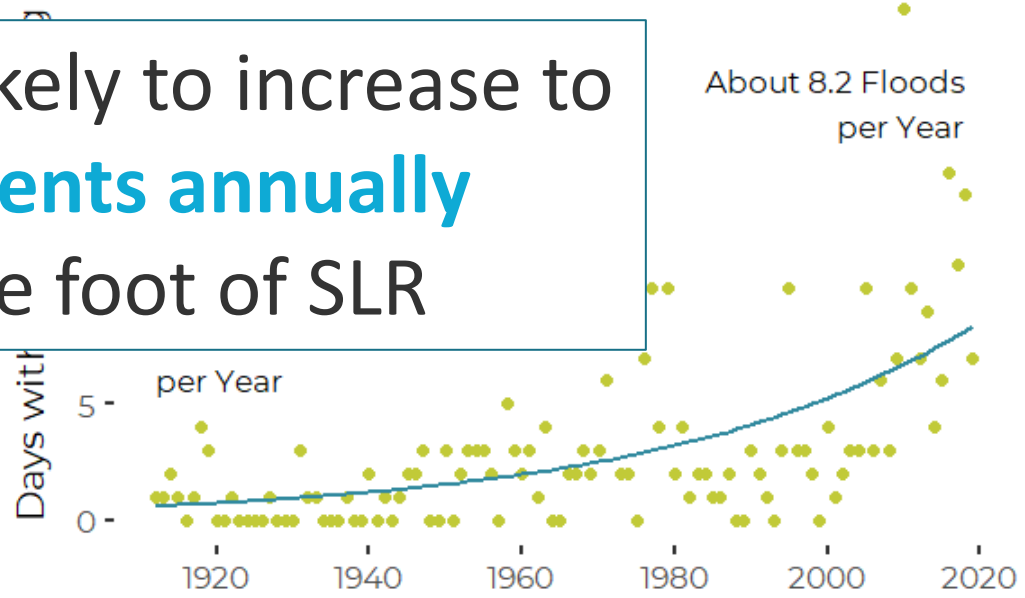
Data: FOCB

Rising Seas, More Flooding

Seas have been rising gradually



Leading to increasing flood frequency



Flood frequency likely to increase to

About 60 flood events annually

With just one more foot of SLR

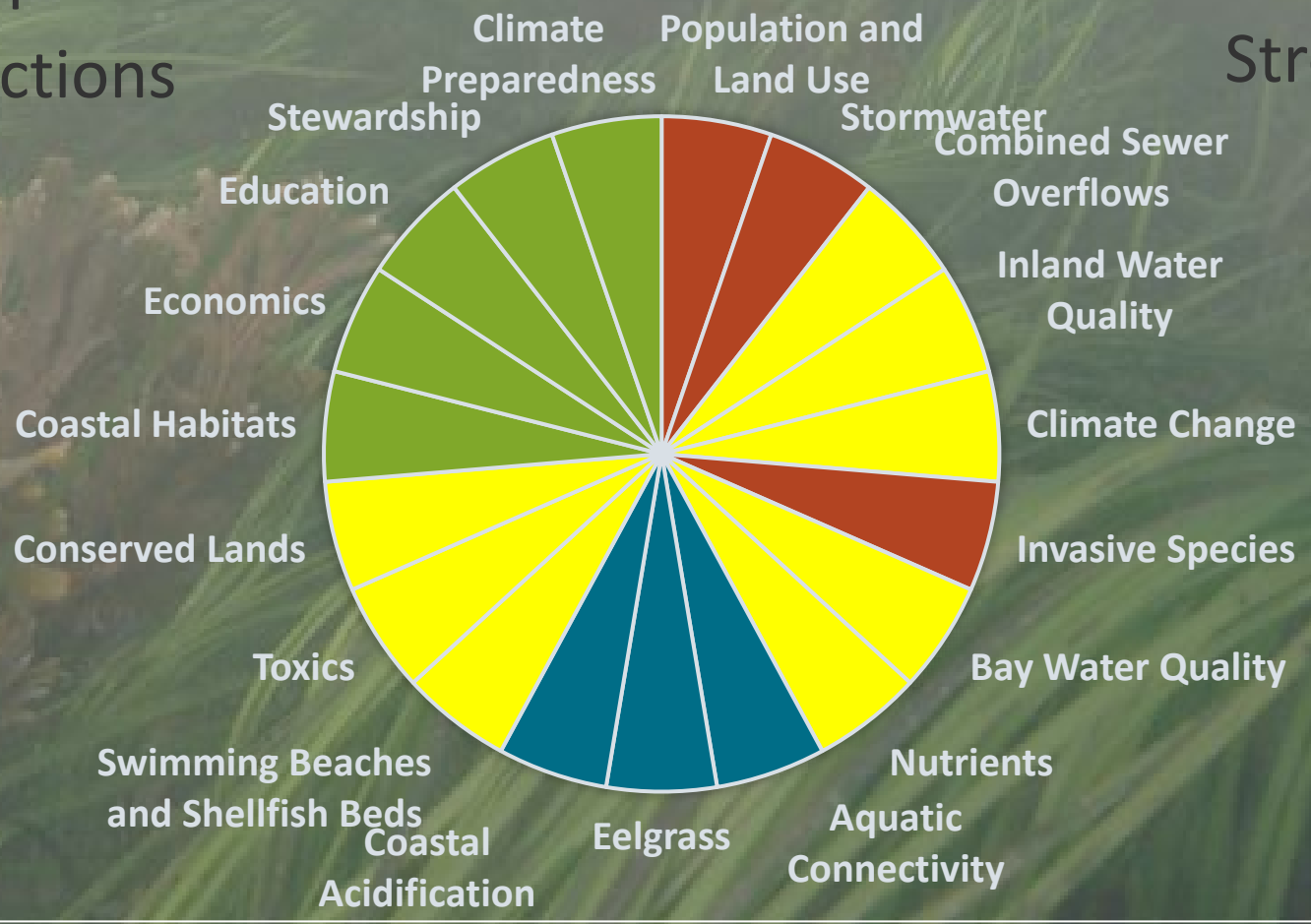
A “flood” is defined here as a day with ocean level Above HAT. Most are “blue sky” floods.

Data: NOAA Portland Tide Gauge

STATE OF CASCO BAY

Human Connections

Drivers and Stressors



Condition of the Bay

Looking Forward, not Back

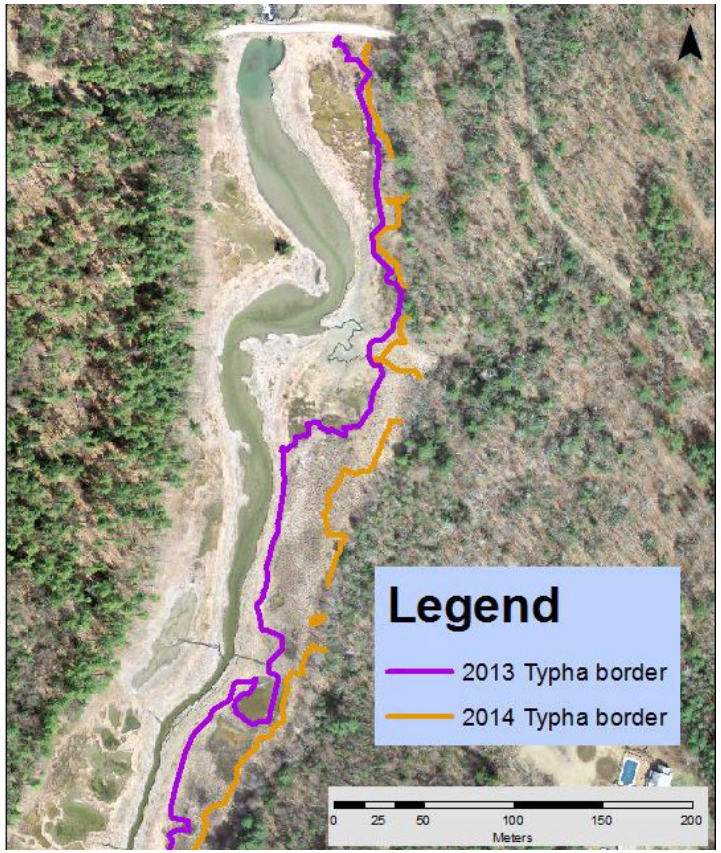
WATER IS ABOUT CLIMATE AND COMMUNITY

Partners:
Maine DOT,
Baxter State Park Authority
Landowners

Tidal Marsh Restoration

Long Reach Lane, Harpswell

Infrastructure Upgrade



Map courtesy of Shri Verrill

Habitat Restoration
Habitat Resilience

Partners:
- CCSWCD
- Town of Harpswell
- Landowners

What Were We Missing?

Long Reach Lane

Wallace Shore Road

Working with the Town of Harpswell

Dozens of vulnerable crossings

Many on shared private roads

Most lack road associations

Casco Bay Estuary Partnership

The Future of Clean Water

Casco Bay Estuary
PARTNERSHIP

Thank You

Curtis Bohlen
Director, Casco Bay Estuary Partnership
curtis.bohlen@maine.edu

https://www.cascobayestuary.org/
https://github.com/CBEP-SoCB