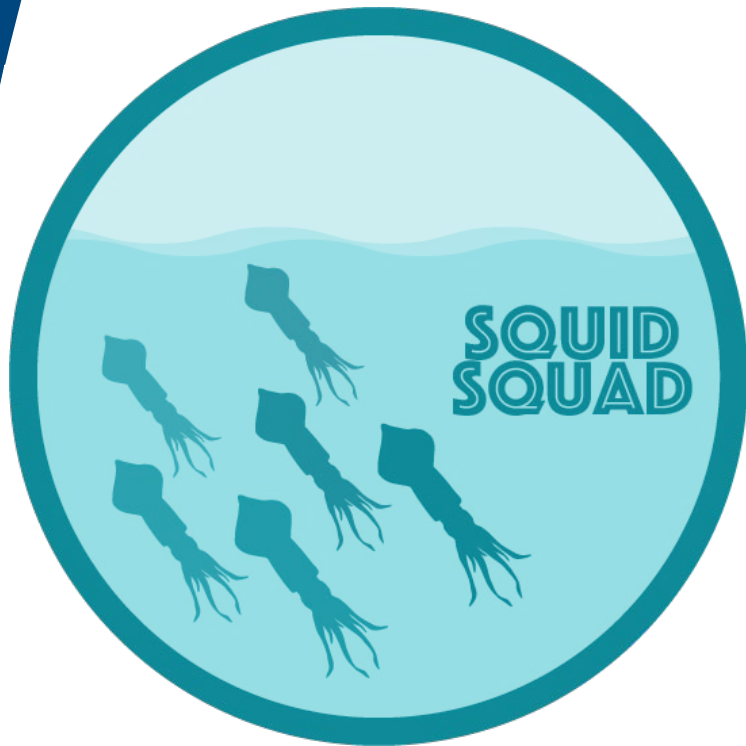




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SQUID SQUAD: Using a collaborative framework to identify oceanographic indicators of *Illex illecebrosus*

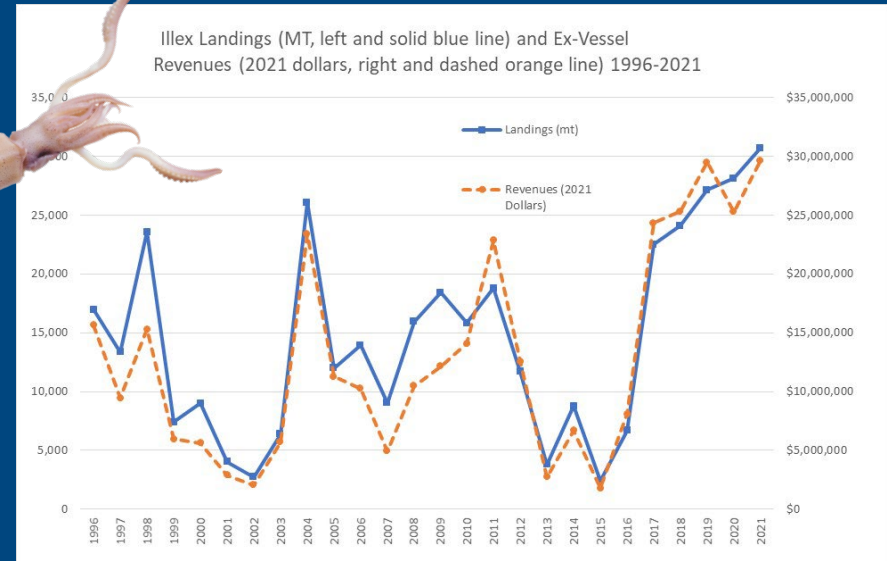
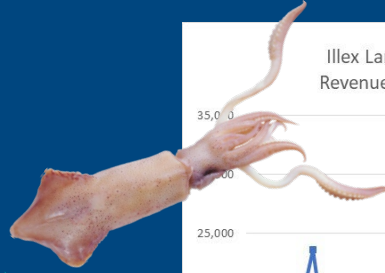
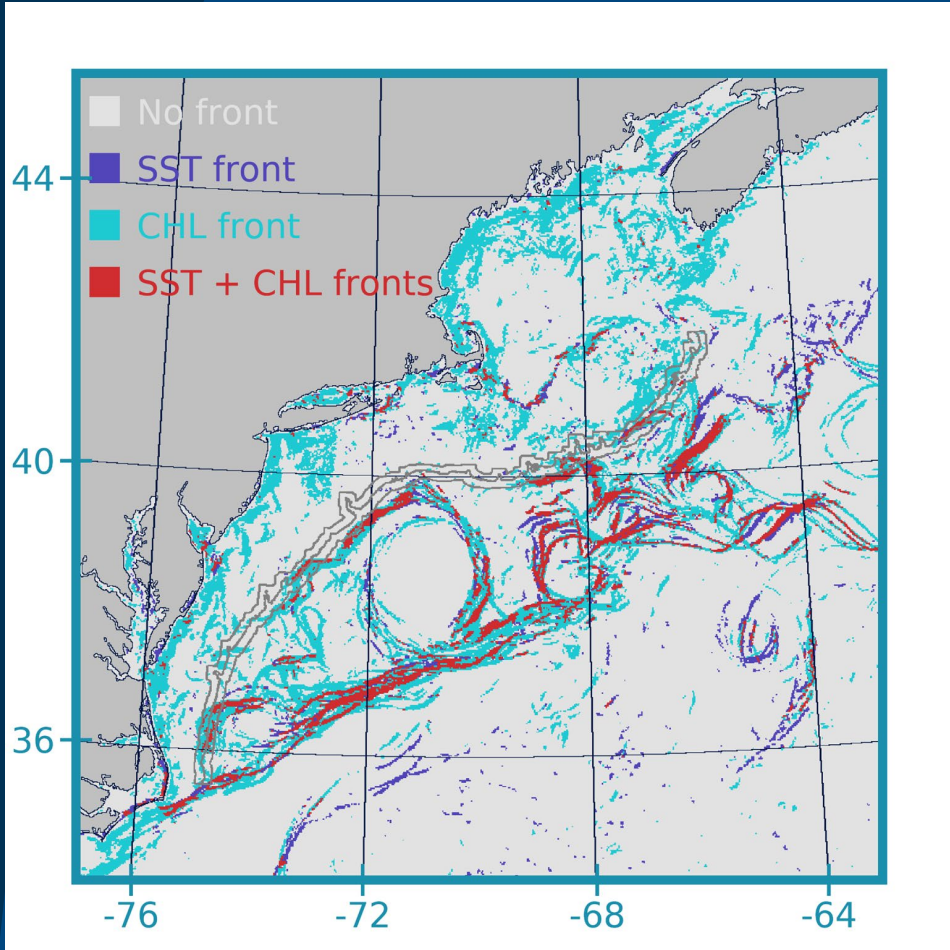
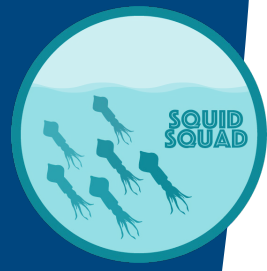


Kimberly Hyde, Anna Mercer,
Sarah Salois

Northeast Fisheries Science Center | NOAA Fisheries
SMASST | University of Massachusetts Dartmouth

Northeast Cooperative Research Summit 2023

How it started

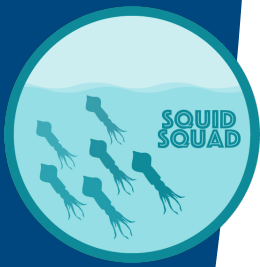


Are there oceanographic drivers that can help explain the variability in *Illex* catch?



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Background



2019 *Illex* Summit: Identified research needs, initiated research partnerships

Ecology: Many aspects of *Illex* habitat and population ecology are uncertain

Oceanography: Changes in the Northwest Atlantic ocean dynamics

Data Availability: There is limited survey data and sampling of their Slope Sea habitat



Summary report Northern shortfin squid (*Illex illecebrosus*) population ecology & the fishery Summit, November 25-26, 2019
Wakefield, Rhode Island



Photo Credit: www.CGriffinVideo.com, CGriffinVideo@gmail.com

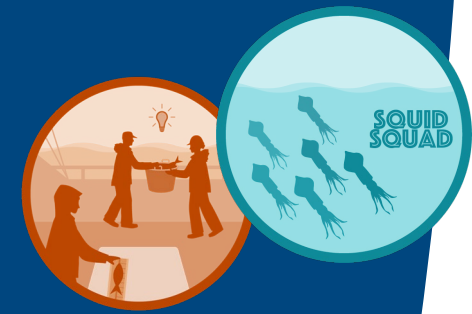
Hosted by the North East US Northern Shortfin Squid Fishery represented by Seafreeze Ltd., Lund's Fisheries, The Town Dock, F/V Jason and Danielle, F/V Retriever, F/V Dyrsten, F/V Prevail, F/V Darana R.

Sponsored by Seafreeze Ltd., Lund's Fisheries, The Town Dock, F/V Jason and Danielle, F/V Retriever, F/V Dyrsten, F/V Prevail, F/V Darana R., NOAA/Northeast Fisheries Science Center, Cooperative Research Program

Summit and report prepared for North East US Northern Shortfin Squid Fishery by
John Piling Manderson PHD
Open Ocean Research
Suite 101
40 West Evergreen Avenue
Philadelphia PA 19118
Email: john.manderson@openoceanresearch.com
Website: <https://www.openoceanresearch.com>

This document can be found at the following link:
https://www.dropbox.com/s/4tdw7cz8jy372nd/SummaryOfTheNorthernShortfinSquidPopulationEcologyAndFisherySummit_Nov2019_03032020.pdf?dl=0

The Experts



The Squid Squad is a highly interdisciplinary group with a common interest - **to improve squid science!**

Government: Kimberly Hyde, Anna Mercer, Sarah Salois, Sarah Gaichas, Thomas Swiader, Andrew Jones, Sarah Turner, Benjamin Galuardi, Daniel Hocking, Paula Fratantoni, Brooke Lowman, Carly Bari

Academia: Adrienne Silver, Avijit Gangopadhyay, Glen Gawarkiewicz, Steve Lorenz

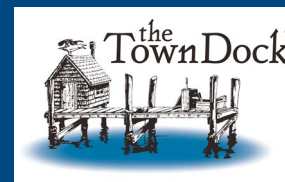
Industry: John Manderson, Katie Almeida, Bill Bright, Greg DiDomenico, Jeff Kaelin, Meghan Lapp, Jimmy Ruhle, Steve Axelsson, Leif Axelsson

Management: Paul Rago

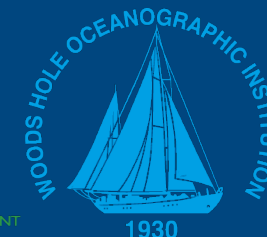
F/V Dyrsten

F/V Defiance

F/V Retriever

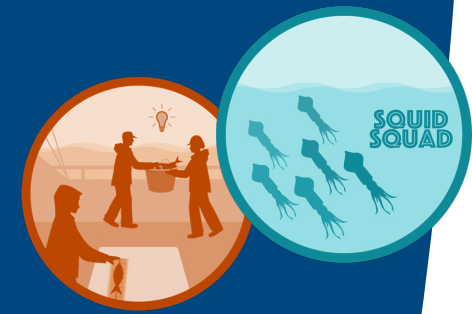


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Research**



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Why This Works



“Collaboration with like minded team members that are specialist in different fields...”

“Sharing knowledge, data and ideas”

“Many different voices & shared enthusiasm”

“Mutual respect & shared curiosity”

“An authentically productive and respectful engagement...”

“Bringing the right people together to explore ideas...”

“Open communication”

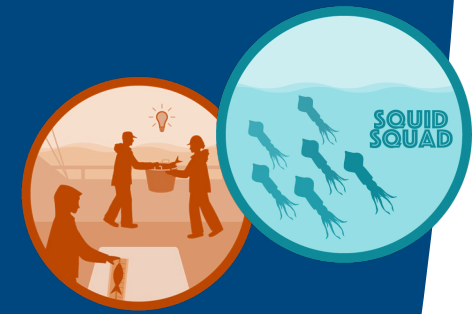
“Collaboration, inclusiveness, and an open dialogue”

“People asking real questions, conducting real collaboration, and a desire to learn...”



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Why This Works

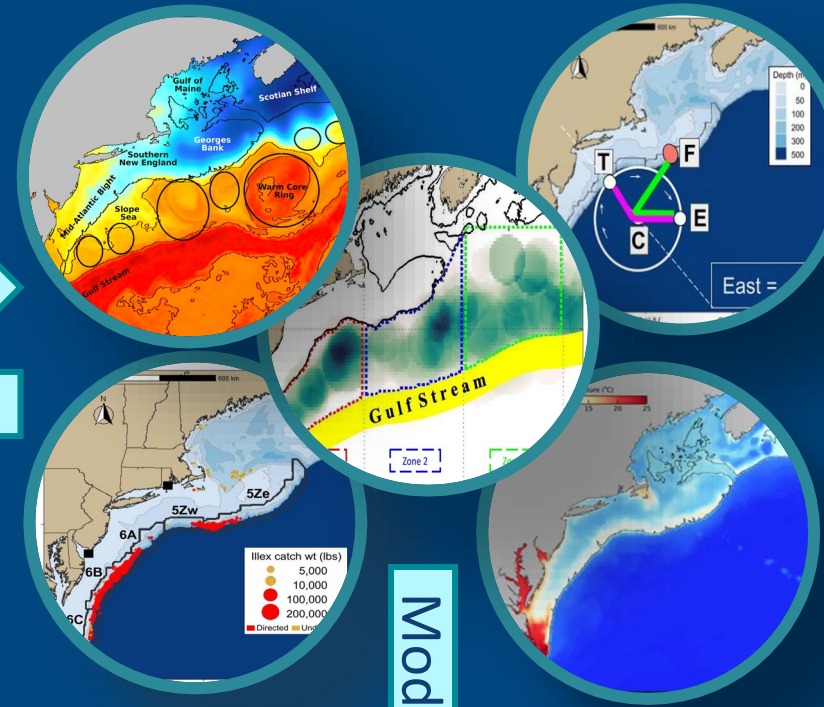
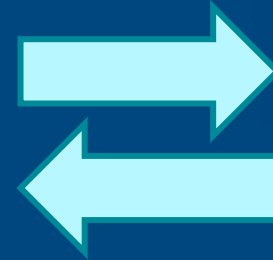
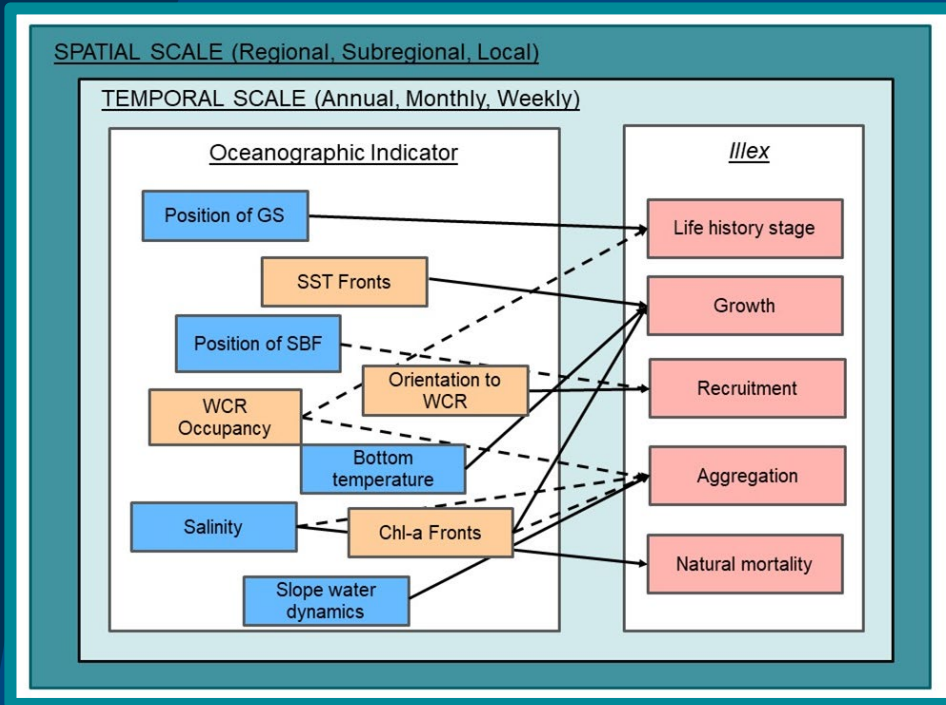


transparent
insightful like-minded collaborative-science
respect creative collaborative-assessment
collaborative sharing
cooperative compassion innovative fascinating productive
supportive industry-science data comprehensive
educational enthusiasm progressive
investigative real-time curiosity learning
rational exploratory thoughtful collaboration
inclusive courageous
synergistic understanding



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The Process

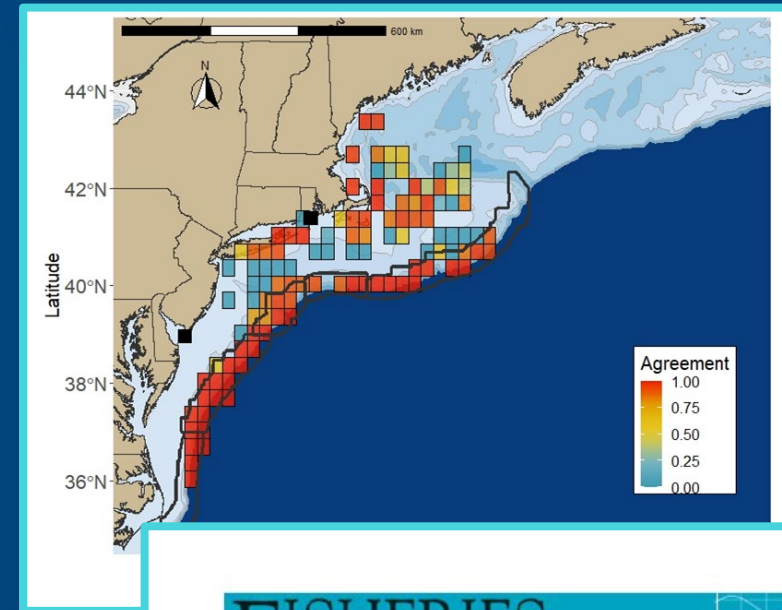
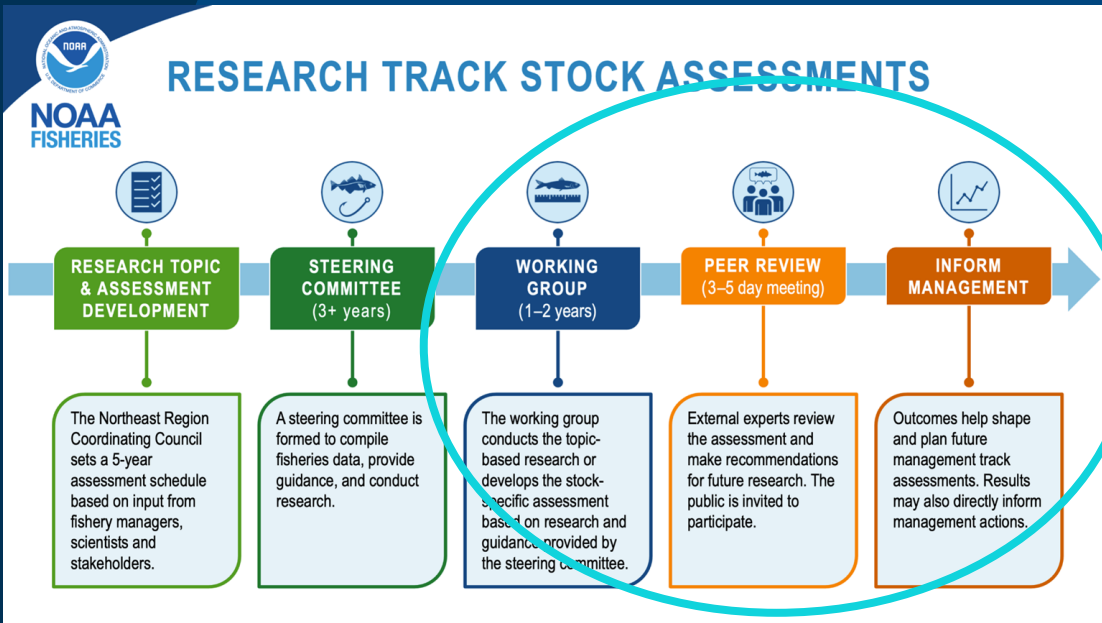


Model

Size of *Illex* catch is a function of a suite of temporal and spatial variables (e.g. date, bottom temperature, warm core ring orientation, chlorophyll fronts)



The Products



FISHERIES OCEANOGRAPHY

Shelf break exchange processes influence the availability of the Northern Shortfin Squid, *Illex illecebrosus*, in the Northwest Atlantic

“The COLLABORATION of different backgrounds coming together to try to piece together the puzzle of *Illex* production”

Visualization Tools



Weekly Indicators

Fishing season 2022

September

Week 36 (September 4 - September 10)

August

July

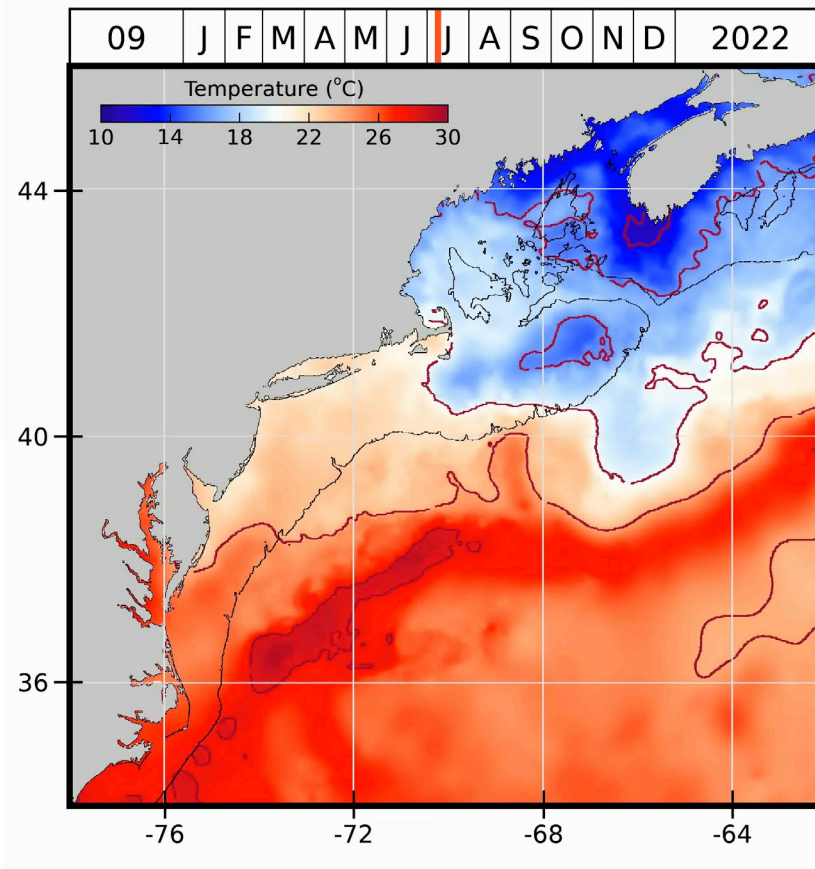
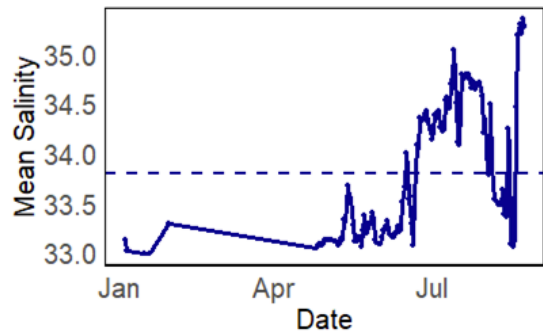
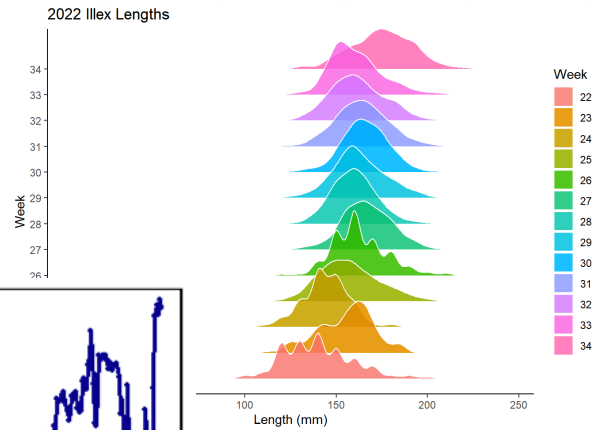
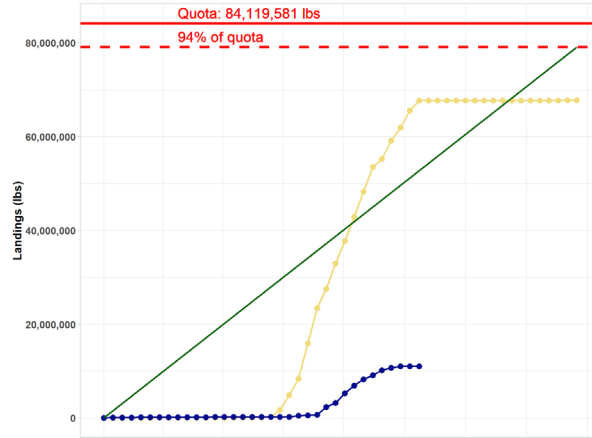
June

May

April

General Inforr

2021 Case St



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Visualization Tools

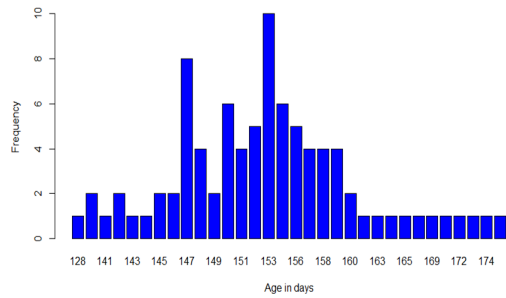


Shortfin Squid Electronic Size Monitoring

A collaboration between NOAA researchers and Industry partners to collect high frequency, region-wide, size and weight sampling of shortfin squid

[Histogram](#)
[Map](#)
[Highlighting Maps](#)
[Fleet dynamics](#)
[Relative Condition](#)
[Age at weight](#)

Estimating age at weight



Visualizing ILXSM data

Select times and locations of interest

Year:

GARFO Fisheries Statistical Areas:

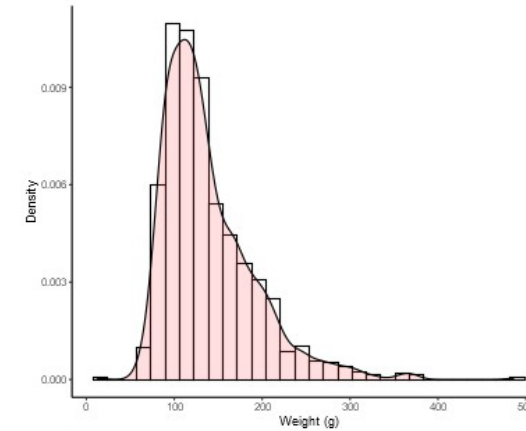
Week:

Shortfin Squid Electronic Size Monitoring

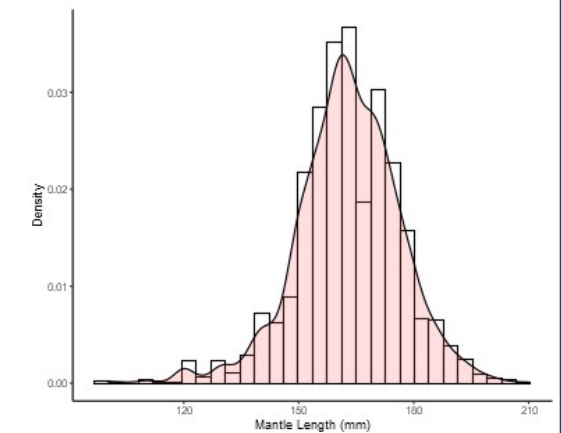
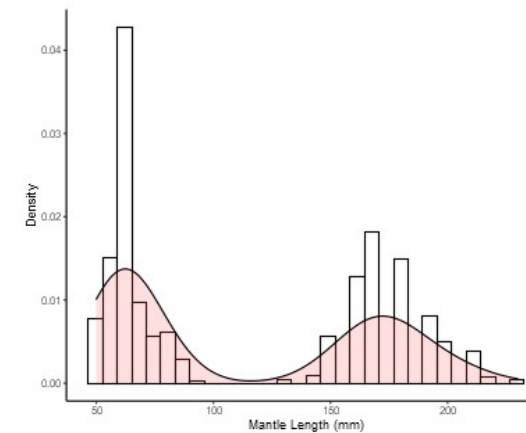
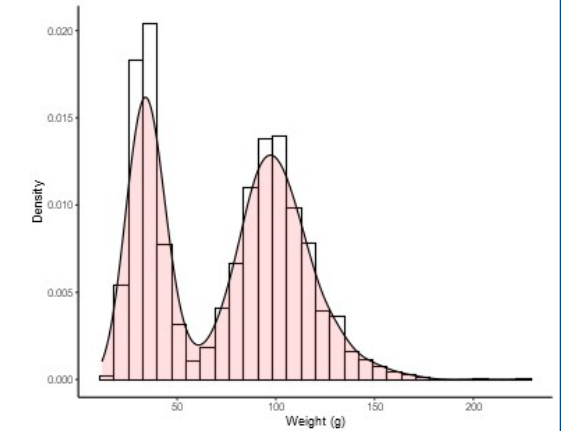
A collaboration between NOAA researchers and Industry partners to collect high frequency, region-wide, size and weight sampling

[Histogram](#)
[Map](#)
[Highlighting Maps](#)
[Fleet dynamics](#)
[Relative Condition](#)
[Age at weight](#)

2021



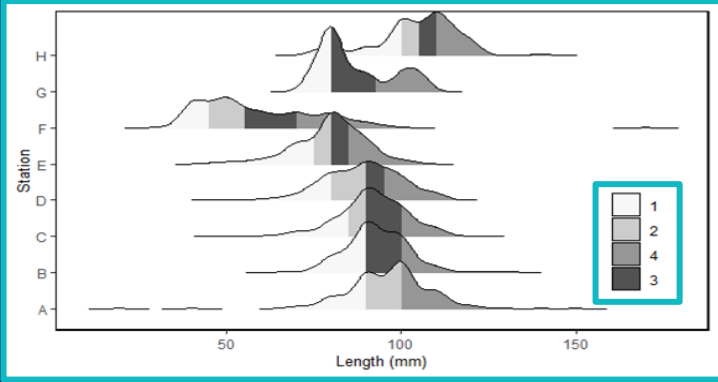
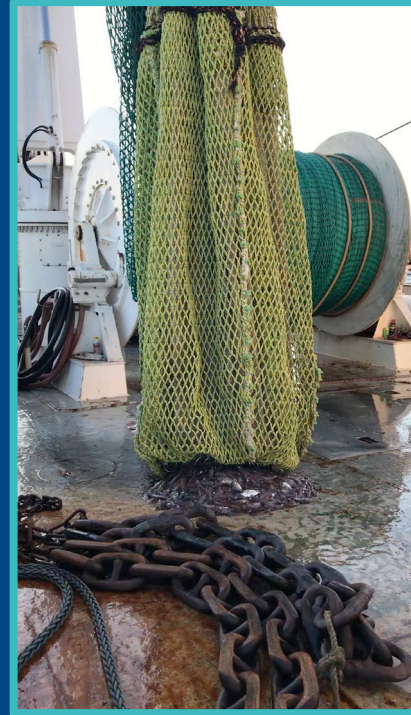
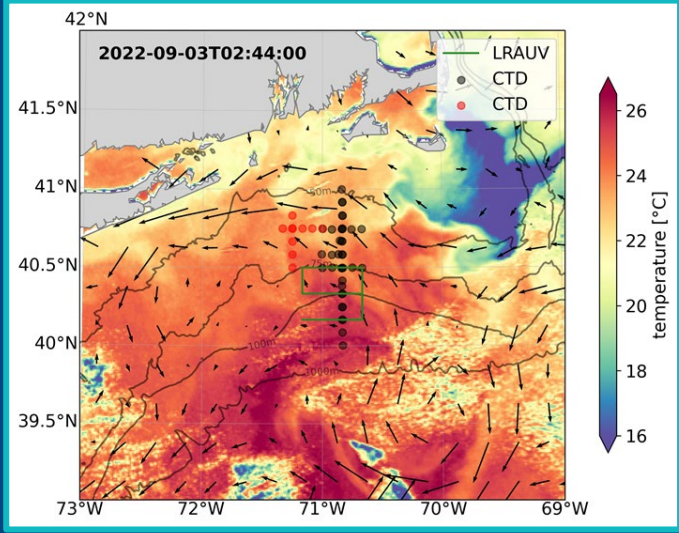
2022



Collaborations



<https://sirates.sites.umassd.edu/>



What's Next?



Data Collection: Collaborate with fishing vessels and academic researchers to simultaneously collect biological and physical data to test hypotheses.

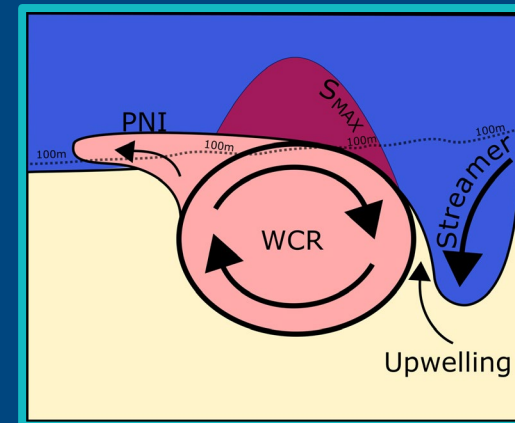
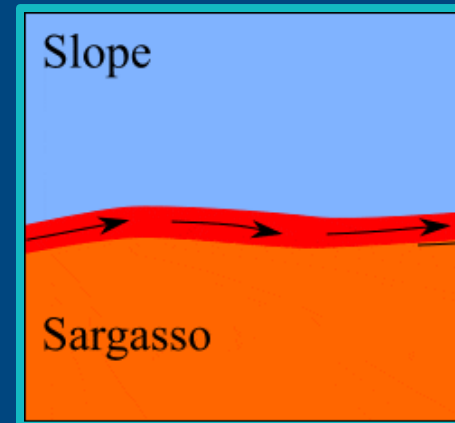
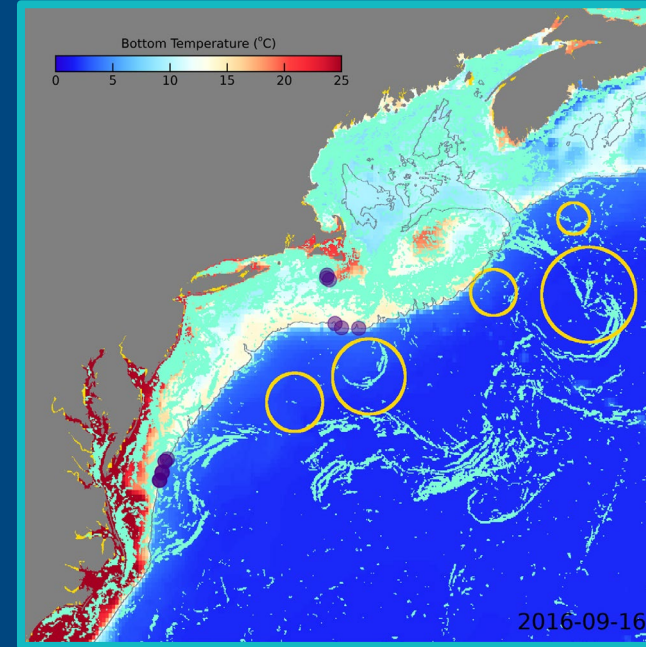
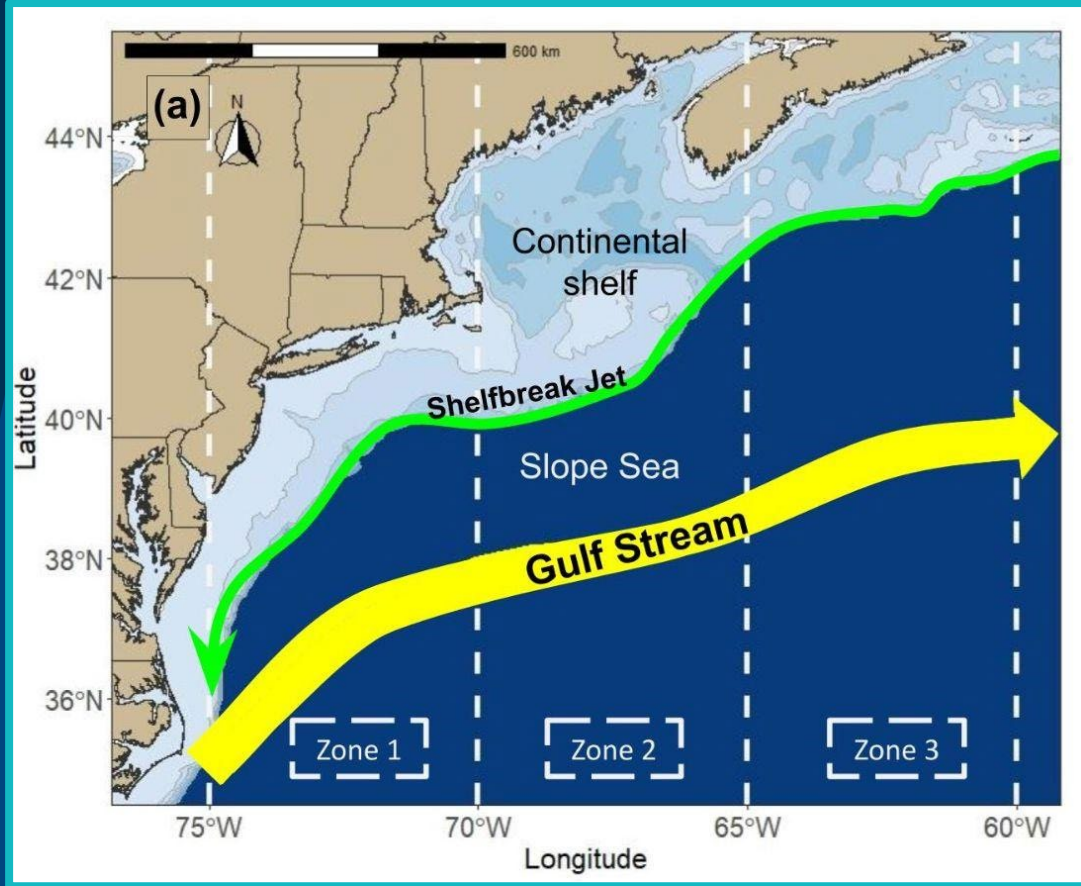
Prioritize Research Recommendations: Continue to investigate how the changing environment affects *Illex* availability and help refine best management practices.

Loligo: Compare and contrast the *Illex* and *Loligo* fisheries and consider more socioeconomic factors.

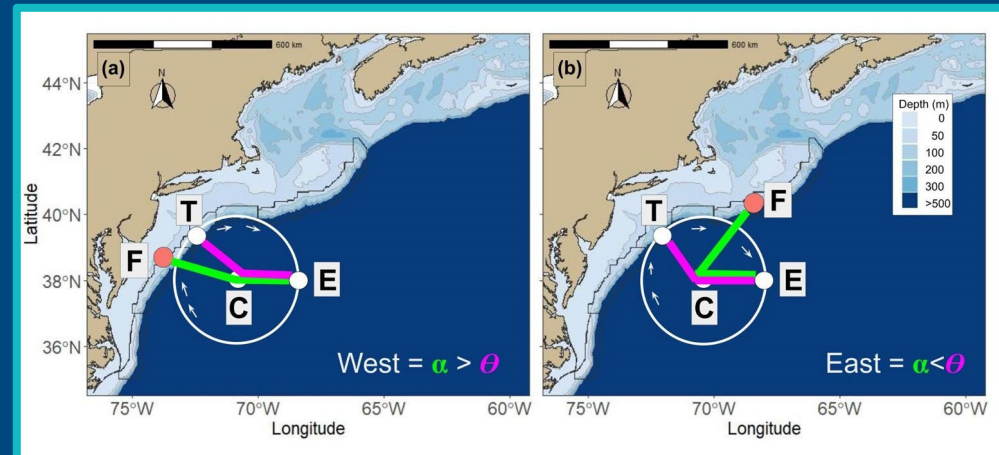
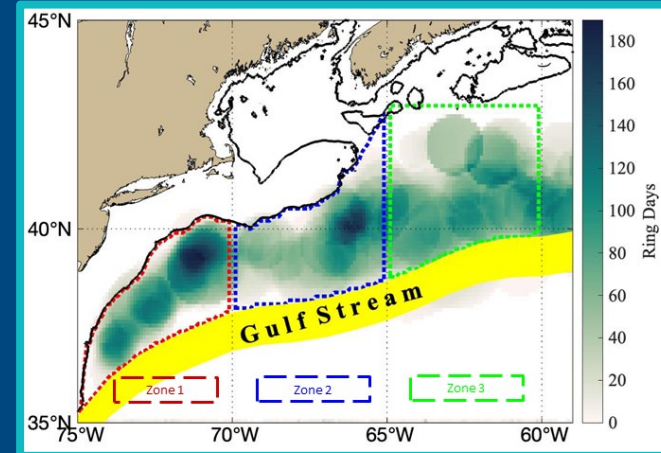
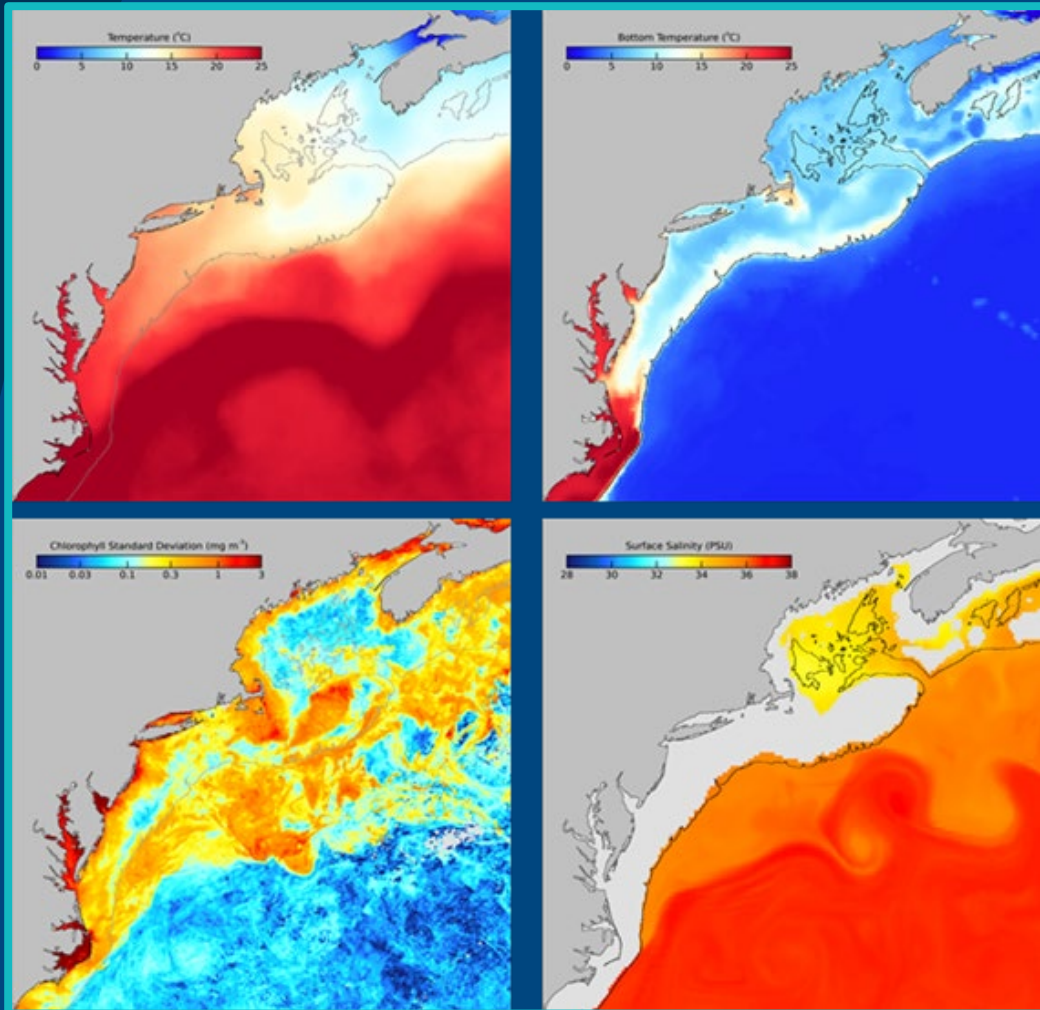


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Oceanography



Oceanography



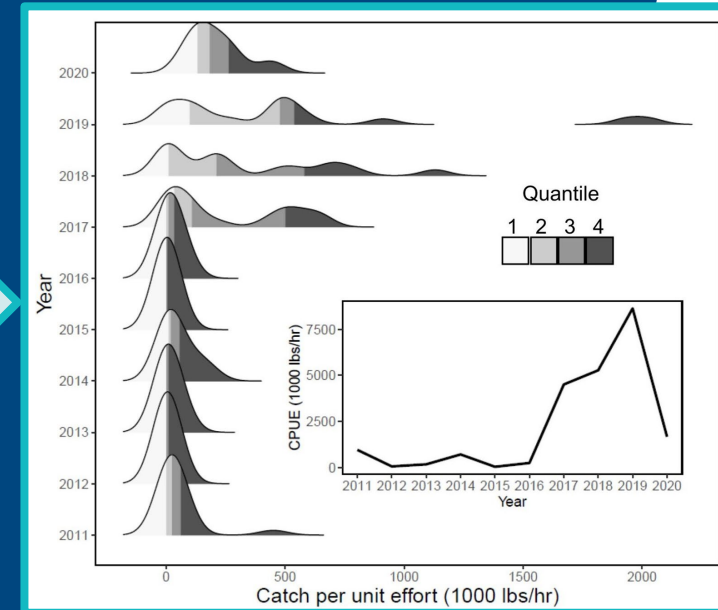
Research Results



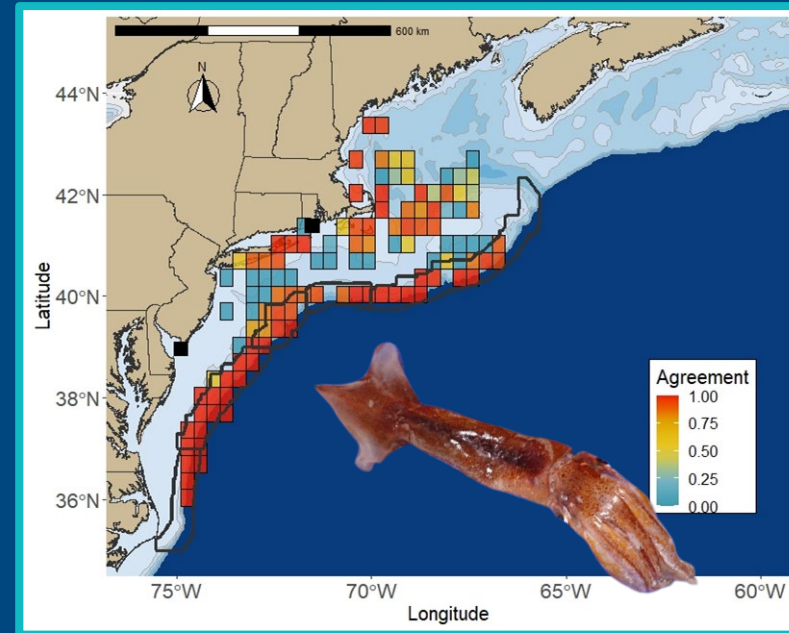
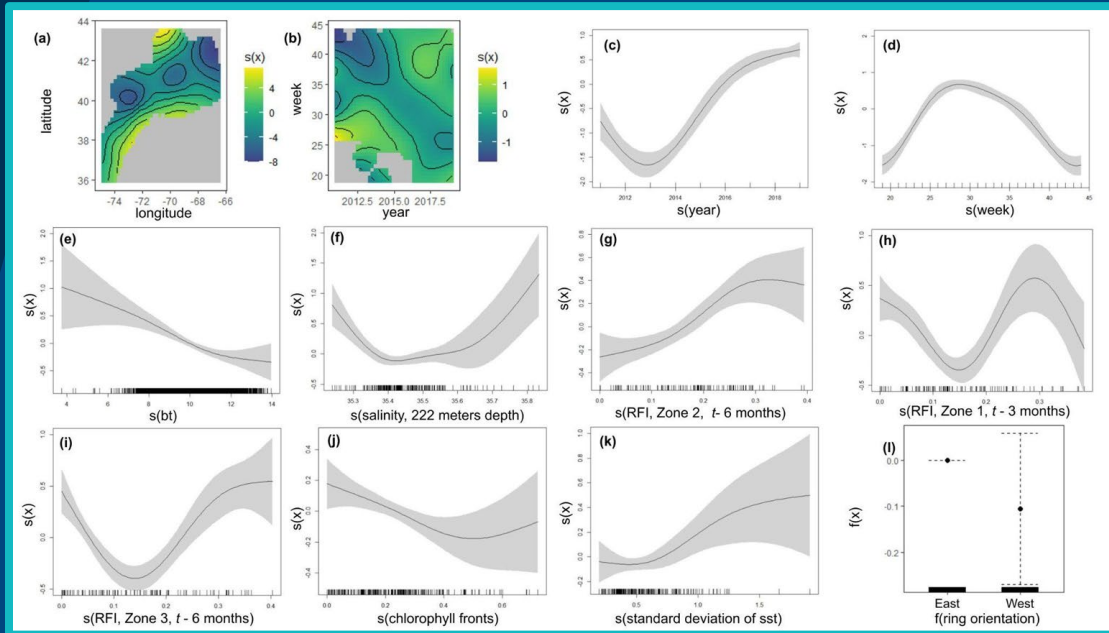
By combining knowledge about the dynamics of the physical oceanography in the region with the current ecological and observational understanding of this species, we were able to construct a model that represents a reasonable hypothesis about how the system works.

- Bottom temperatures
- Timing, size and location of WCRs
- Subsurface salinity
- Chlorophyll fronts
- Variability of SST

Explained over 50% of the variation in CPUE for the Illex fishery over the past 10 years



Research Results



Specifically:

- (i) Cooler bottom temperatures
- (ii) Higher Ring Footprint Indices (RFI) in the winter and early spring months (ahead of the summer fishery)
- (iii) Upwelling processes (e.g.: frontal dynamics and interactions between WCRs and subsurface features) are associated with greater CPUE.

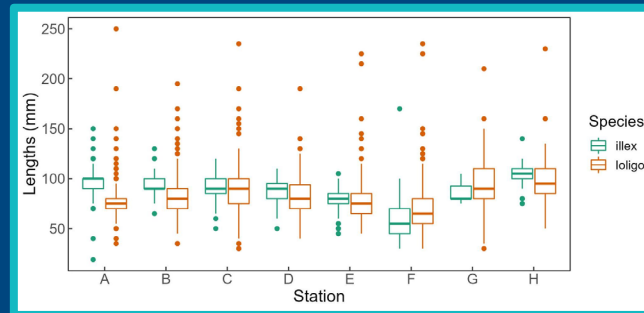
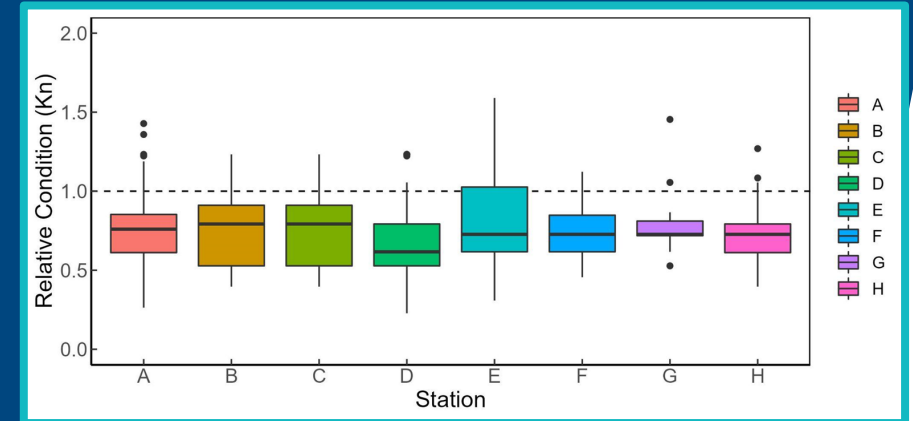
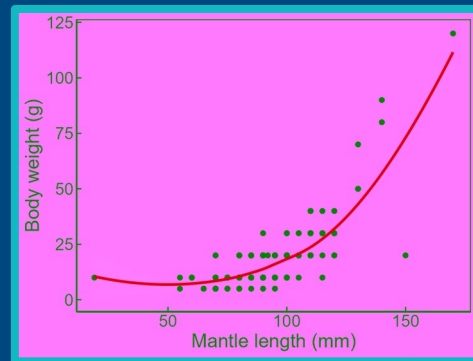
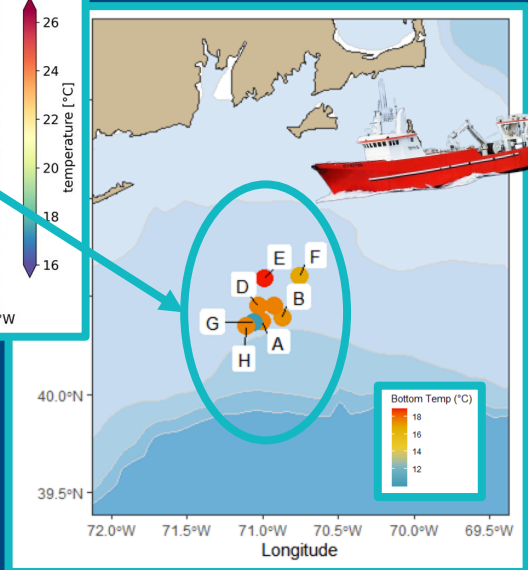
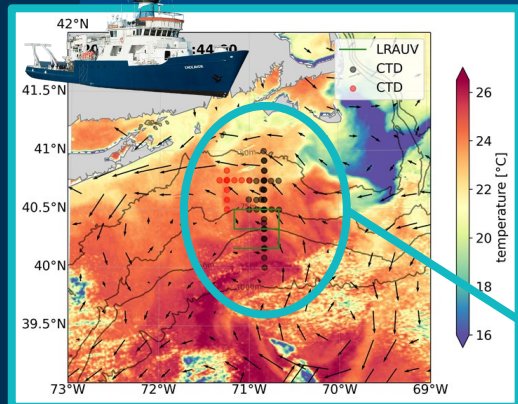


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Current work

F/V Dyrsten & R/V Endeavor: Fishing and research vessel collaboration

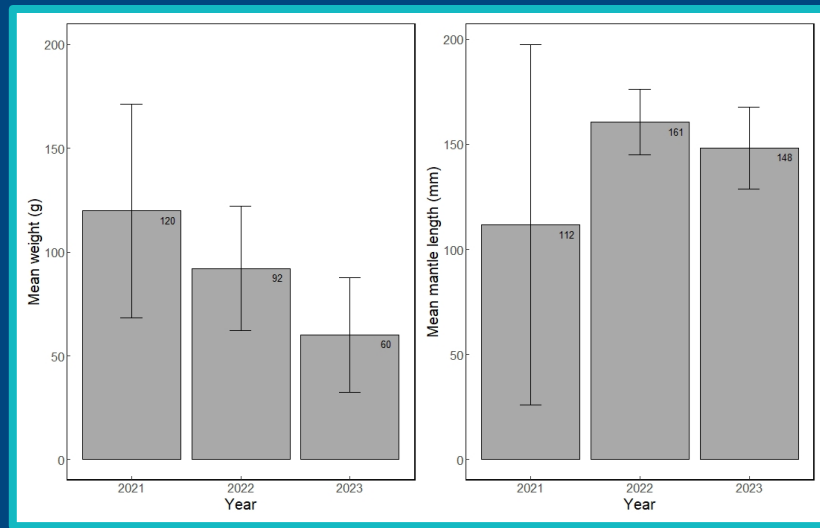
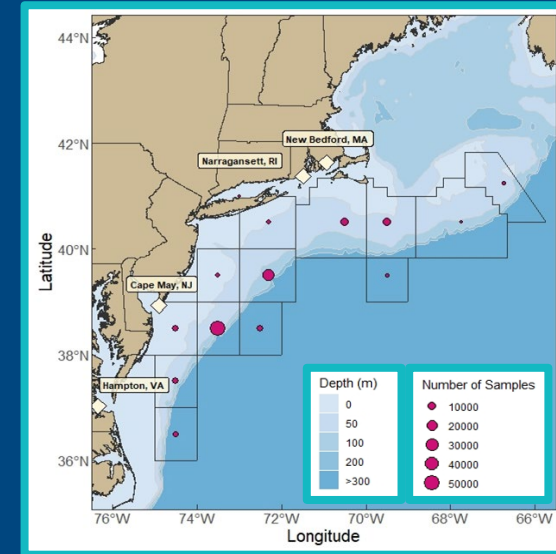
- Relationship between salinity intrusion squid
- Species richness, abundance, acoustics, lengths, weights, bottom temperatures, salinity
- Relative condition estimations
- Size frequency analysis



Current work

ILXSM: Paired length and weight data analysis

- Size frequency analyses
 - Age at weight estimations
 - Growth curve estimations
- Relative condition estimations



MAFMC Priorities



Collect: Demographic Information

Analyze: Availability changes due to oceanography

Examine: Oceanographic and abundance correlates

Investigate: Feasibility of real-time management



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Pending Research



Oceanographic Drivers: Field sampling and ecological modeling to better understand the mechanisms driving changes in *Illex* availability (pending funding).

Frontal metrics: Develop metrics for the Shelf Slope Front and cross-shelf exchange (pending funding).

Population Dynamics: Enhanced biological sampling for *Illex* and *Loligo*, with focus on reproductive dynamics (pending funding).

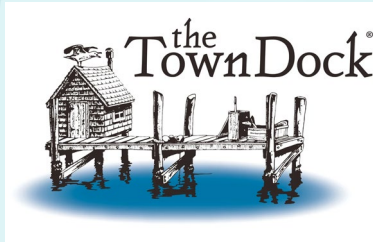


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OpenOcean
Research

LUND'S
FISHERIES



SQUID
SQUAD

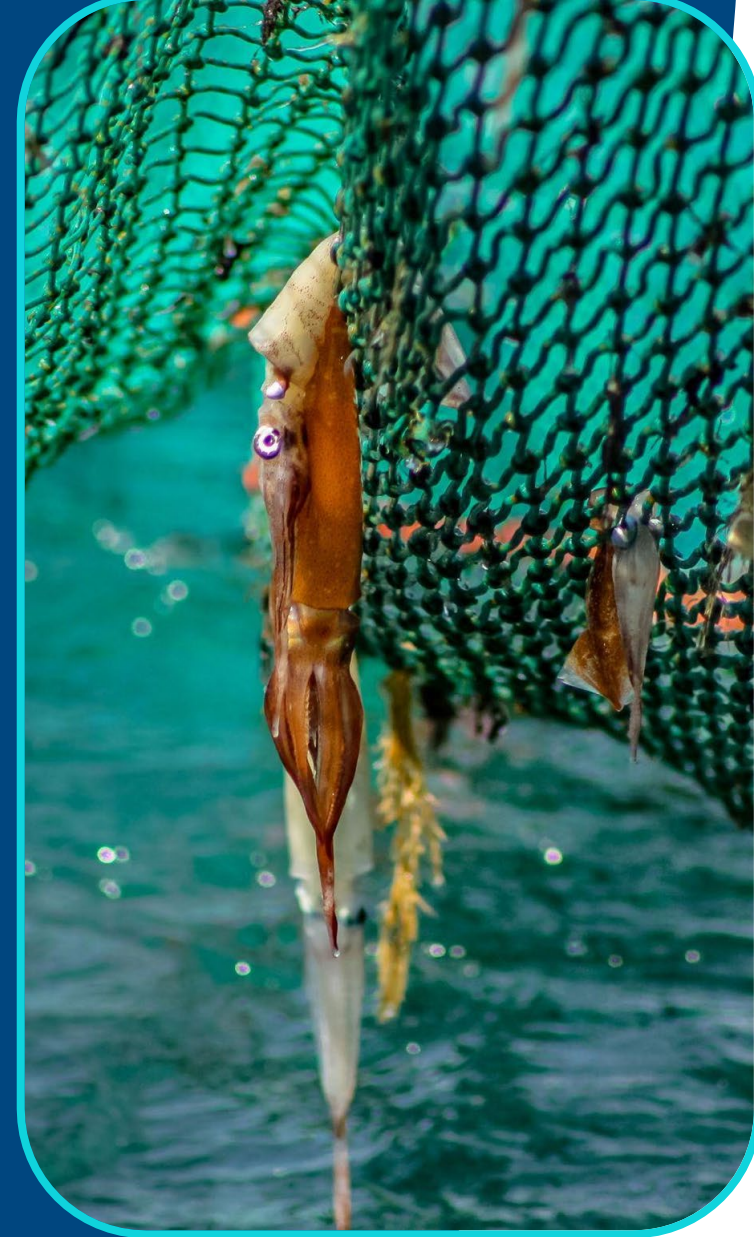
 School for Marine Science & Technology
UMass Dartmouth

F/V Drysten
F/V Defiance
F/V Retriever

Seafreeze Ltd.



MID-ATLANTIC FISHERY
MANAGEMENT
COUNCIL



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