



GMRI Research Overview

U.S. NE Atlantic Biological Observations Workshop

NERACOOS

ATN-MBON-OTN

Graham Sherwood

May 7, 2019

Durham, NH



**Gulf of Maine
Research Institute**

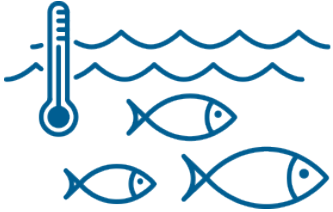
Science. Education. Community.

GMRI is a private non-profit research institute whose mission is to

Pioneer collaborative solutions to global ocean challenges

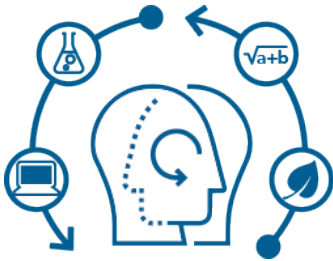


GMRI Core Commitments



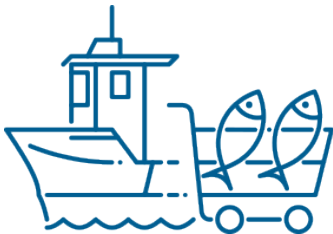
Science

Increase understanding of the Gulf of Maine ecosystem and economy through interdisciplinary, collaborative, and action-oriented research.



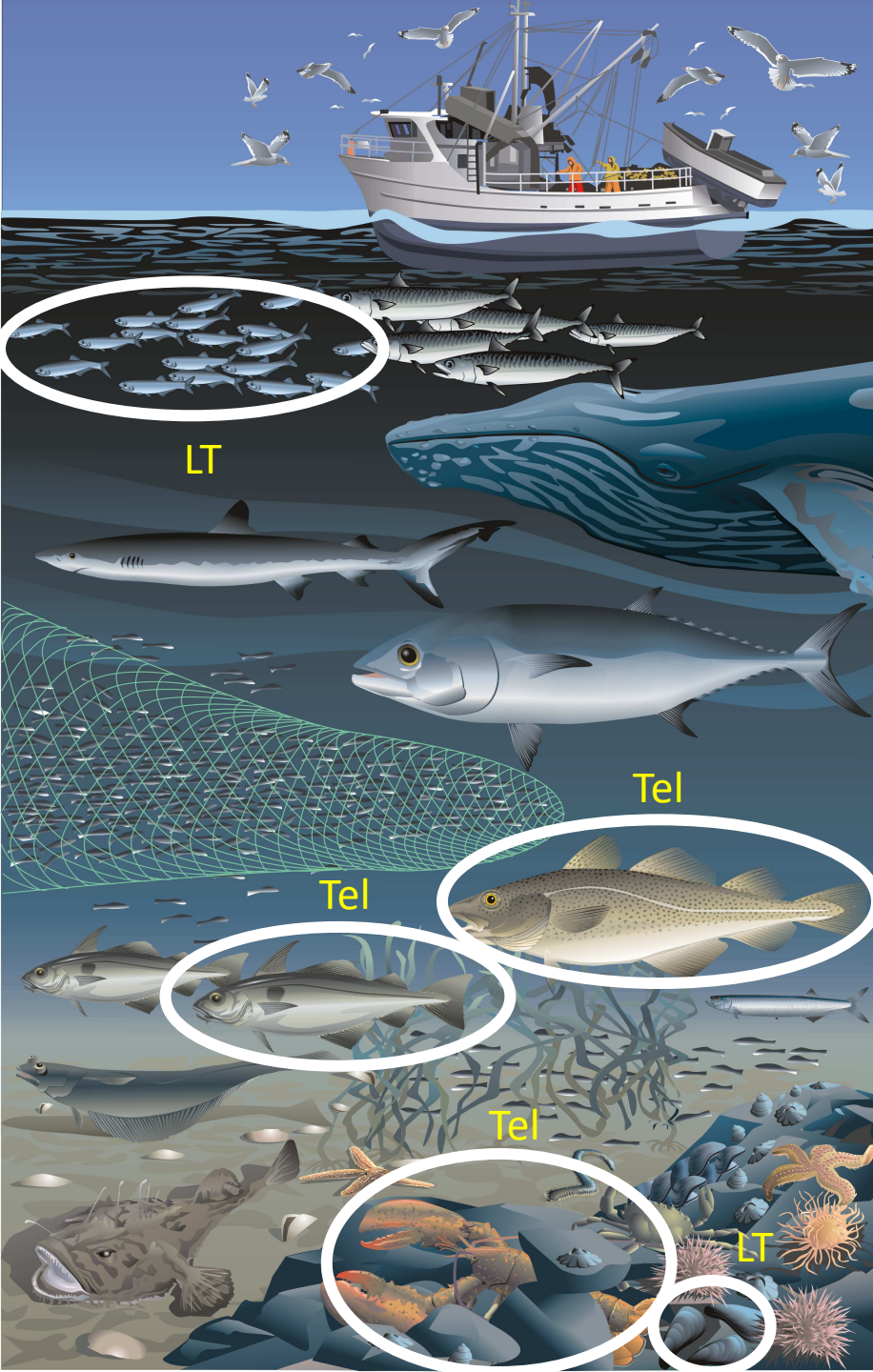
Education

Build Maine middle school students' critical thinking skills and understanding of the nature of science through participation in authentic science experiences.

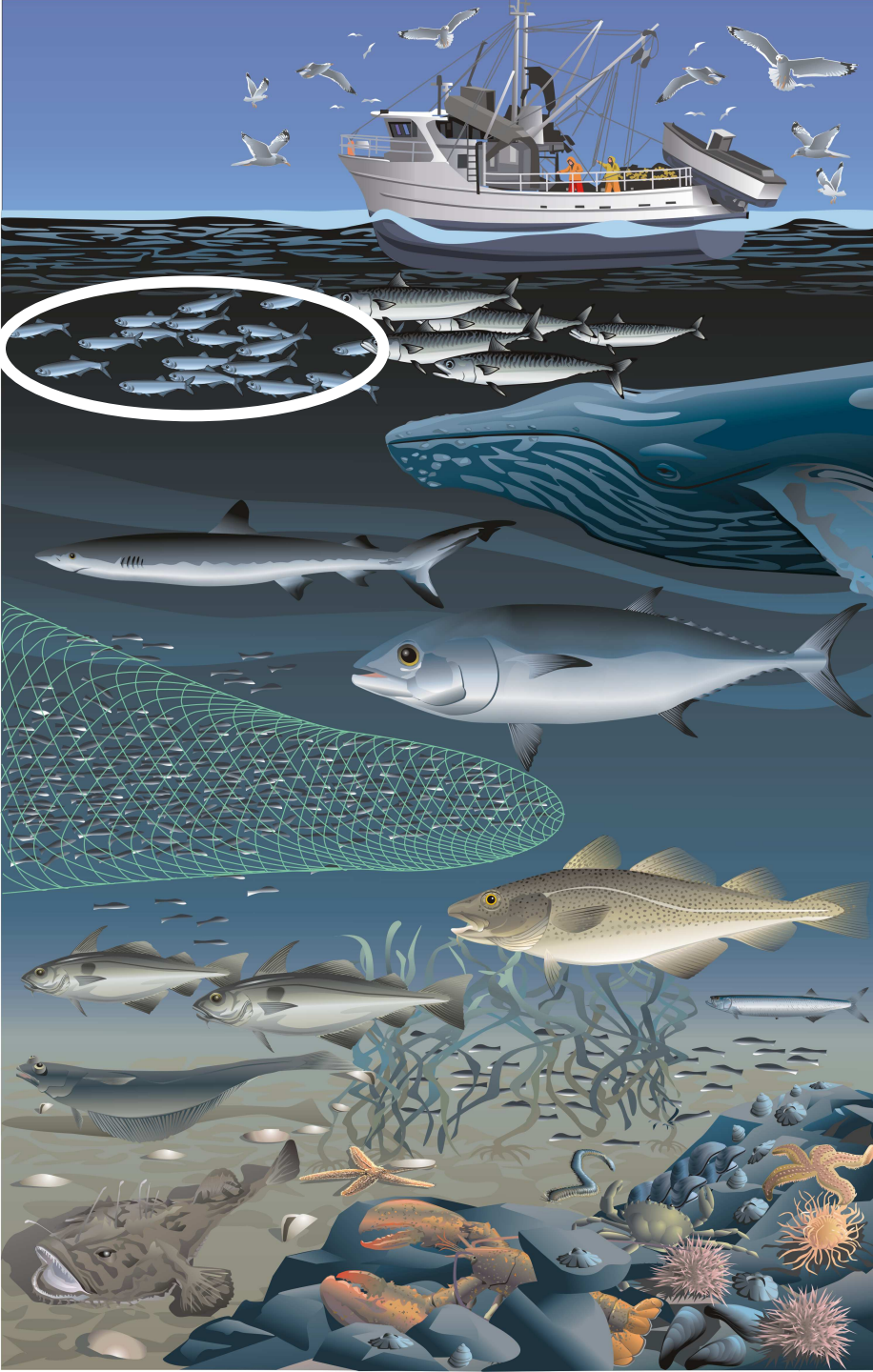


Community

Engage marine stakeholders to share knowledge, learn, and make decisions that nurture ecologic and economic resilience in the Gulf of Maine.



GMRI research scientists conduct a range of studies focusing on various aspects of the fishery ecosystem and interconnections between these and how these, in turn, may be impacted by changing ocean conditions.

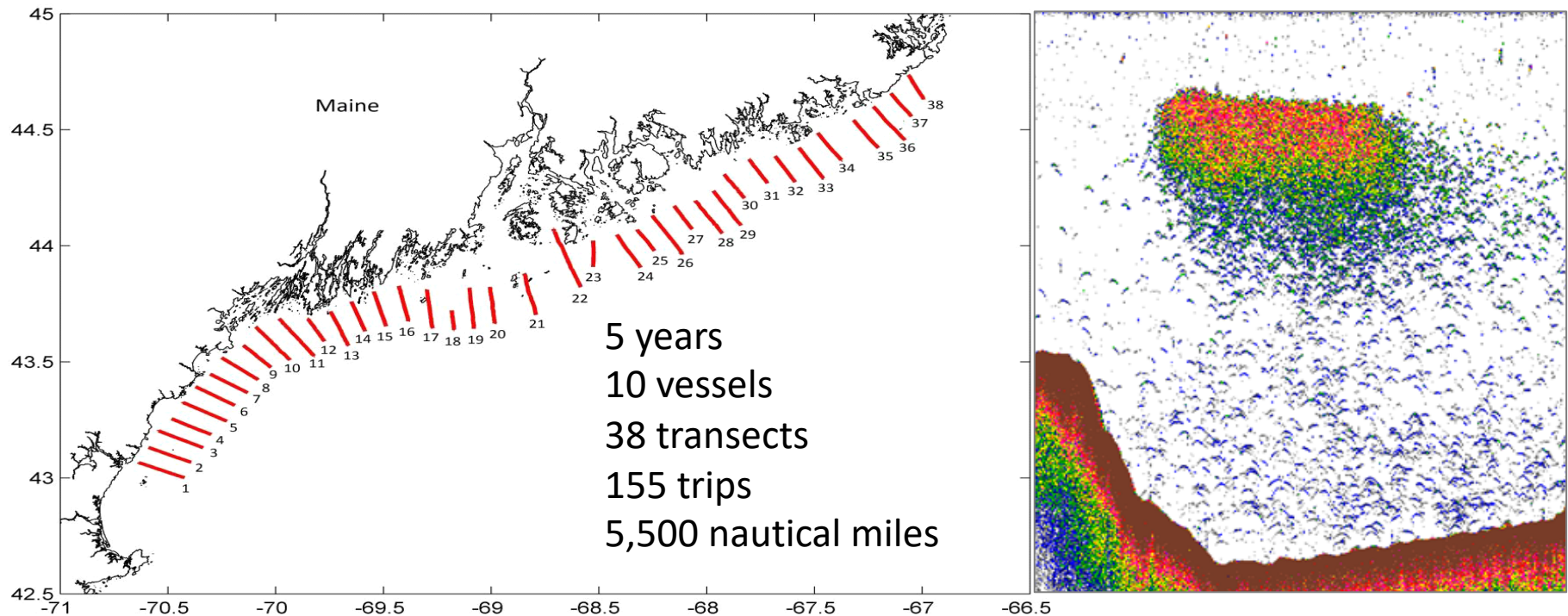


Herring

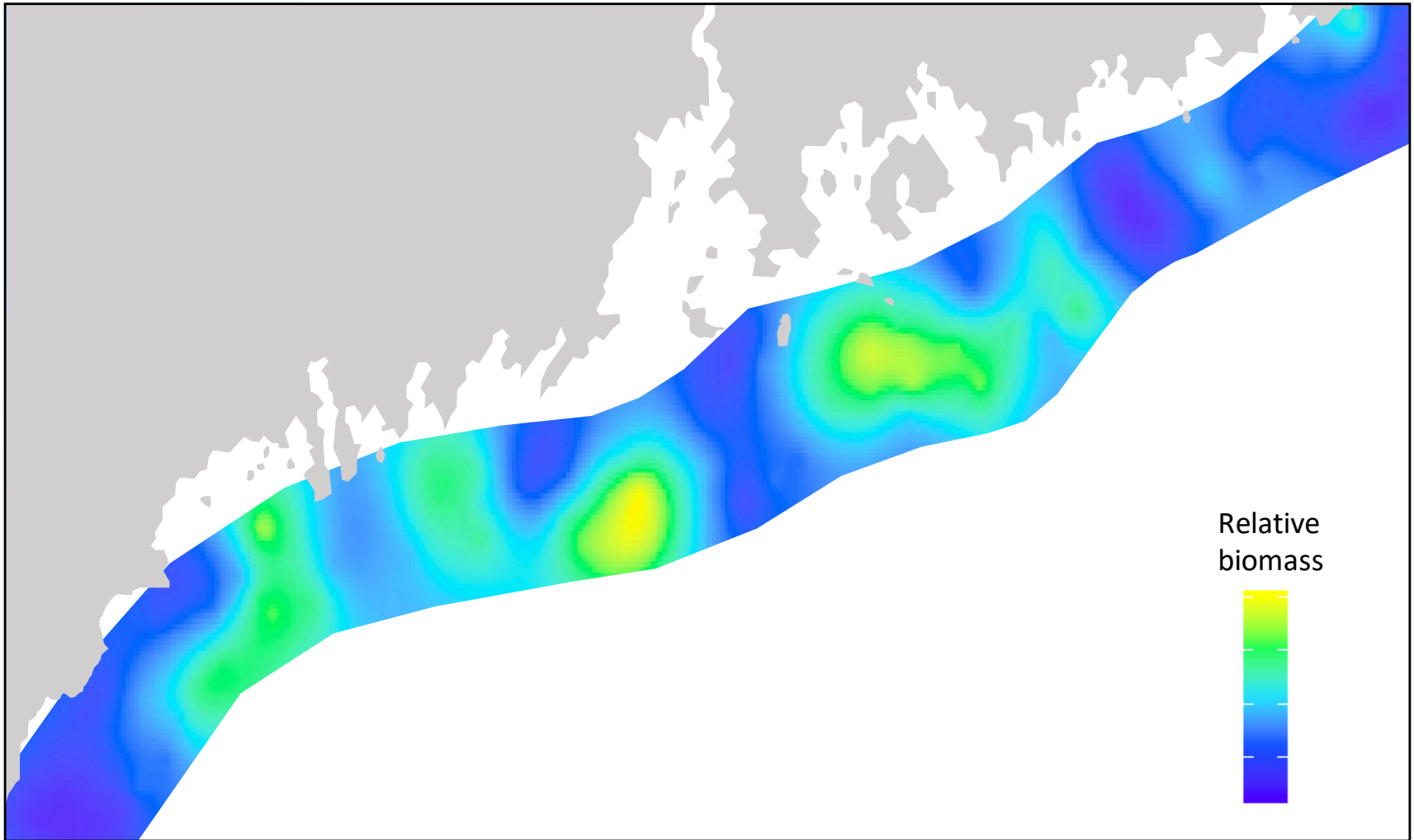
Maine inshore acoustic herring survey (2012-2016)

Purpose: provide an independent view of inshore herring resource to compare to whole stock

Approach: install echosounders on lobster vessels, survey repeatedly over same area over many years; describe spatial/temporal variability

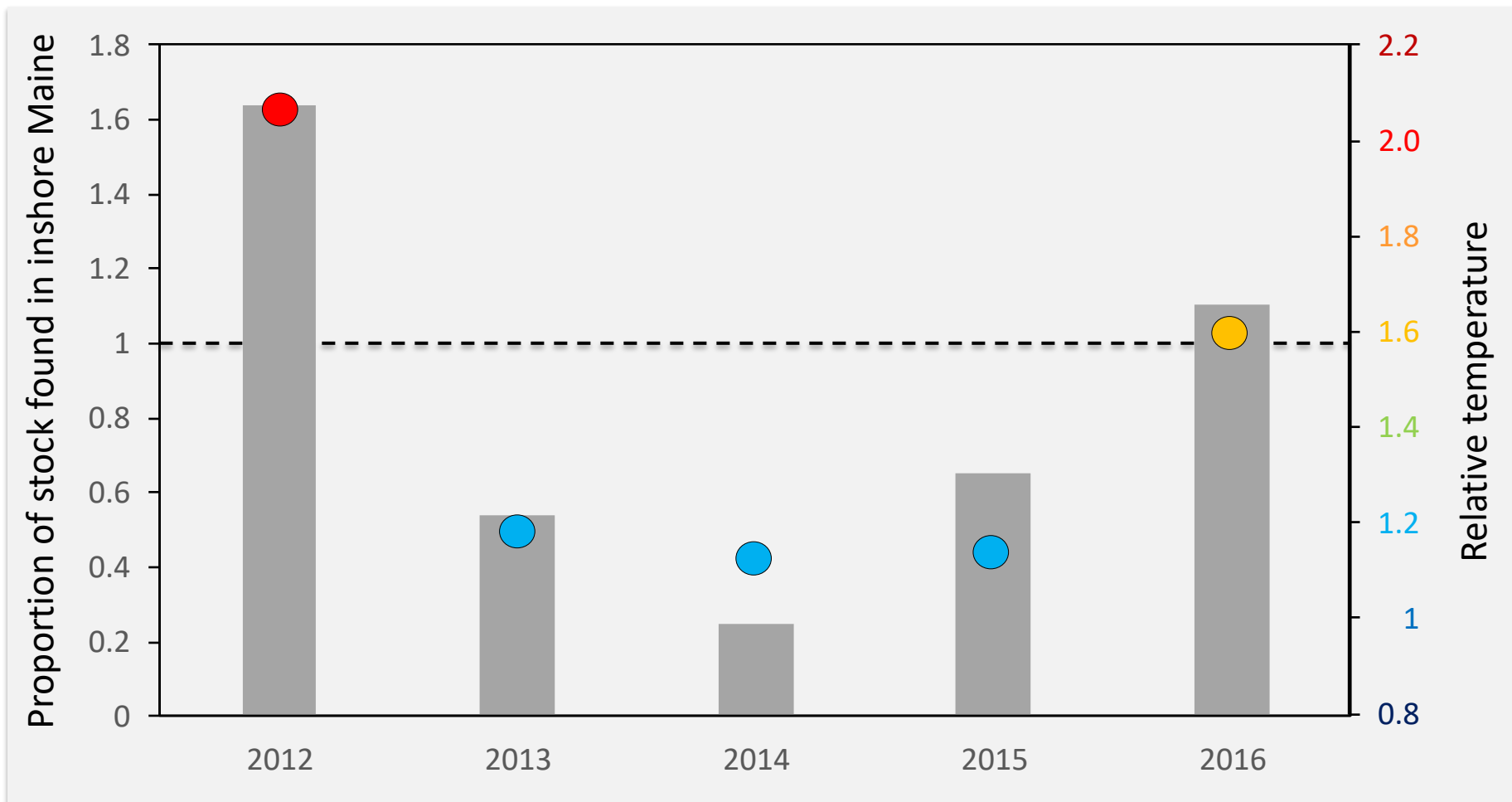


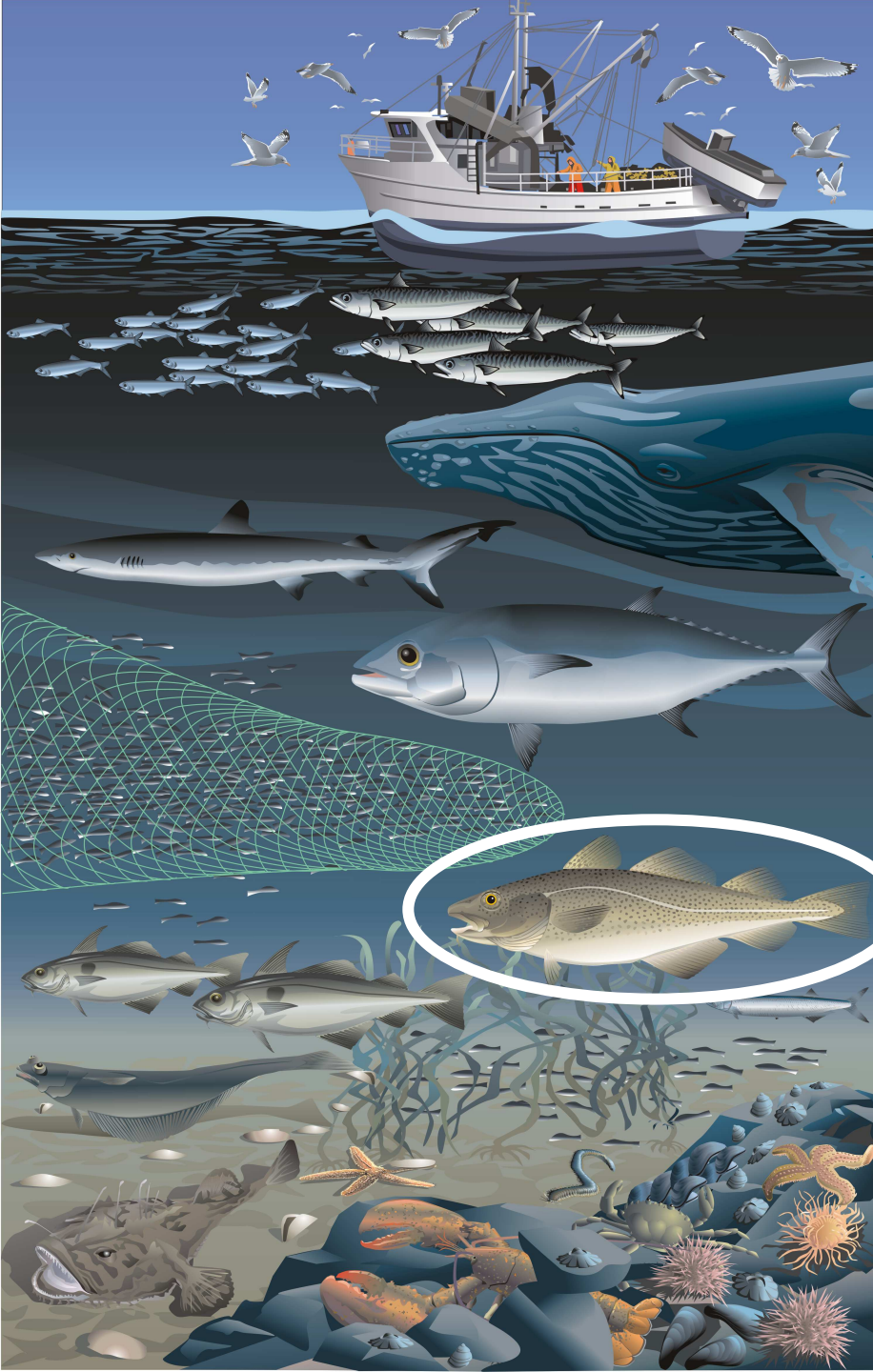
Spatial variability: 2012



Temporal variability: Interannual

All the herring come to inshore Maine during warmest years in the fall





Cod

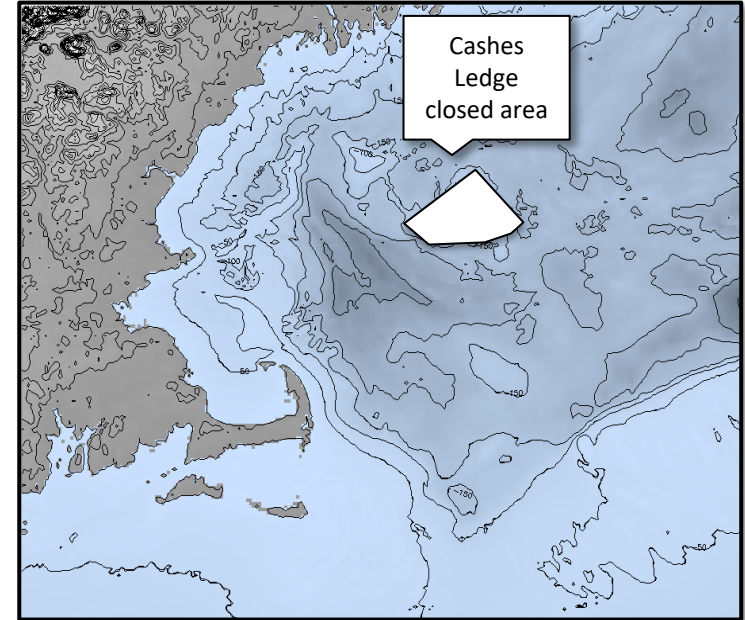
Acoustic telemetry to observe variable behavior in cod ecotypes

Question: Do different cod *ecotypes* display variable movement and residency behaviors?

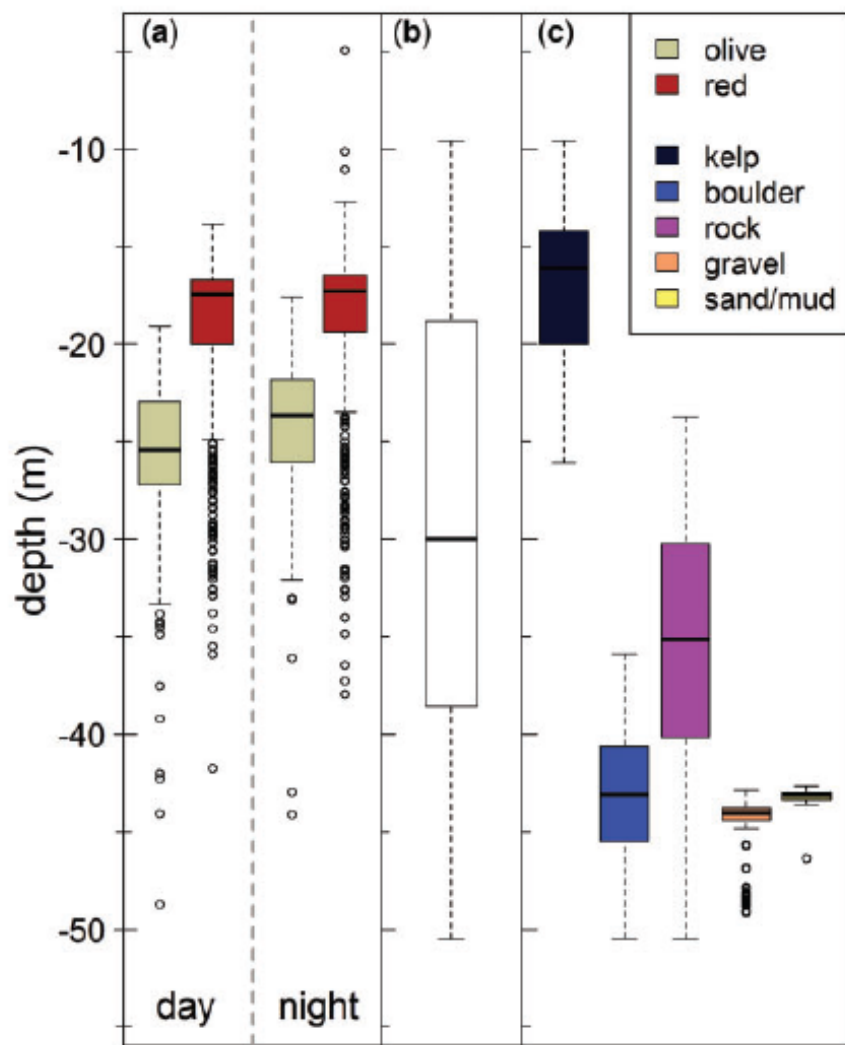
Approach: Deploy acoustic array at Cashes Ledge (central GOM); tag cod



Sherwood and Grabowski (2010)

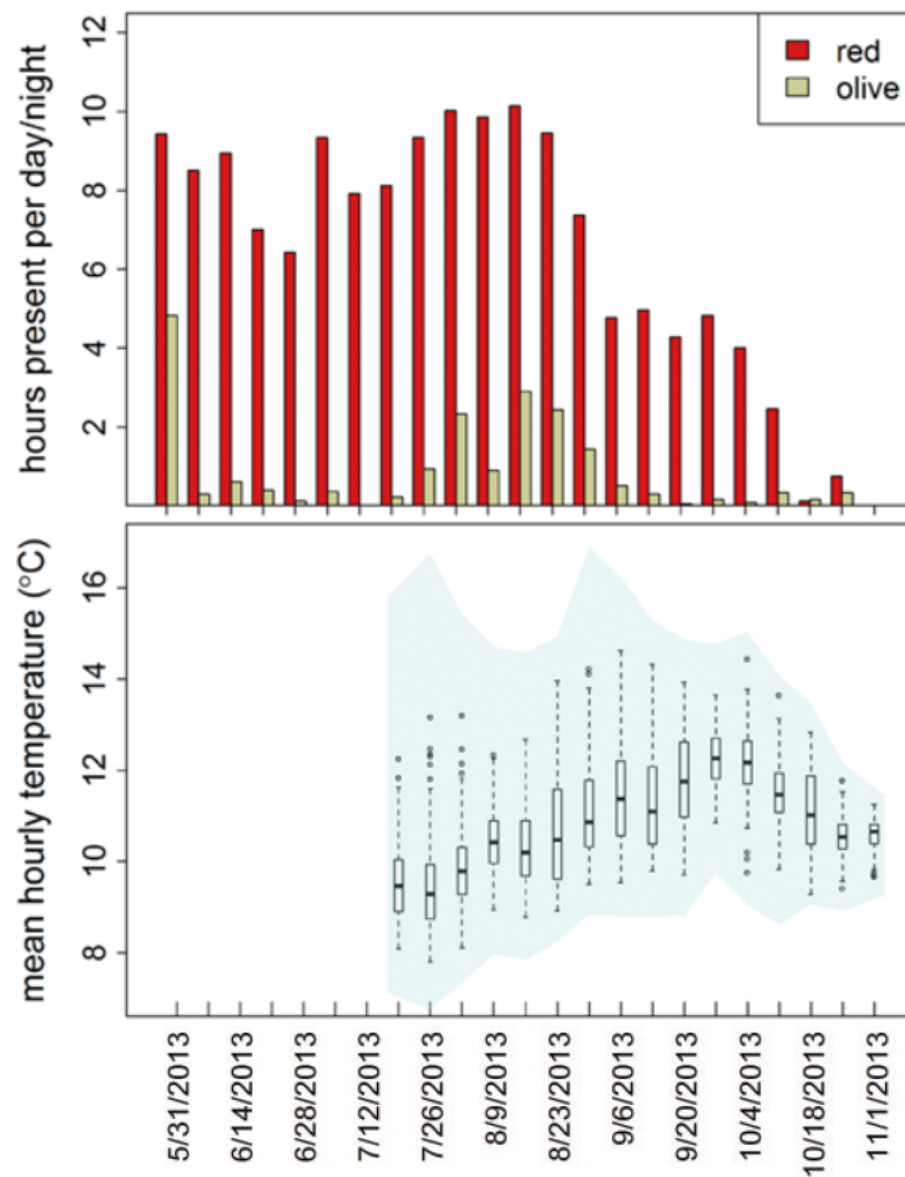


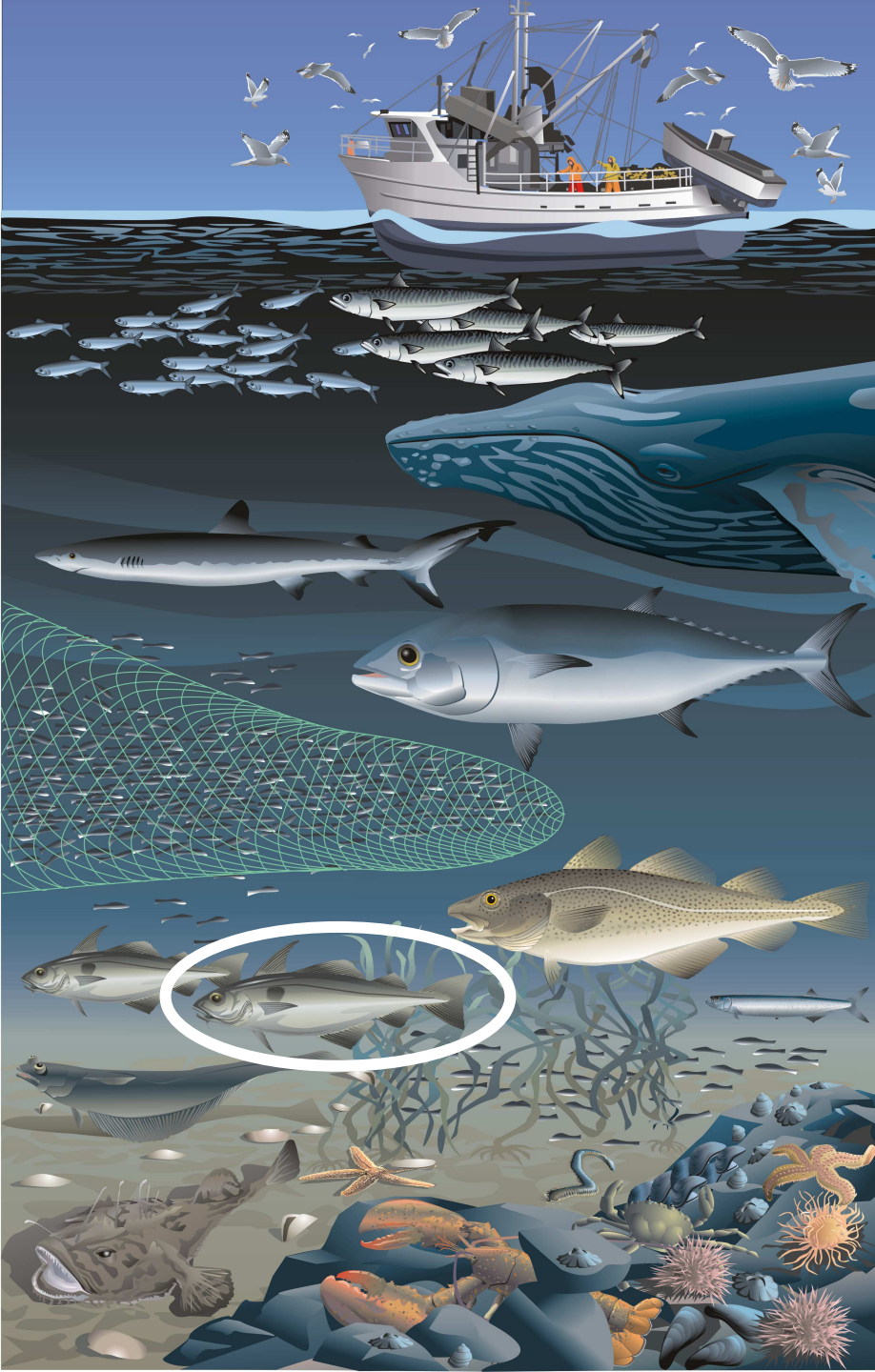
Red cod live shallower – in kelp



Conroy et al (2017)

Red cod are more warm tolerant



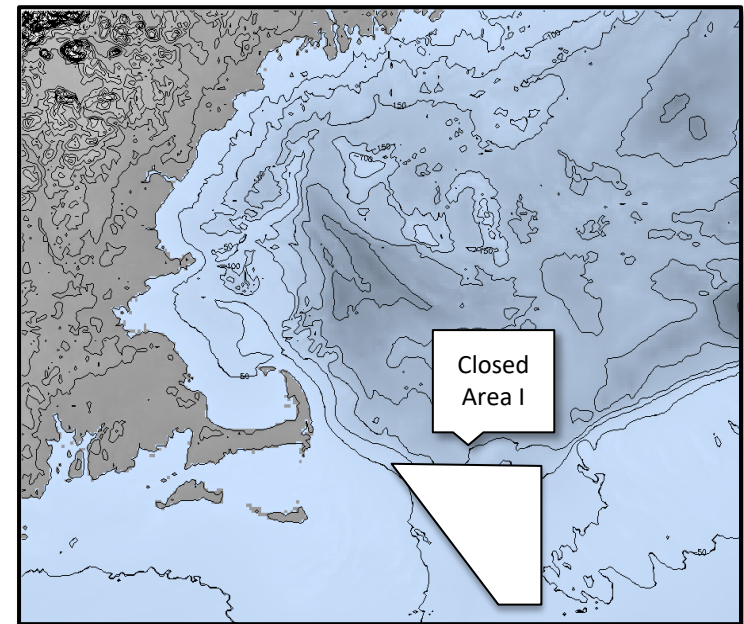
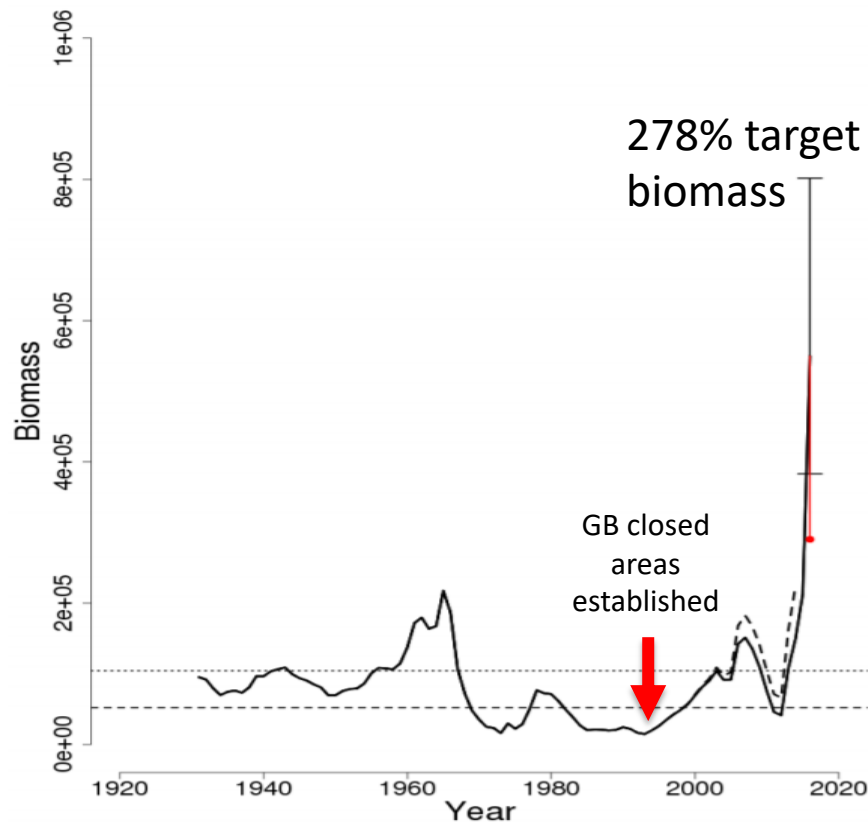


Haddock

Acoustic telemetry to observe haddock use of offshore closed area

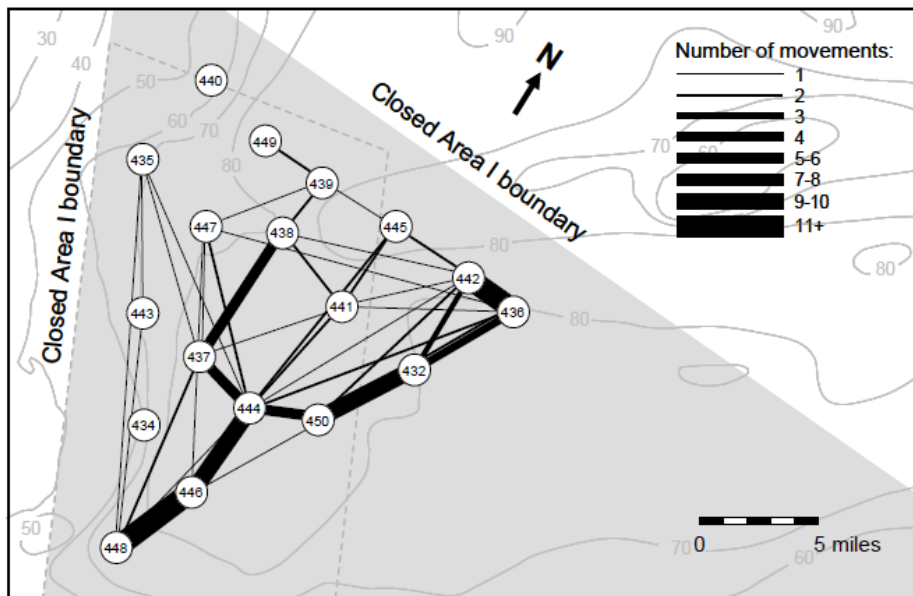
Question: What role did closed areas play in resurgence of haddock? Are haddock resident to closed areas?

Approach: Deploy acoustic array in closed area I; tag haddock



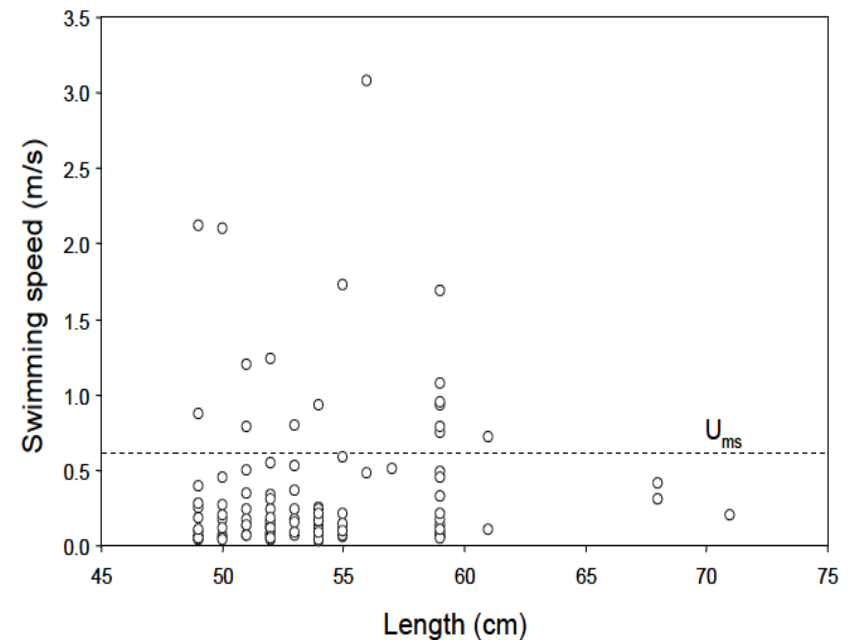
- Roughly one third of haddock (out of 80 tagged) were highly resident
- They also appear to be smart!

Haddock know where the boundary is?



Sherwood 2009

Haddock use tidal transport?





Lobster

Acoustic telemetry to observe lobster predator avoidance behavior

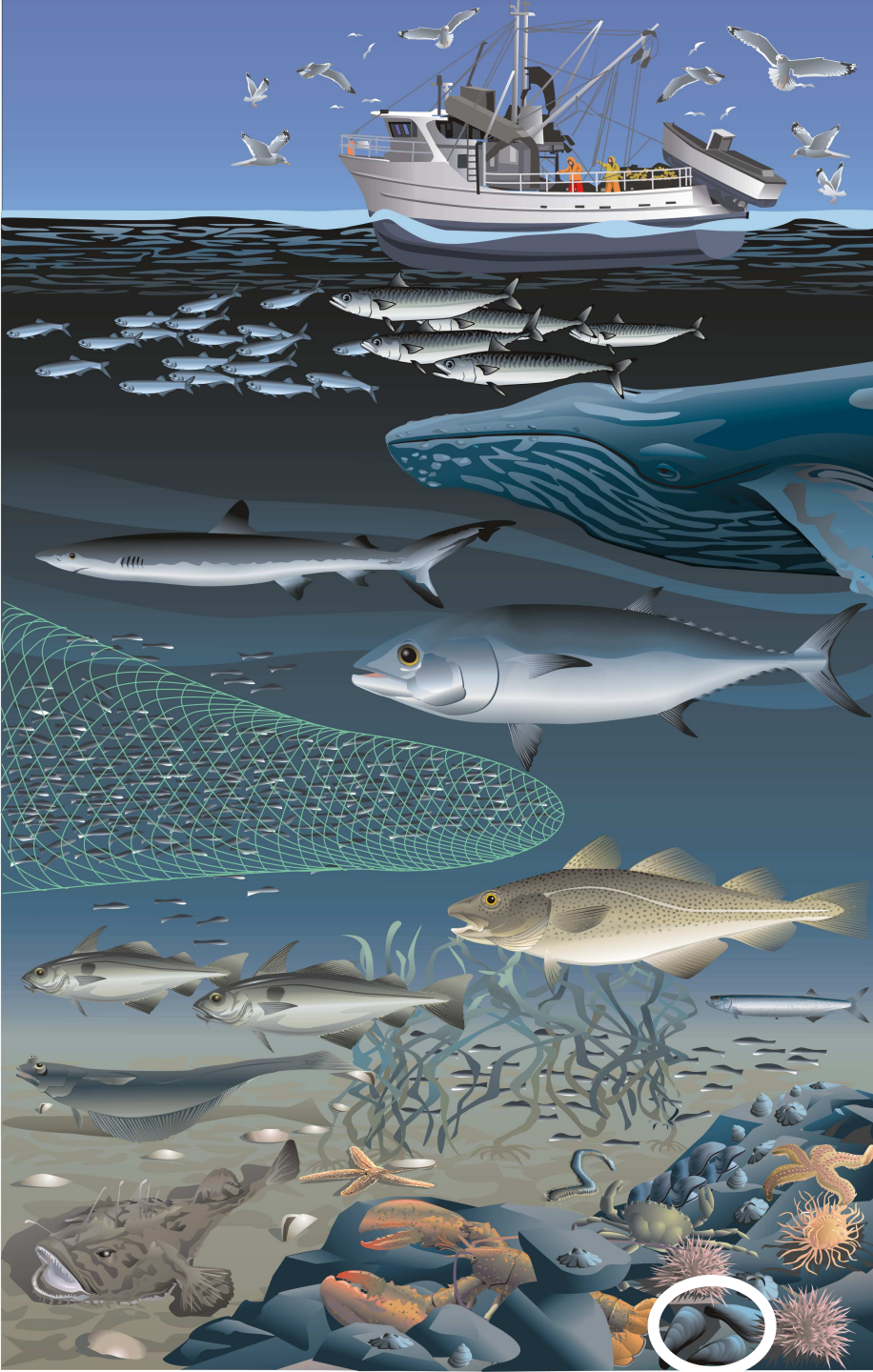
Question: Do lobsters modify their behavior (sheltering, foraging) in presence of predators like cod?

Approach: Deploy acoustic positioning array in a semi-enclosed bay without predators; establish “baseline” lobster behavior; add cod...





McMahan et al (2013)



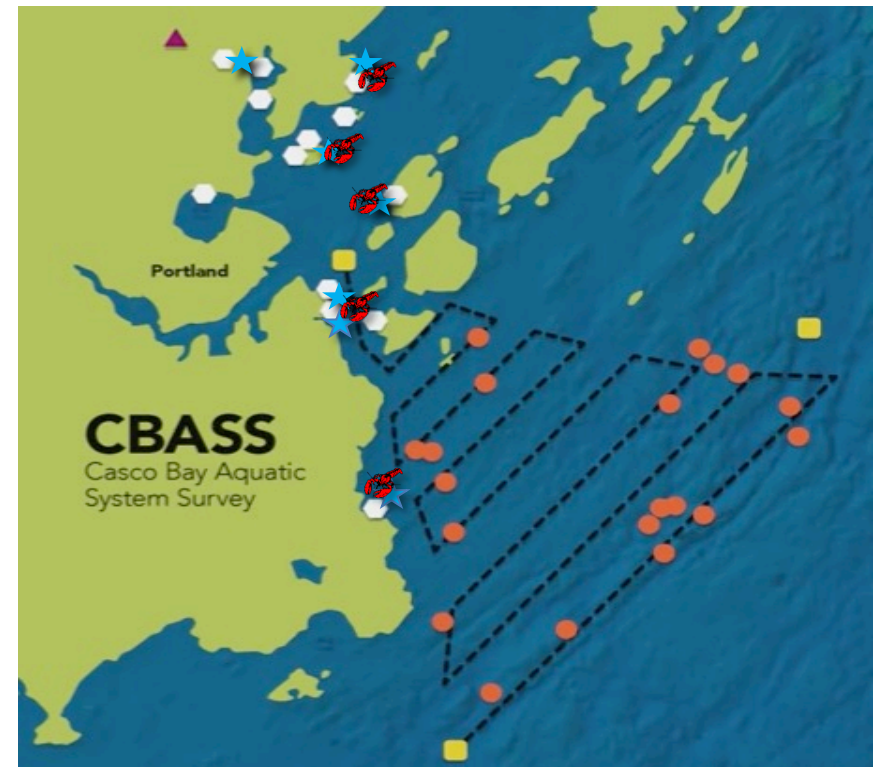
Mussels

Blue mussel $\delta^{15}\text{N}$ to trace human nitrogen influences in Casco bay

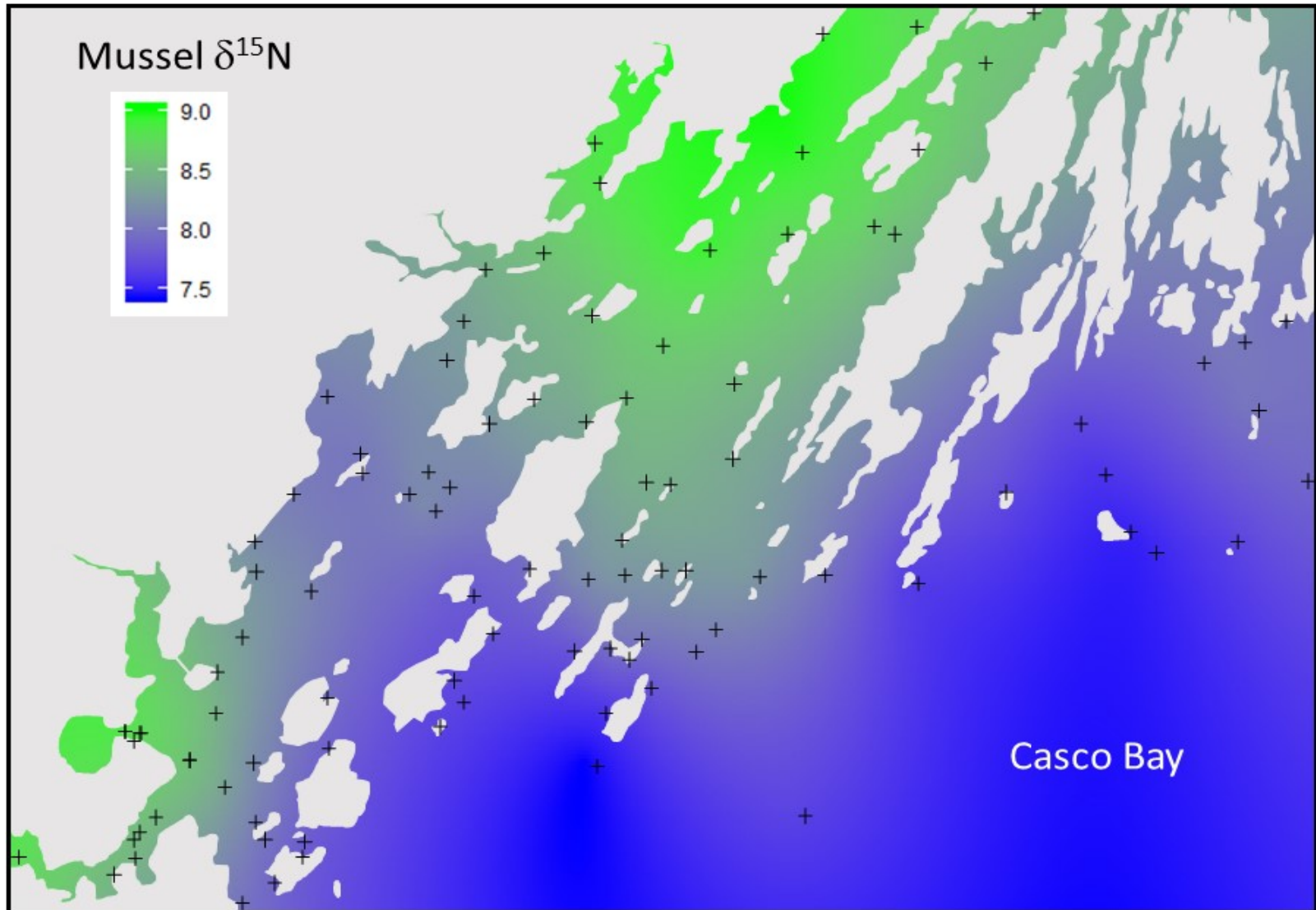
Purpose: Use mussels to provide a time-integrated depiction of nitrogen loading to a coastal marine ecosystem

Approach: Sample mussels from a variety of locations throughout bay; analyze tissue $\delta^{15}\text{N}$ which is higher in human sources than natural sources

Part of a larger coastal ecosystem monitoring program at GMRI ongoing since 2014 – the Casco Bay Aquatic System Survey (CBASS)



Portland has a predictable effect on mussel $\delta^{15}\text{N}$; elevated $\delta^{15}\text{N}$ in eastern portion of bay may be related to runoff and circulation patterns.



GMRI is engaged in fisheries ecosystem research that helps identify variations in movement patterns and distribution of fish that may be responding to changes in ocean conditions (e.g., warming) and food-web structure (e.g., predator loss/addition).

Telemetry has played a role in these studies, but we have not found a way to incorporate telemetry into longer-term monitoring (cost).

The challenge for longer-term work is funding. CBASS has the greatest potential to add value to regional monitoring efforts.