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

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The Team!

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NERACOOS
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

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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 at each site.

UNH extracts, amplifies, and sequences the samples.

Bioinformatics and species identification follow.

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

“Average” Year (0.85 chicks/nest) 2019

“Bad” Year (0.33 chicks/nest) 2021

“Good” Year (0.96 chicks/nest) 2022

Seabirds need to move more in bad years, to catch low-quality prey
Advisory panel and boundary organization

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

Linas Kenter
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
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

Climate and Fisheries Data Dashboard

Providing tools stakeholders can use to better understand

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 Busy Map will be available for a limited time:
http://neracoos.org/realtime_map

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 "Predictions" tab to view predicted conditions at the location

Gulf of Maine Research Institute
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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