

Quantifying marine biodiversity through movements and feeding: Assessing coastal marine ecosystem dynamics near estuary mouths

MBON

Marine Biodiversity
Observation Network



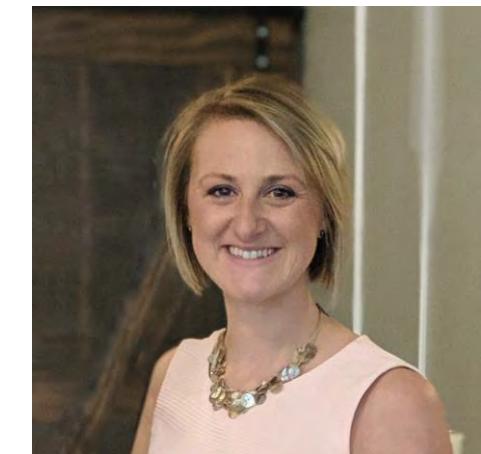
dynamics near
estuary mouths

November 2, 2022



The Team!

- Nathan Furey
- Alison Watts
- Elizabeth Craig
- Graham Sherwood
- Riley Young-Morse
- Jackie Motyka



University of
New Hampshire

Sea Grant
New Hampshire



Gulf of Maine
Research Institute

NERACOOS

QUEBEC

Gulf of
St. Lawrence

MAINE

NEW YORK

Gulf
of Maine

Atlantic Ocean



Isles of Shoals,
New Hampshire

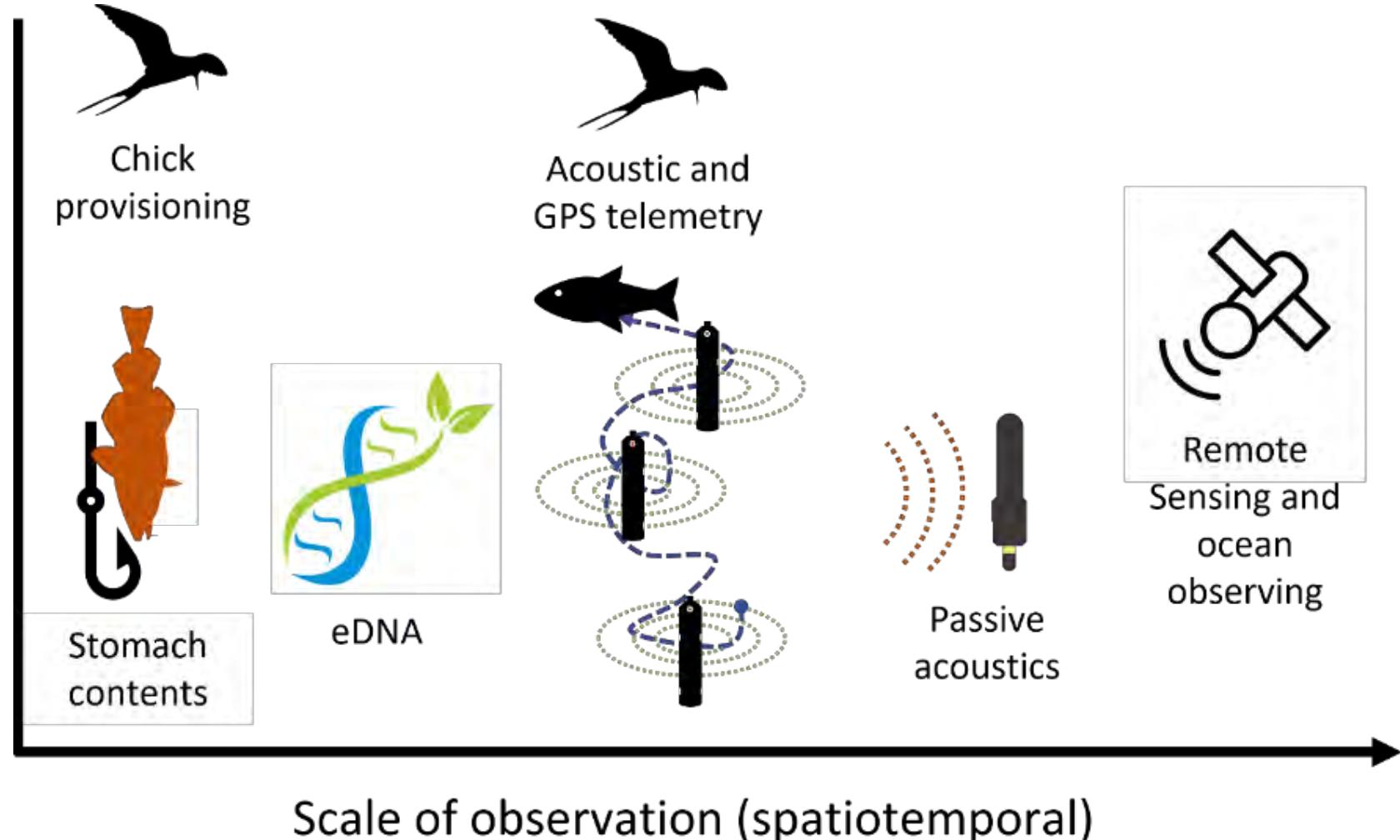


Casco Bay, Maine

Atlantic cod and common terns: model consumers



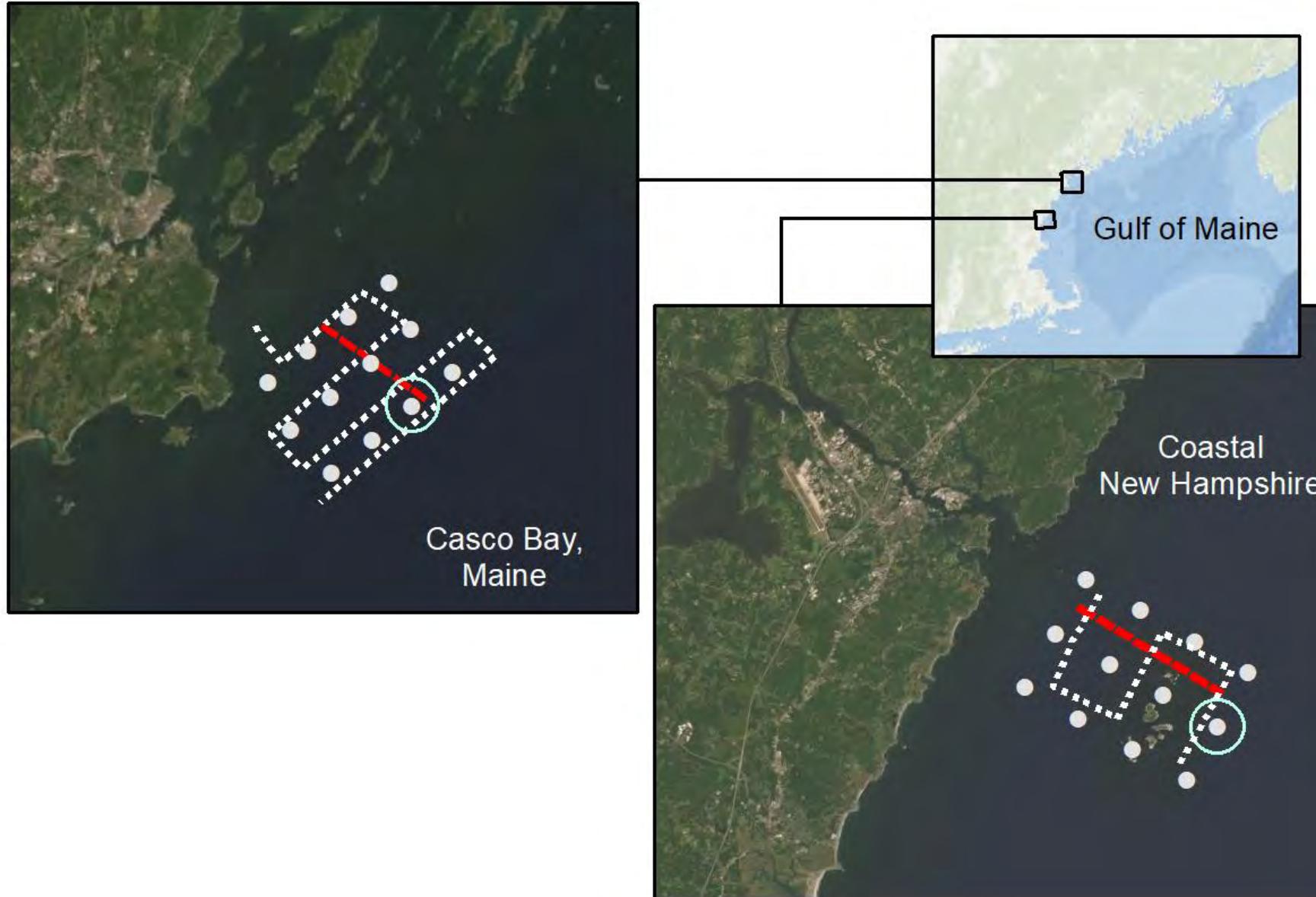
Main questions: How do measurements of marine biodiversity vary through space and time, and how do two model predators respond to variation?



Objectives

1. Characterize seasonal and interannual changes in Atlantic cod and common tern movements, their diets, and the presence of forage species in two coastal systems
2. Correlate movements and diet of predators with regional marine biodiversity
3. Determine how indicators of biodiversity vary with environmental changes
4. Use bioenergetics modeling to predict potential consequences of changes in water temperature and food availability on energy budgets of Atlantic cod and common terns

Two sites, three years



- Gray points = telemetry receivers
- Cyan circles = paired passive acoustic receiver
- Red line = eDNA transect
- White line = active acoustic survey

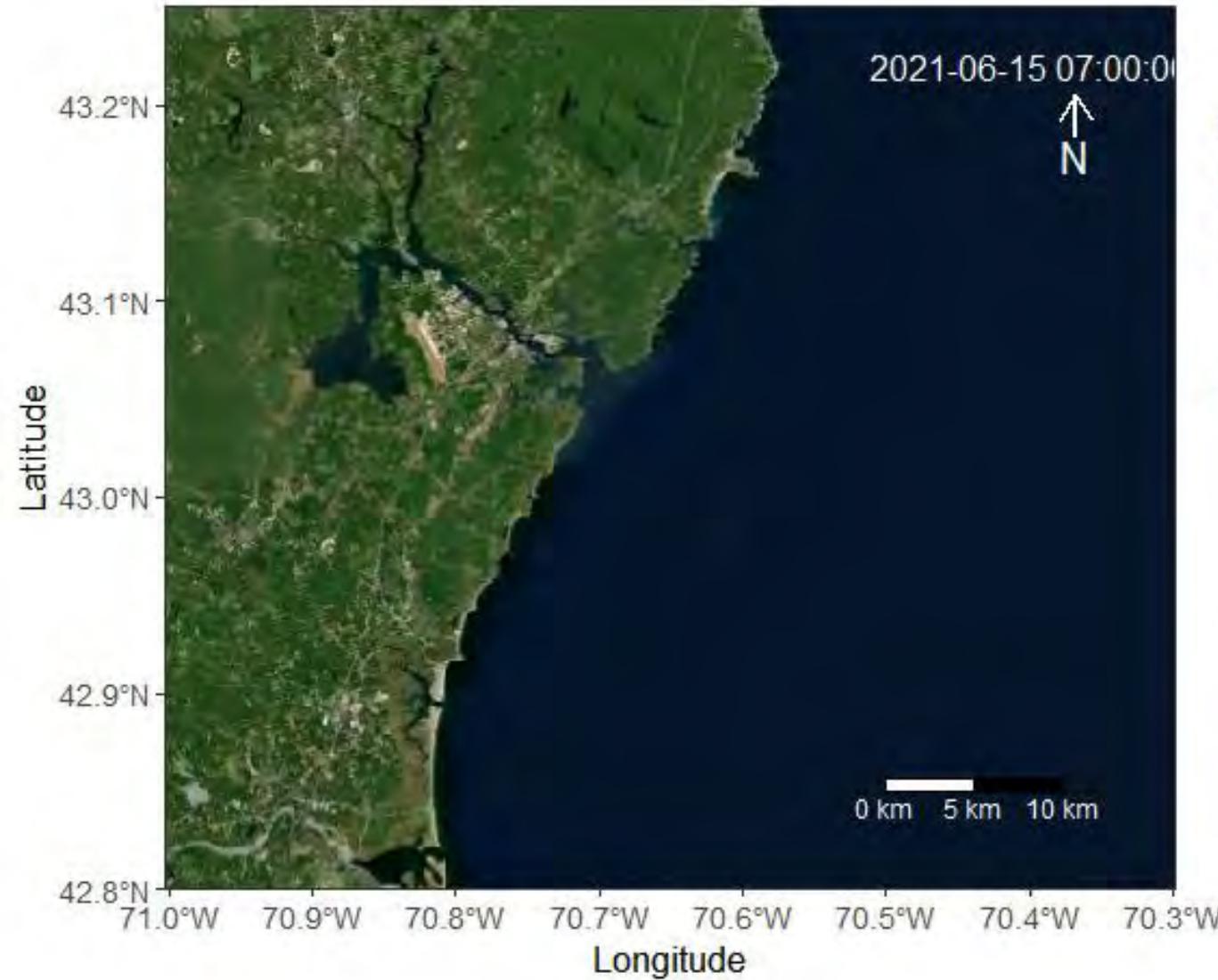
Atlantic cod telemetry and diet

- Focusing on fish with high site fidelity
- Metabarcoding of stomach contents



Sherwood and Grabowski 2010

GPS Telemetry: common terns



Behavioral State

- Nesting
- Transiting
- Foraging

TagID

224
244
802
811
840
925
994



Aliya Caldwell





Integrate
movement with
chick
provisioning data



Quantifying marine biodiversity through movements and feeding: eDNA component

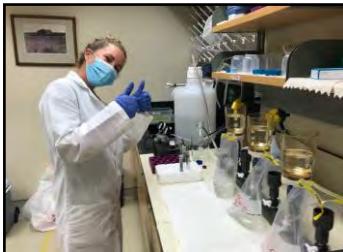
Samples are collected
And filtered each site



UNH extract, amplify, and
sequence

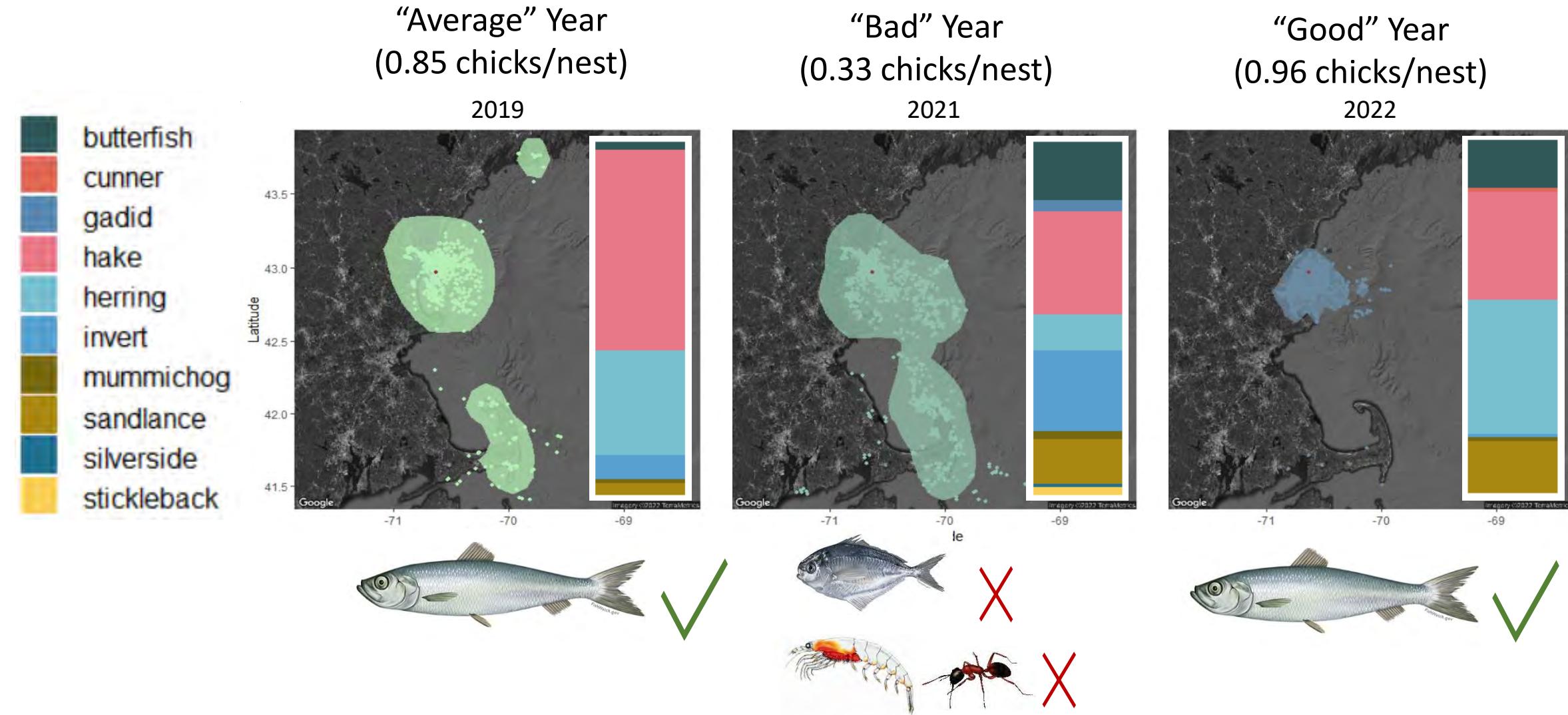


Bioinformatics and
species ID



Reality check: are the results
reasonable, how should data
be presented to stakeholders?
Modify if needed.

Seabirds need to move more in bad years, to catch low-quality prey



Advisory panel and boundary organization



Linas Kenter



Stakeholders / Advisory Panel

NHFG: Kevin Sullivan

MDMR: Danielle Frechette

NMFS: Sarah Gaichas, Brian Smith

GBNERR: Chris Peter

PREP: Kalle Matso

AWSC/MDMF: Megan Winton, Greg Skomal

Recreational fishers

Leveraging opportunities from rivers to coastal ocean

- Diadromous fishes
- Estuarine habitat and water quality
- Linking to fisheries independent datasets (NHFG, MDMR, NMFS)
- Leveraging ongoing data collection



GREAT BAY
NATIONAL
ESTUARINE
RESEARCH
RESERVE

Examples of specific products for stakeholders

- NHFG: Potential mechanistic linkages between tern behavior, chick provisioning, and chick success
 - Development of open-source bioenergetics model that can be applied to novel settings
- NMFS: Additional inputs for ecosystem-based reports (terns), as well as further information on local Atlantic cod ecology
 - Development of bioenergetics models
- PREP/GBNERR: Linkages between water quality and marine biodiversity (and potential estuarine-coastal linkages)
- AWSC/MDMF: Use of NH waters as migratory corridor for white sharks
- All: Data visualization tool (as determined by advisory panel)
- All: Species lists, seasonality, inter-method comparisons

Integration with environmental information, open-data workflows



The screenshot shows the homepage of the Gulf of Maine Research Institute's Climate and Fisheries Data Dashboard. The header features the GMRI logo and navigation links for About, Commitments, Stories, Events, and Join Us. The main title "Climate and Fisheries Data Dashboard" is prominently displayed. Below the title, there are three small maps showing environmental data (likely temperature or salinity) over the Gulf of Maine. A large, detailed map of the Northeast coast is visible at the bottom left.



The screenshot shows the NERACOOS Mariners' Dashboard. The header includes the NERACOOS logo and navigation links for Home, Regions, and About. The main content area features a large map of the Northeast coast with numerous orange dots representing buoy locations. A color scale bar on the left indicates data values from 0 to 4. The text "Providing tools stakeholders can use to better understand" is displayed above the map. A call-to-action button labeled "GET STARTED" is located at the bottom right.

NERACOOS Mariners' Dashboard

Welcome to the NERACOOS Mariners' Dashboard, which delivers high-quality, timely data from a growing network of buoys and sensors into the hands of mariners heading to sea.

If you encounter a bug or have feedback regarding your experience, please use [this form](#) to submit a report.

The original Buoy Map will be available for a limited time:
<http://neracoos.org/realtimemap>

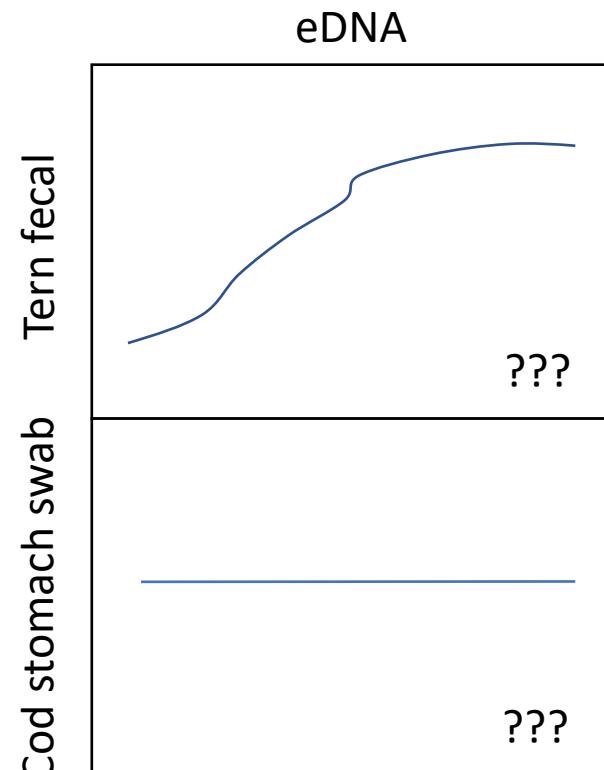
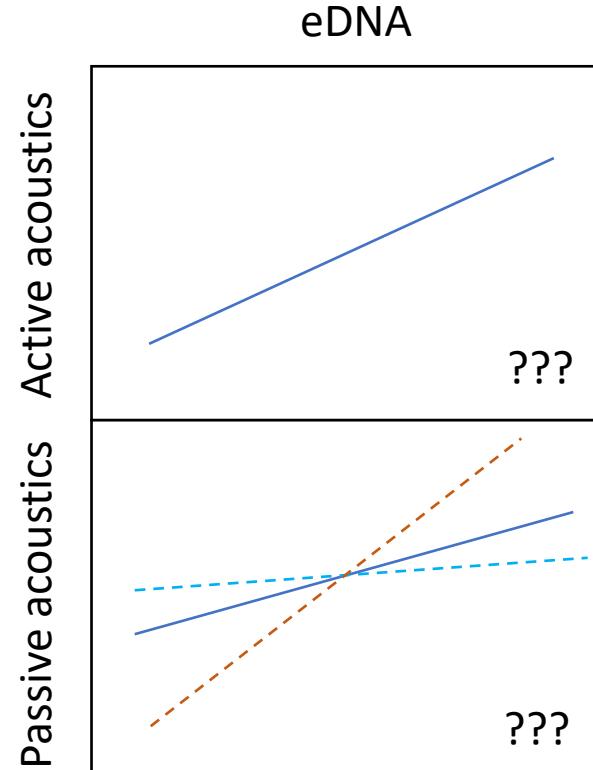
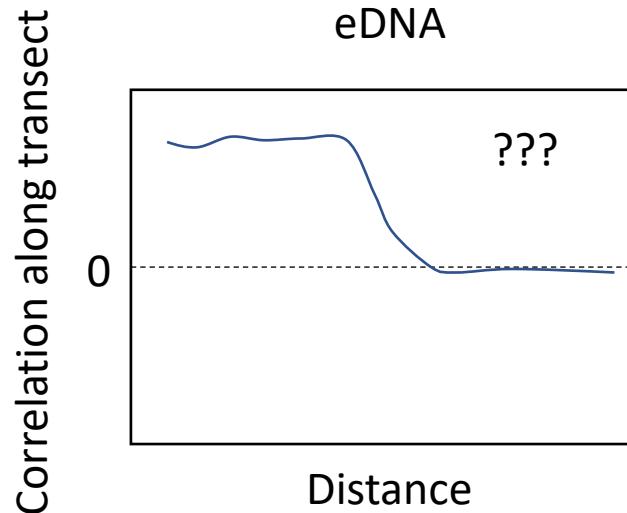
GET STARTED:

- To view the current conditions at a station, click a circle on the map
- You can also filter stations for a specific area of the Northeast by clicking the **Regions** dropdown menu located in the upper right-hand corner of the page
- Use the "Observations" tab to view the most recent data for the station's available variables
- Select the "Forecasts" tab to view predicted conditions at the location



Products (more broadly)

- Identification of spatiotemporal coherence among marine biodiversity metrics
- Potential for animals to sample biodiversity for us
- What data products are meaningful and how can they be packaged and accessible?



Thank you!

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