Marine Invasions in a Rapidly Warming Gulf of Maine:

Using citizen scientists to track the spread of marine invasive species in Southern Maine.

Casco Bay Estuary Partnership Monitoring Committee Meeting
February 17th, 2022

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wellsreserve
at laudholm
Wells National Estuarine
Research Reserve

NOAA
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
U.S. DEPARTMENT OF COMMERCE

Casco Bay Estuary
PARTNERSHIP

Massachusetts Office of
Coastal Zone Management

national estuarine research reserve system

National Estuarine Research Reserve System (NERRS)

New CT Reserve 2022!

National Estuarine Research Reserves
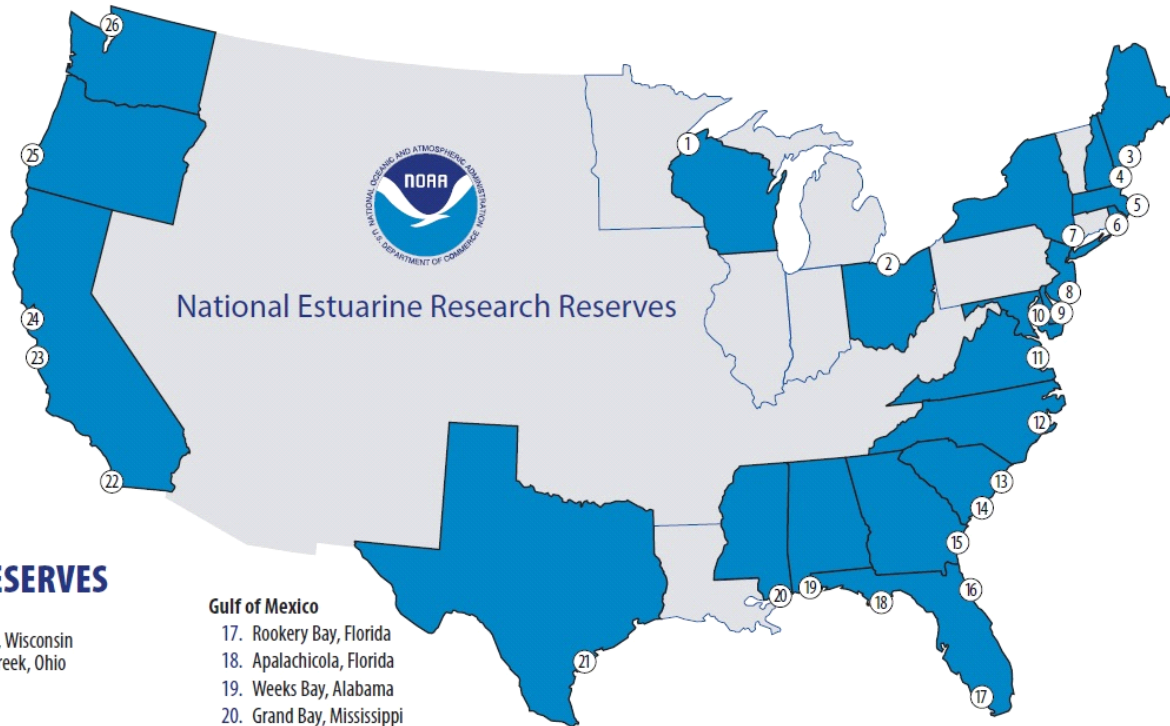
LIST OF RESERVES

Great Lakes
1. Lake Superior, Wisconsin
2. Old Woman Creek, Ohio

Northeast
3. Wells, Maine
4. Great Bay, New Hampshire
5. Waquoit Bay, Massachusetts
6. Narragansett Bay, Rhode Island

Mid-Atlantic
7. Hudson River, New York
8. Jacques Cousteau, New Jersey
9. Delaware
10. Chesapeake Bay, Maryland
11. Chesapeake Bay, Virginia

Southeast
12. North Carolina
13. North Inlet-Winyah Bay, South Carolina
14. ACE Basin, South Carolina
15. Sapelo Island, Georgia
16. Guana Tolomato Matanzas, Florida

Gulf of Mexico
17. Rookery Bay, Florida
18. Apalachicola, Florida
19. Weeks Bay, Alabama
20. Grand Bay, Mississippi
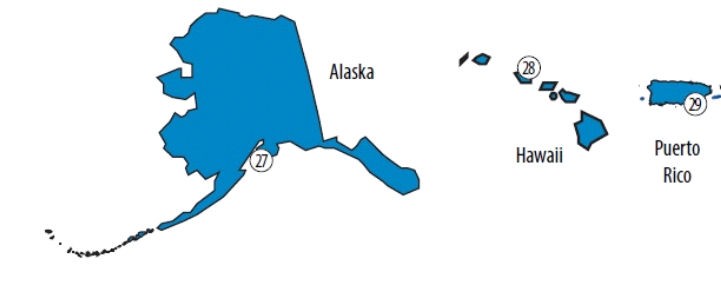21. Mission-Aransas, Texas

West
22. Tijuana River, California
23. Elkhorn Slough, California
24. San Francisco Bay, California
25. South Slough, Oregon
26. Padilla Bay, Washington
27. Kachemak Bay, Alaska

Pacific
28. He'eia, Hawai'i

Caribbean
29. Jobos Bay, Puerto Rico

Wells National Estuarine Research Reserve, Wells, Maine
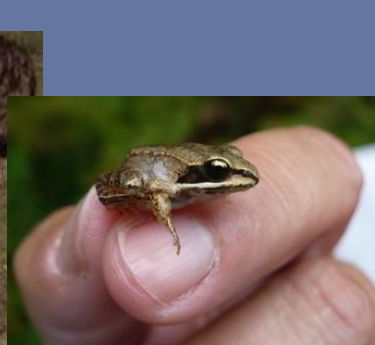
wells**reserve**
at laudholm

Wells National Estuarine Research Reserve
342 Laudholm Farm Road, Wells, Maine
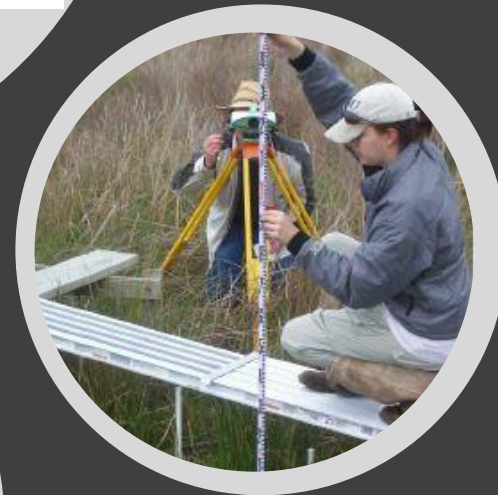wellsreserve.org   207-646-1555

Education

Research

Stewardship

wellsreserve
Wells National Estuarine
Research Reserve

Coastal Training Program

System-Wide Monitoring Program (SWMP)

- **Abiotic Monitoring**
  - 15 min Water quality
  - Monthly nutrients
  - 15 min Meteorological
  - Marsh elevation/SETs

- **Biological Monitoring**
  - Habitat change (veg transects/SAV)
  - Biodiversity (fish/plants/crustacea)
    - **Invasive species**
    - Crabs
    - Larval fish
    - Veg transects

MISSION: Identify and track short-term variability and long-term changes in the integrity and biodiversity of estuarine ecosystems.

Marine Invasive Species "101"

- **Species represent complex range of taxa and "life histories".**
  - Less known about behavior outside of native range
  - Cryptogenic?
  - Identification can be difficult…

Marine Invasive Species "101"

- **Estuaries and coasts are most heavily invaded.**
  - Vectors – shipping/aquaculture/etc.
  - Impacts from climate change "extreme effects" on estuaries.

Review

An 'extreme' future for estuaries? Effects of extreme climatic events on estuarine water quality and ecology

Michael S. Wetz [a,*], David W. Yoskowitz [b]

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ABSTRACT

Recent climate observations suggest that extreme climatic events (ECE; droughts, floods, tropical cyclones, heat waves) have increased in frequency and/or intensity in certain world regions, consistent with climate model projections that account for man's influence on the global climate system. A synthesis of existing literature is presented and shows that ECE affect estuarine water quality by altering: (1) the

What is MIMIC?

"The Marine Invader Monitoring and Information Collaborative"

- Network of trained volunteers, scientists and state/university staff

- Monitor for marine invasive species along the New England coastline

- Docks, Tidepools, and Cobble Shore

Goals of the MIMIC Program

- **Early Detection**: Find non-native species before they spread and/or become established in the ecosystem

- **Education:** Educate about marine invasive species and how to reduce their spread

- **Data:** provide data to interested users via online database and collaborations

A Rapidly Warming Gulf

- Gulf of Maine one of fastest warming bodies of water on the Planet
  - 2012 GOM temp "anomaly"
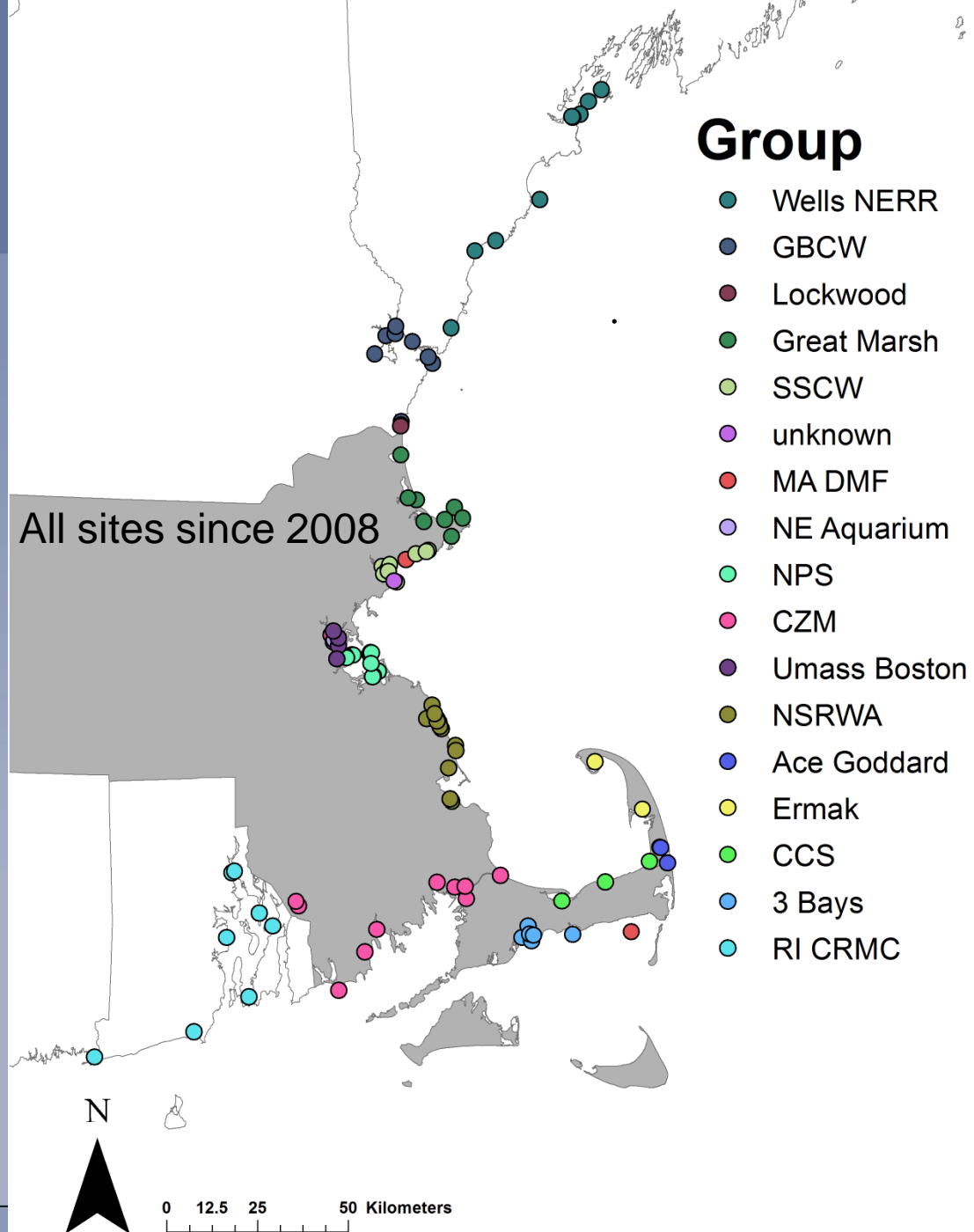 - Fall 2021- 2nd warmest on record in Gulf of Maine.
  - 46 F (7.8C) in Mid Jan 2022…
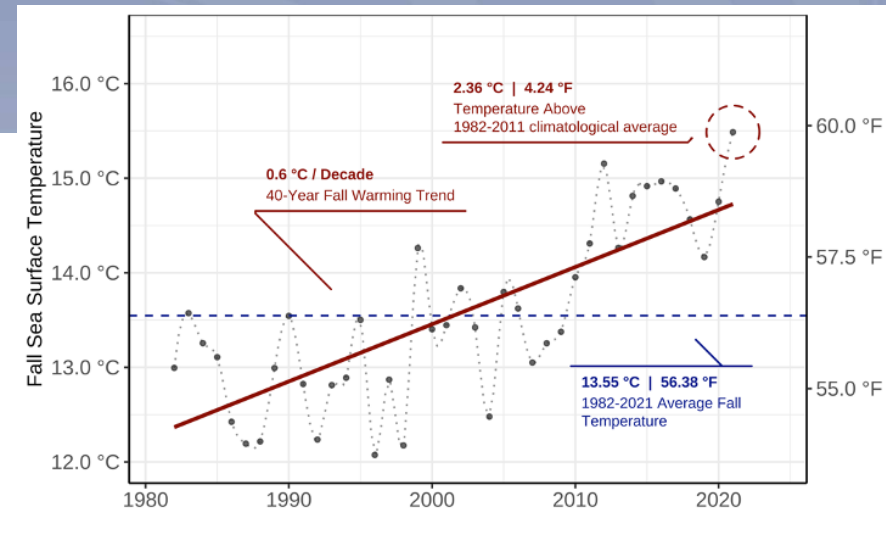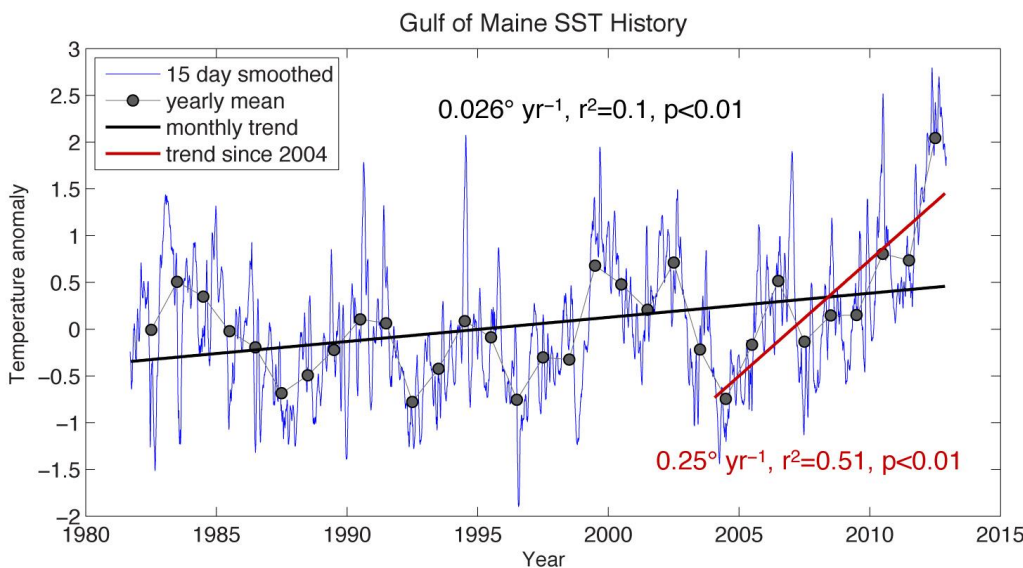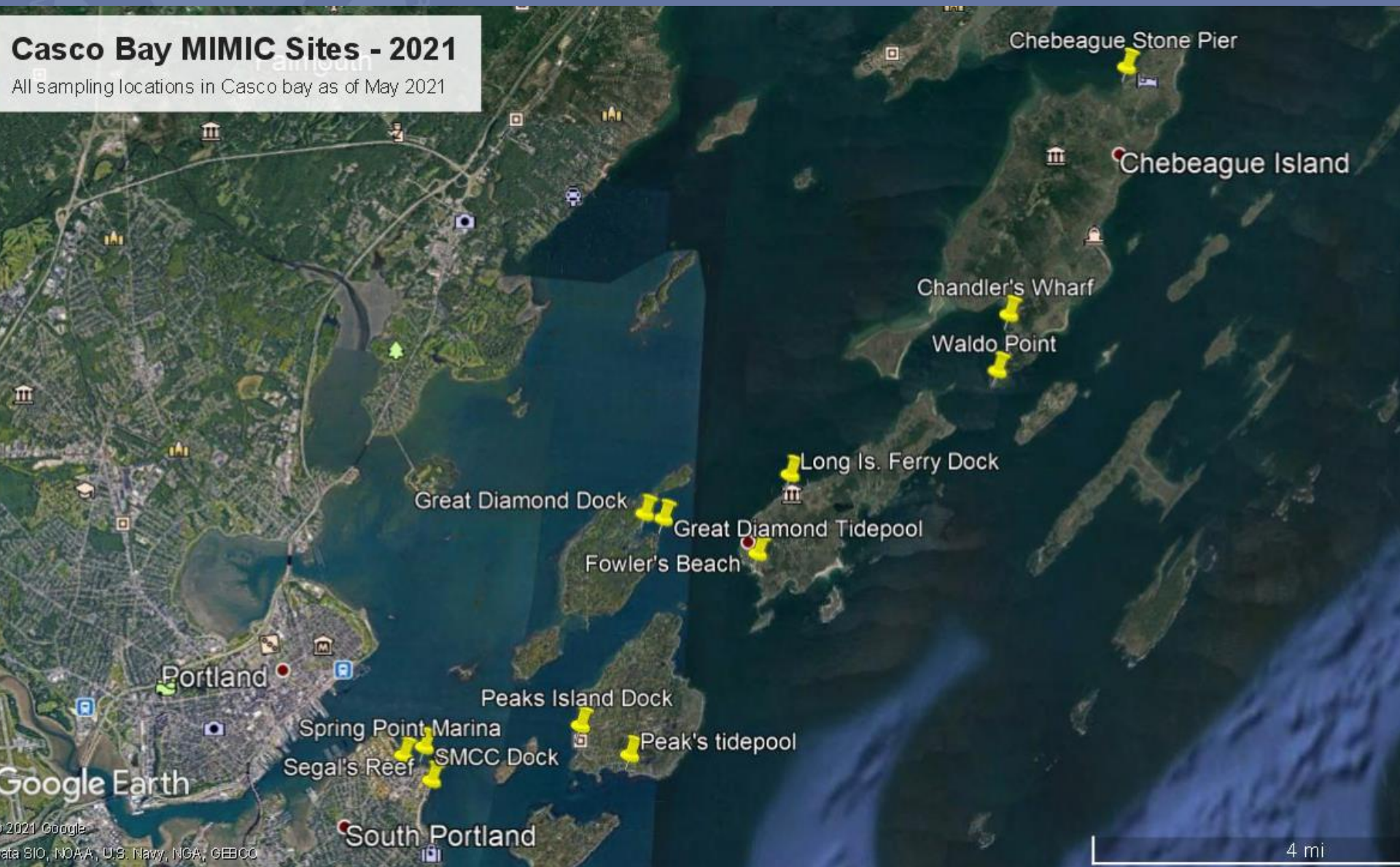

(Kemberling, Pershing - GMRI)

MIMIC Sites:

Since 2008

- 114 sites have been monitored
- 15 non-profits/state/university partners
- Over 1300 monitoring events
- Used to "fill gaps" between larger "Rapid Assessment Surveys"

All sites since 2008

Group

- Wells NERR
- GBCW
- Lockwood
- Great Marsh
- SSCW
- unknown
- MA DMF
- NE Aquarium
- NPS
- CZM
- Umass Boston
- NSRWA
- Ace Goddard
- Ermak
- CCS
- 3 Bays
- RI CRMC

N

0 12.5 25 50 Kilometers

Casco Bay MIMIC Sites - 2021
All sampling locations in Casco bay as of May 2021

TIDE POOLS

Diplosoma (fouling tunicate)

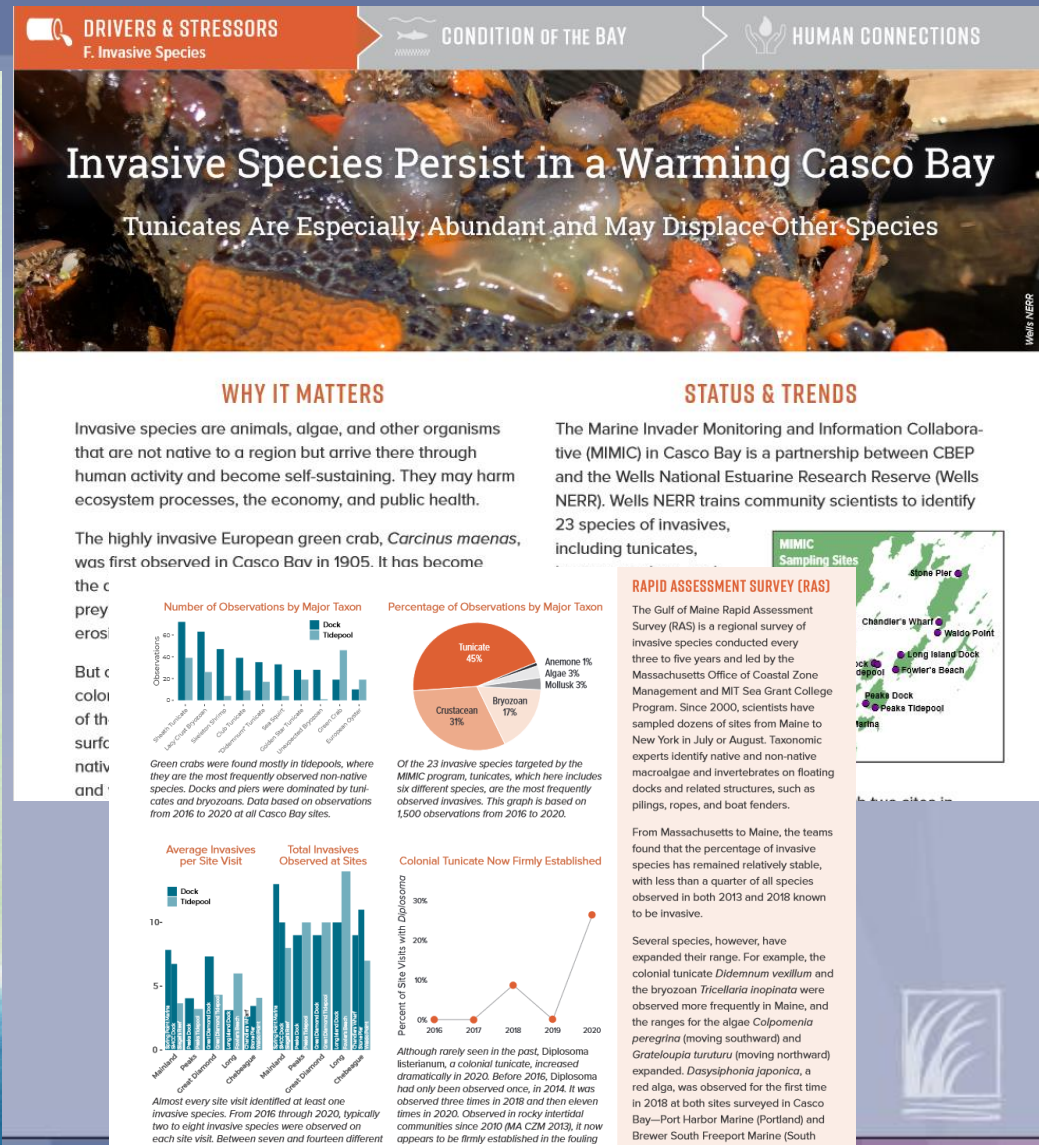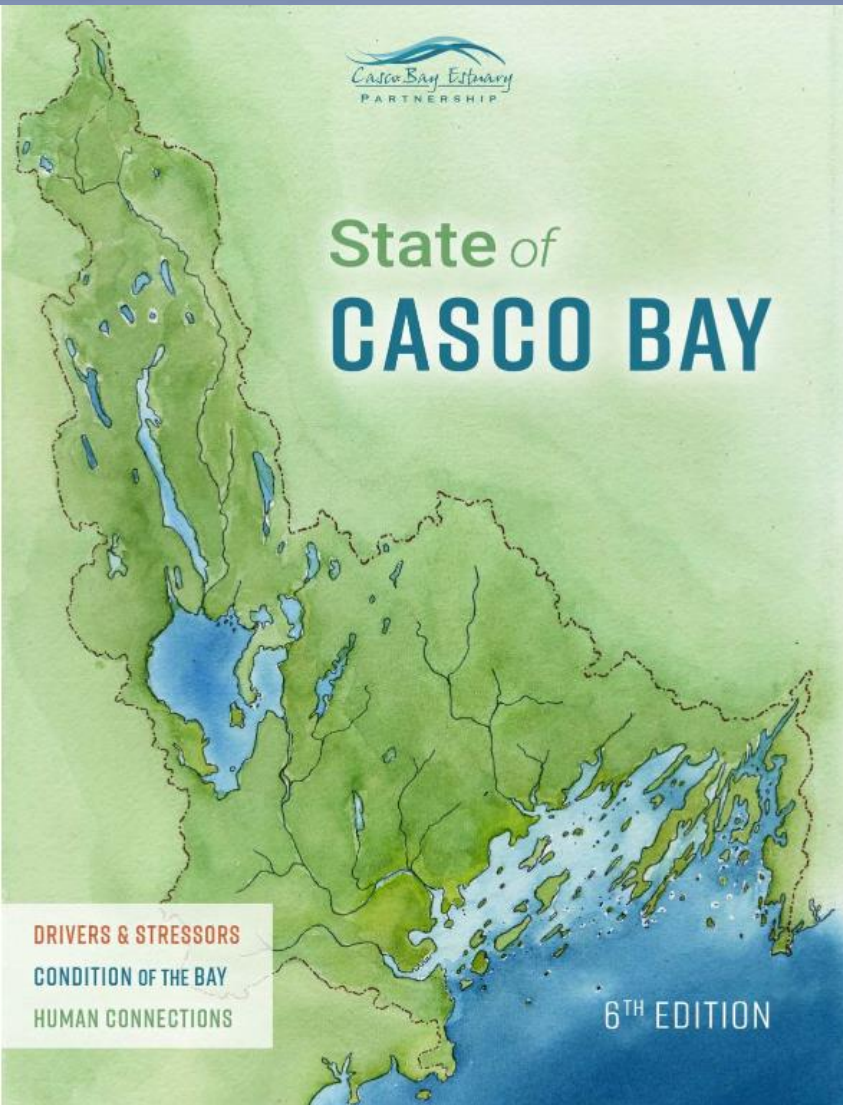# New Species of Tunicate?!..

"Styella plicata"

Found at SMCC dock in Oct. Still there as of this week!!....Overwinter?

Data informing our partners!

Number of Observations by Major Taxon

Legend: Dock, Tidepool

Y-axis: Observations

X-axis categories: Sheath Tunicate, Lacy Crust Bryozoan, Skeleton Shrimp, Club Tunicate, "Didemnum" Tunicate, Sea Squirt, Golden Star Tunicate, Unexpected Bryozoan, Green Crab, European Oyster

Green crabs were found mostly in tidepools, where they are the most frequently observed non-native species. Docks and piers were dominated by tunicates and bryozoans. Data based on observations from 2016 to 2020 at all Casco Bay sites.

Percentage of Observations by Major Taxon

Tunicate 45%
Anemone 1%
Algae 3%
Mollusk 3%
Bryozoan 17%
Crustacean 31%

Of the 23 invasive species targeted by the MIMIC program, tunicates, which here includes six different species, are the most frequently observed invasives. This graph is based on 1,500 observations from 2016 to 2020.

Average Invasives per Site Visit

Legend: Dock, Tidepool

Site labels: Spring Point Marina, SMCC Dock, Siegal's Reef, Peaks Dock, Peaks Tidepool, Great Diamond Dock, Great Diamond Tidepool, Long Island Dock, Fowler's Beach, Chandlers Wharf, Stone Pier, Waldo Point

Region labels: Mainland, Peaks, Great Diamond, Long, Chebeague

Total Invasives Observed at Sites

Site labels: Spring Point Marina, SMCC Dock, Siegal's Reef, Peaks Dock, Peaks Tidepool, Great Diamond Dock, Great Diamond Tidepool, Long Island Dock, Fowler's Beach, Chandlers Wharf, Stone Pier, Waldo Point

Region labels: Mainland, Peaks, Great Diamond, Long, Chebeague

Almost every site visit identified at least one invasive species. From 2016 through 2020, typically two to eight invasive species were observed on

Colonial Tunicate Now Firmly Established

Y-axis: Percent of Site Visits with Diplosoma

X-axis: 2016, 2017, 2018, 2019, 2020
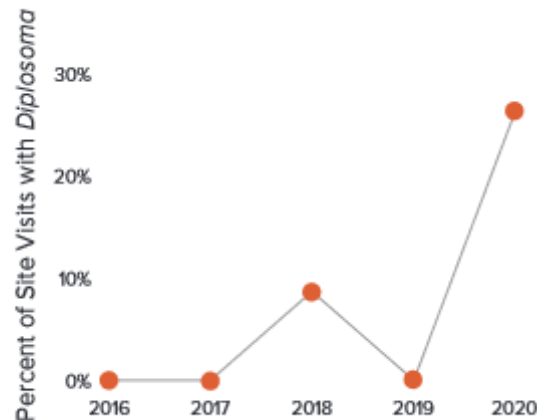
Although rarely seen in the past, Diplosoma listerianum, *a colonial tunicate, increased dramatically in 2020. Before 2016, Diplosoma had only been observed once, in 2014. It was observed three times in 2018 and then eleven times in 2020. Observed in rocky intertidal communities since 2010 (MA CZM 2013), it now*
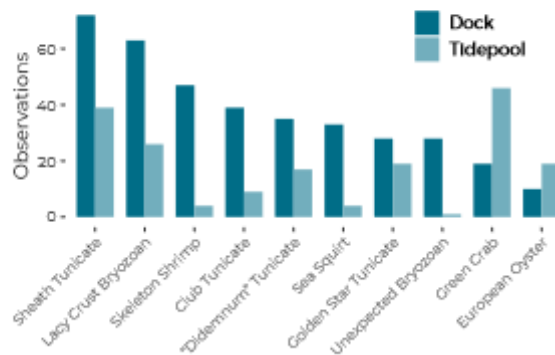
RAPID ASSESSMENT SURVEY (RAS)

The Gulf of Maine Rapid Assessment Survey (RAS) is a regional survey of invasive species conducted every three to five years and led by the Massachusetts Office of Coastal Zone Management and MIT Sea Grant College Program. Since 2000, scientists have sampled dozens of sites from Maine to New York in July or August. Taxonomic experts identify native and non-native macroalgae and invertebrates on floating docks and related structures, such as pilings, ropes, and boat fenders.

From Massachusetts to Maine, the teams found that the percentage of invasive species has remained relatively stable, with less than a quarter of all species observed in both 2013 and 2018 known to be invasive.
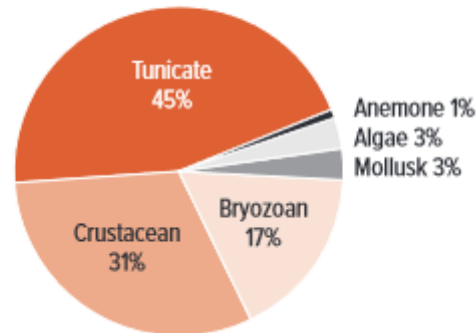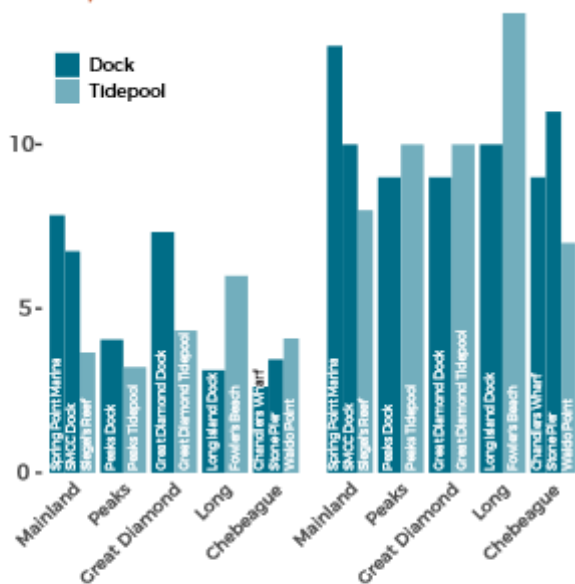
Several species, however, have expanded their range. For example, the colonial tunicate *Didemnum vexillum* and the bryozoan *Tricellaria inopinata* were observed more frequently in Maine, and the ranges for the algae *Colpomenia peregrina* (moving southward) and *Grateloupia turuturu* (moving northward) expanded. *Dasysiphonia japonica*, a red alga, was observed for the first time in 2018 at both sites surveyed in Casco Bay—Port Harbor Marine (Portland) and

One Crab, Two Crab, Green Crab…. BLUE CRAB?!?

Green Crab (C. Meanas)

Does Range Expansion = Invasive Species?

Climate change/warming waters, impacts to native species, etc.

Blue Crabs (Callinectes sapidus) caught in the Webhannet River Marsh, Wells, ME.
Summer 2020.

BLUE CRAB: *Callinectes sapidus*

Two fleshy knobs on rostrum

"Y-shaped" chromataphores on ventral surface near insertion of chelae

Posterior carapace spines- fairly exclusive to *Callinectes*

2022 Casco Bay Community Grant

Personnel: Dr. Erin Grey & Brandon Harvey (Umaine,), Dr. Jason Goldstein, Jeremy Miller, Laura Crane (Wells NERR)

Three sampling techniques to understand current population structure in Casco Bay and to test effiecny of each technique.

1. Adult trapping
2. Larval collectors (hog-hair)
3. eDNA sampling

https://www.estuarydna.org/

Thank you!!

My "invasive species": Lucas (9) and Camille (6)

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