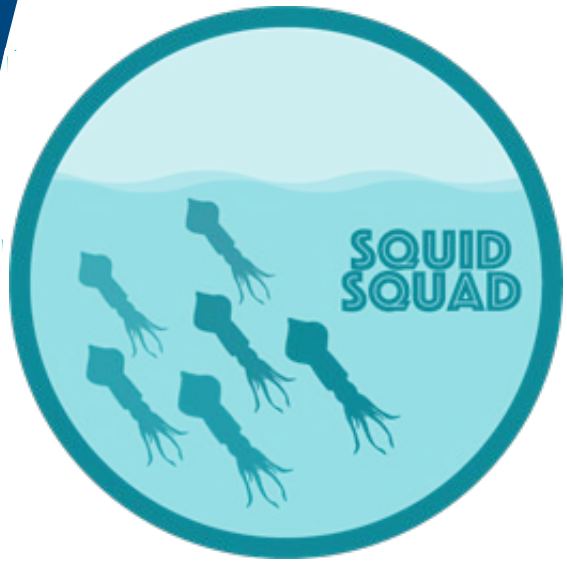
SQUID SQUAD: Using a collaborative framework to identify oceanographic indicators of *Illex illecebrosus*



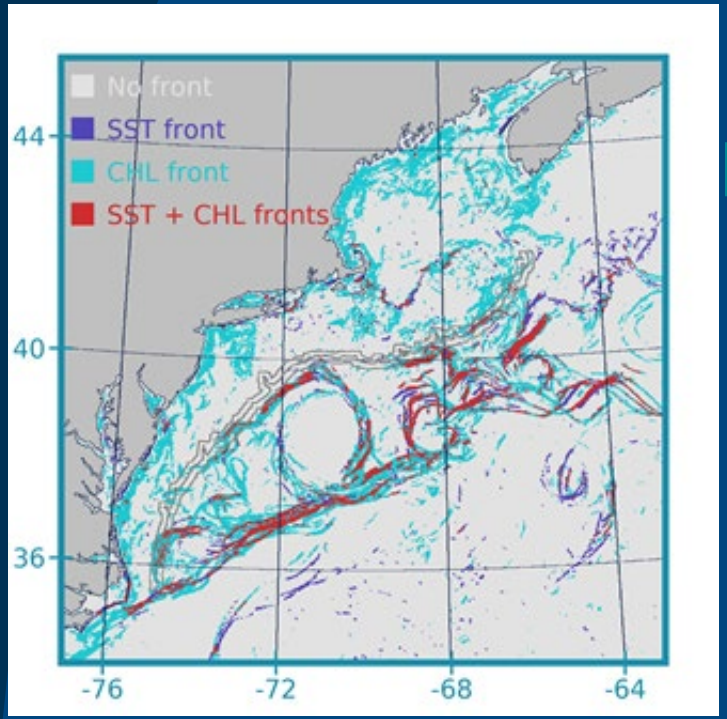
Kimberly Hyde, Anna Mercer, Sarah Salois

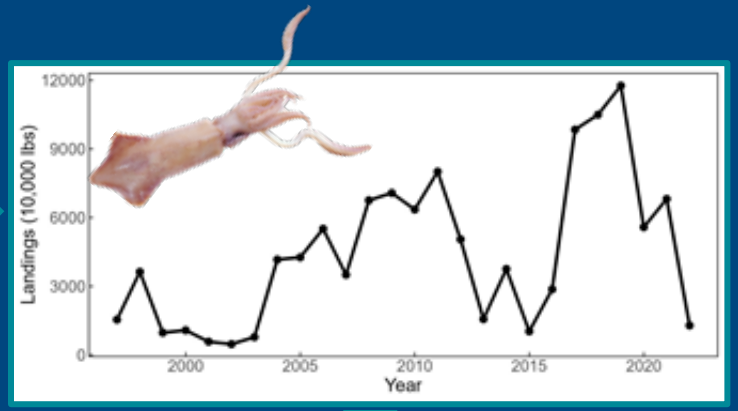
Northeast Fisheries Science Center| NOAA Fisheries

SMAST | University of Massachusetts Dartmouth

MAFMC Science & Statistical Committee 2023

How it started





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

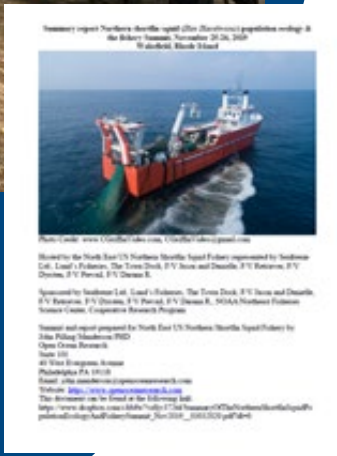
Background

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



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

OpenOcean Research

NOAA

Seafreeze Ltd.

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the TownDock

School for Marine Science & Technology
UMass Dartmouth

MID-ATLANTIC FISHERY MANAGEMENT COUNCIL

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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"

"Bringing the right people together to explore ideas…"

"An authentically productive and respectful engagement…"

"Collaboration, inclusiveness, and an open dialogue"

"Open communication"

"People asking real questions, conducting real collaboration, and a desire to learn…"

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Why This Works

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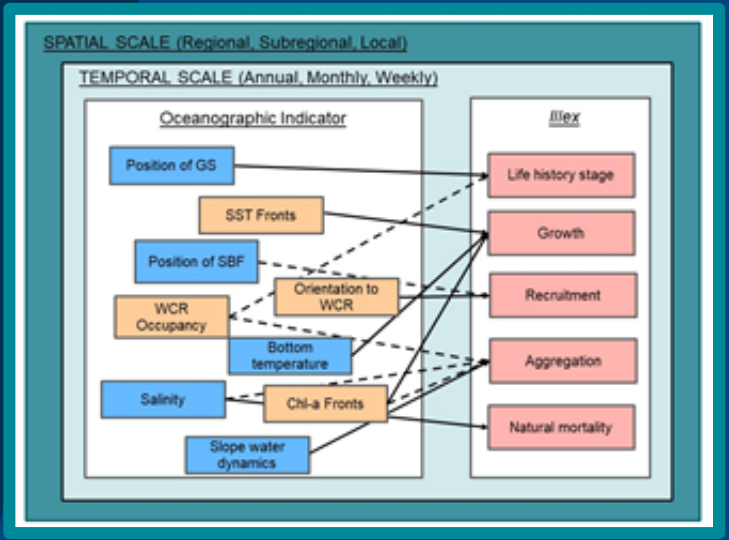
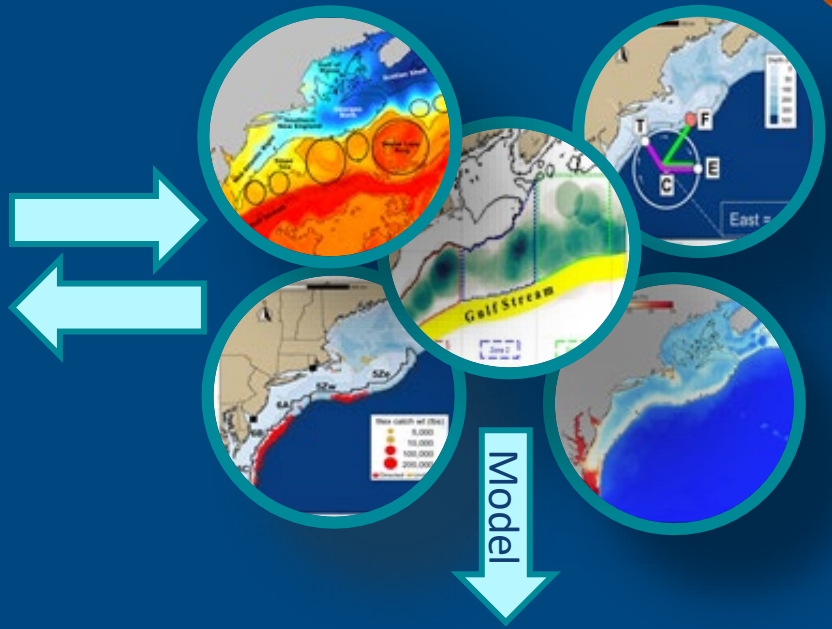
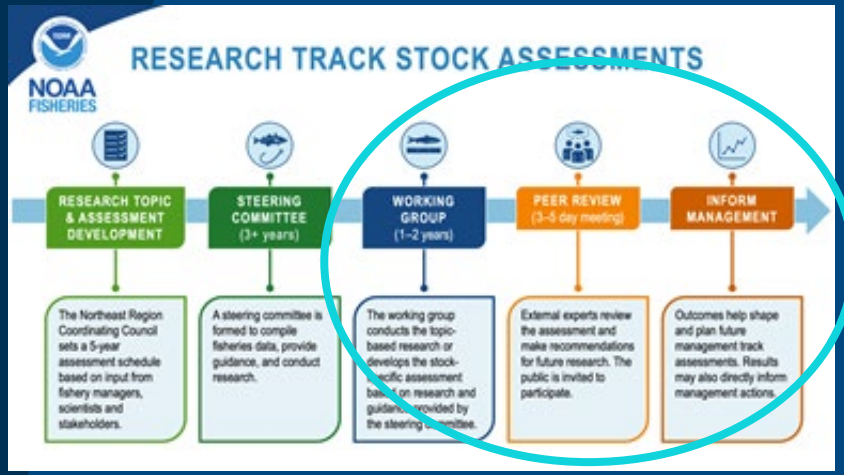
The Process

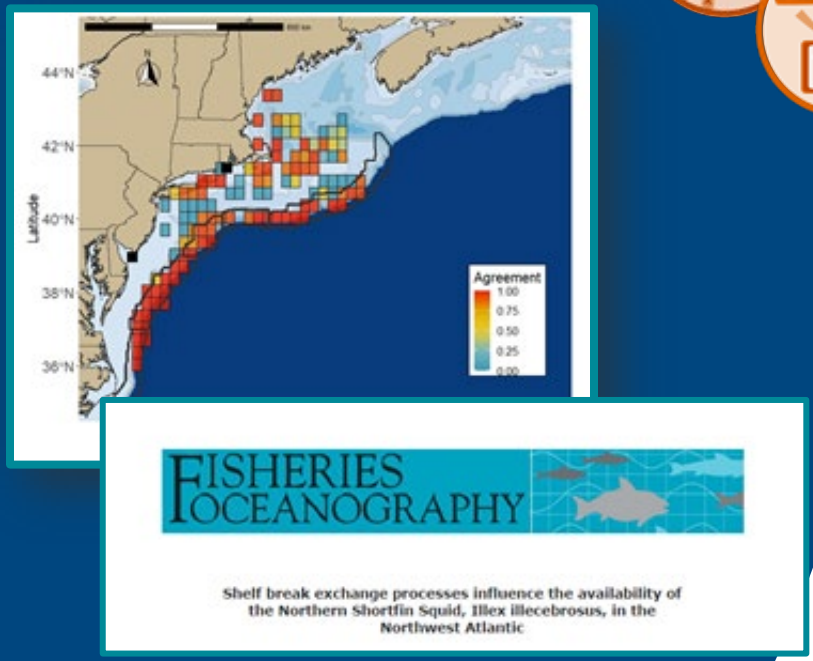




Size of *Illex* catch is a function of a suite of temporal and spatial variables (e.g. date, bottom temperature, warm core ring orientation, chlorophyll fronts)

The Products





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

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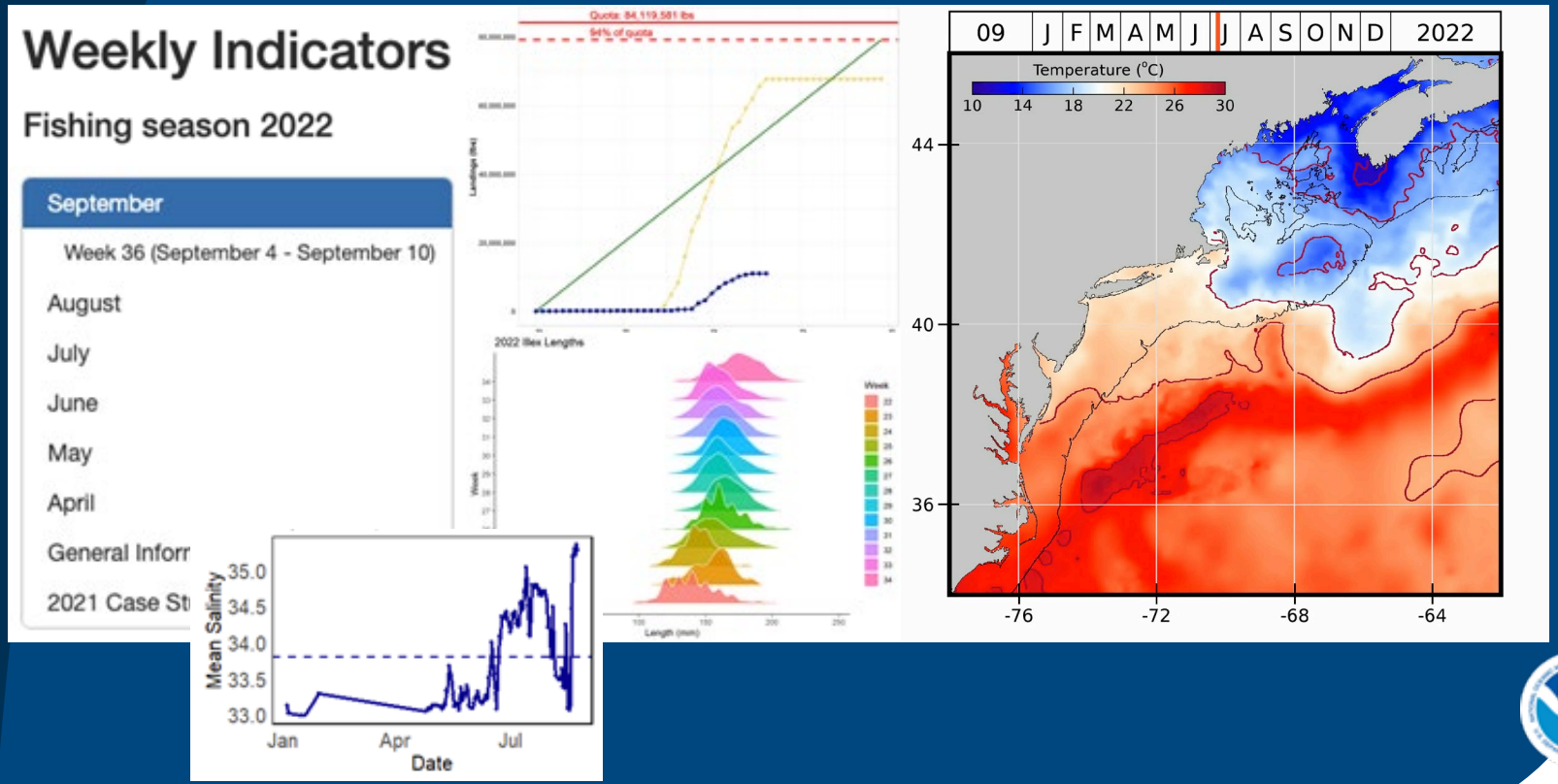
Visualization Tools



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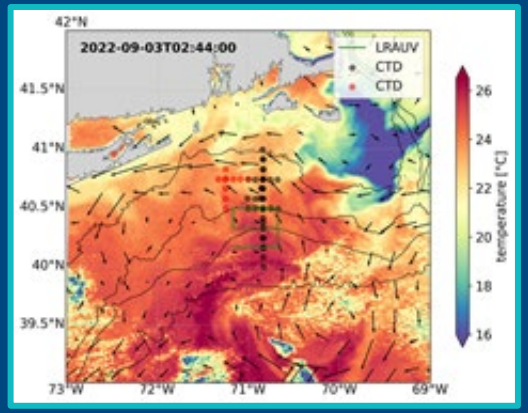
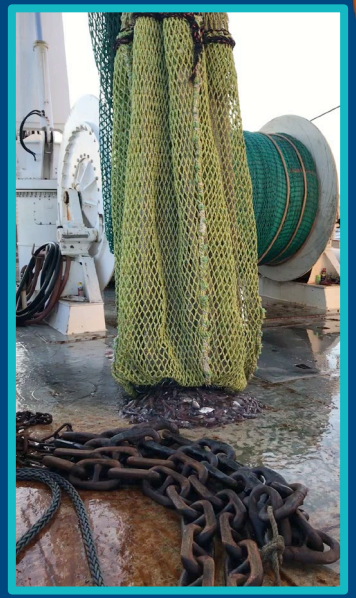
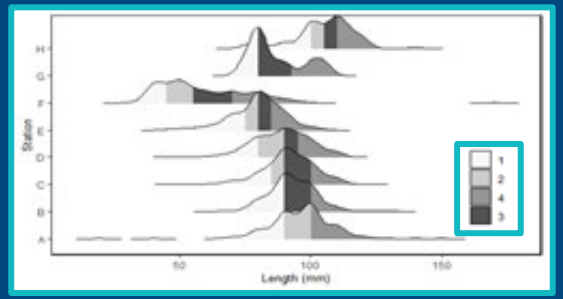
Collaborations

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







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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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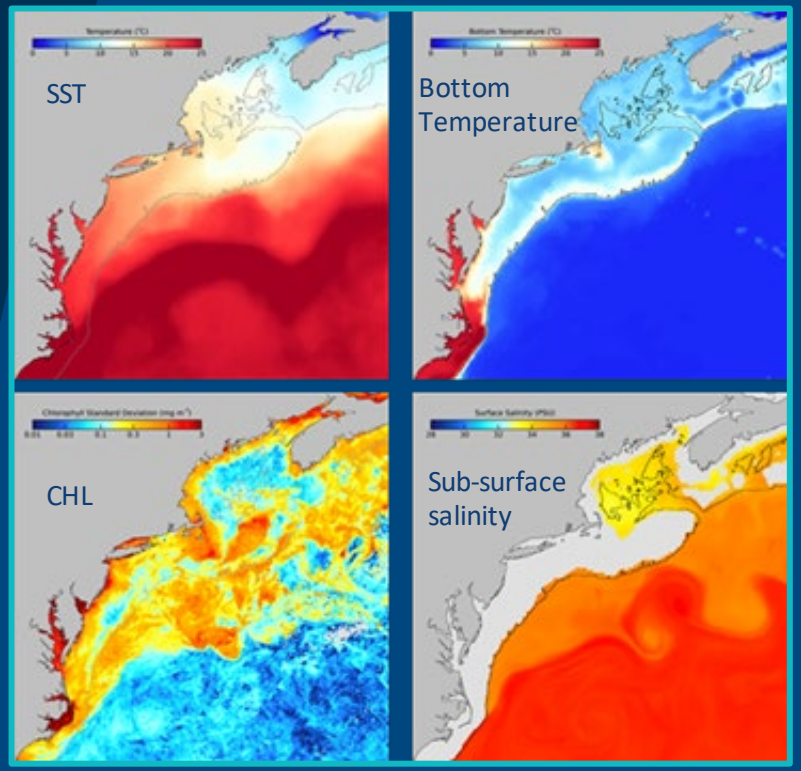
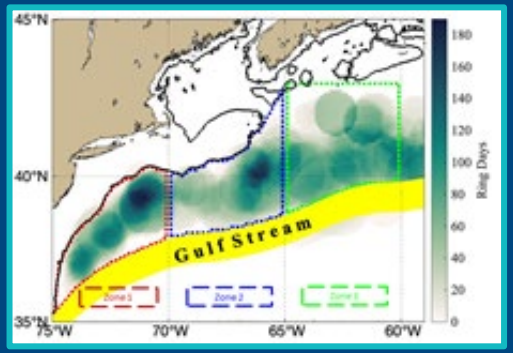
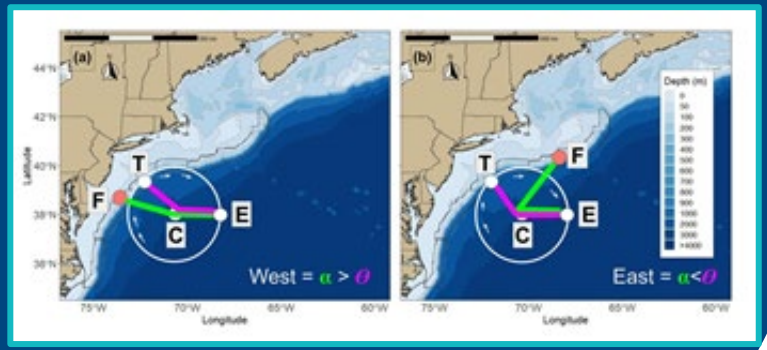
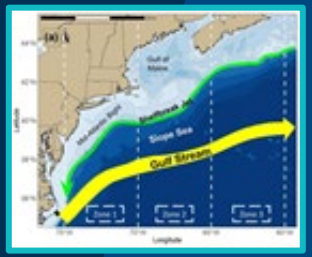
Oceanography







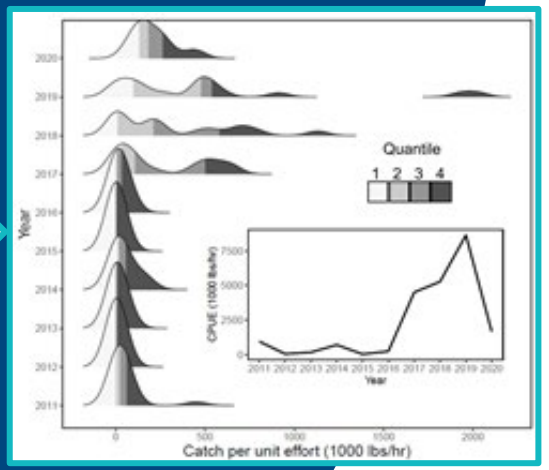
Research Results



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



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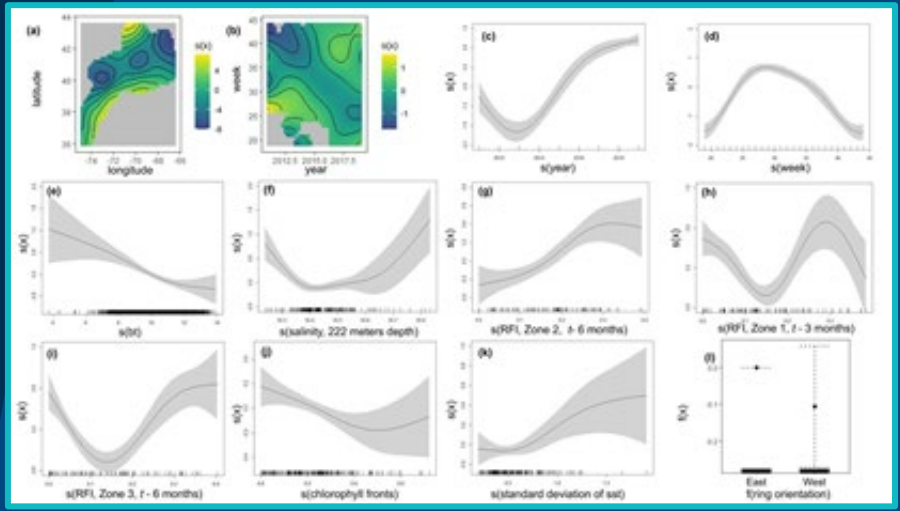
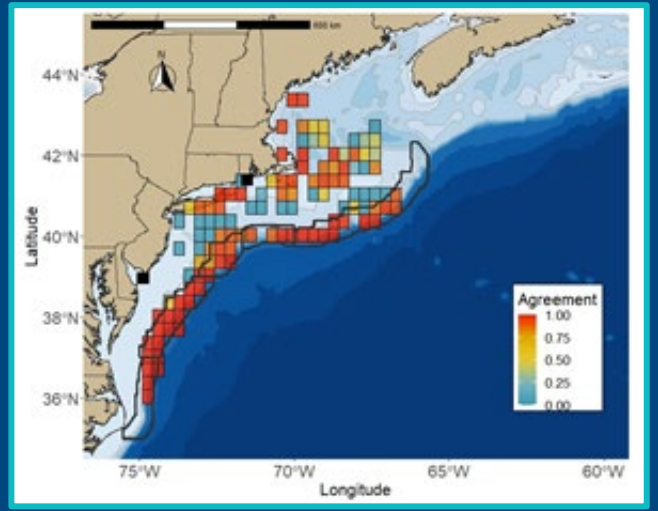
Research Results





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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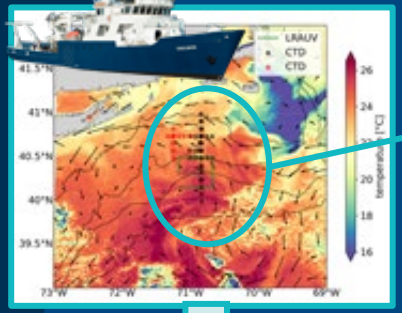
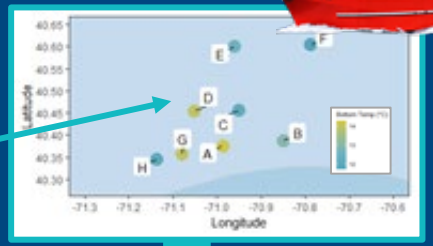
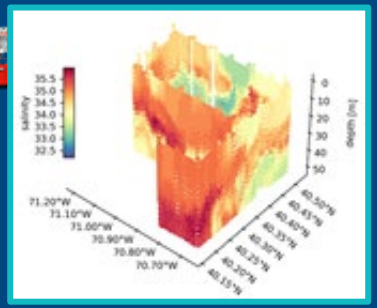
Current work

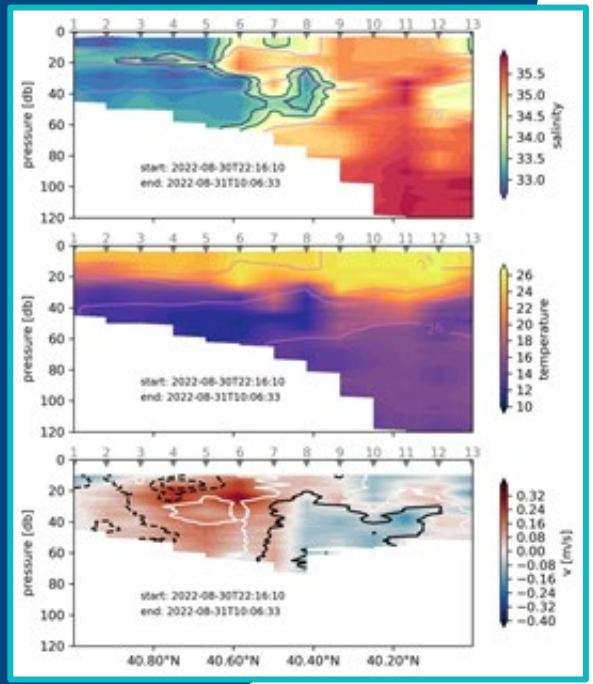
F/V Dyrsten & R/V Endeavor: Fishing and research vessel collaboration

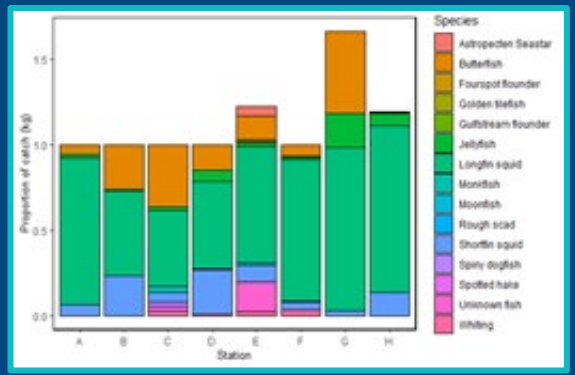
- Explore relationship between salinity maximum intrusion and *Illex* squid
- Oceanographic data: acoustics, length, weight, CTD profiles (temperature, salinity, depth), speed, direction of currents
- Catch data: 8 tows, ~ 15 species







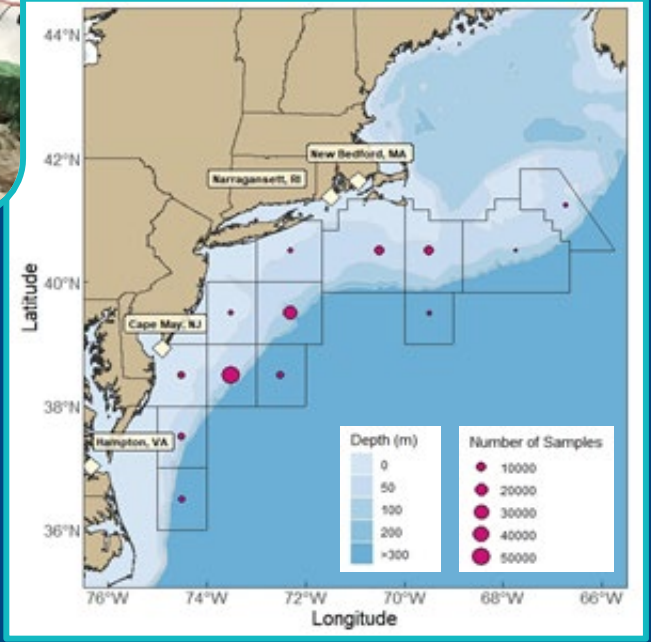


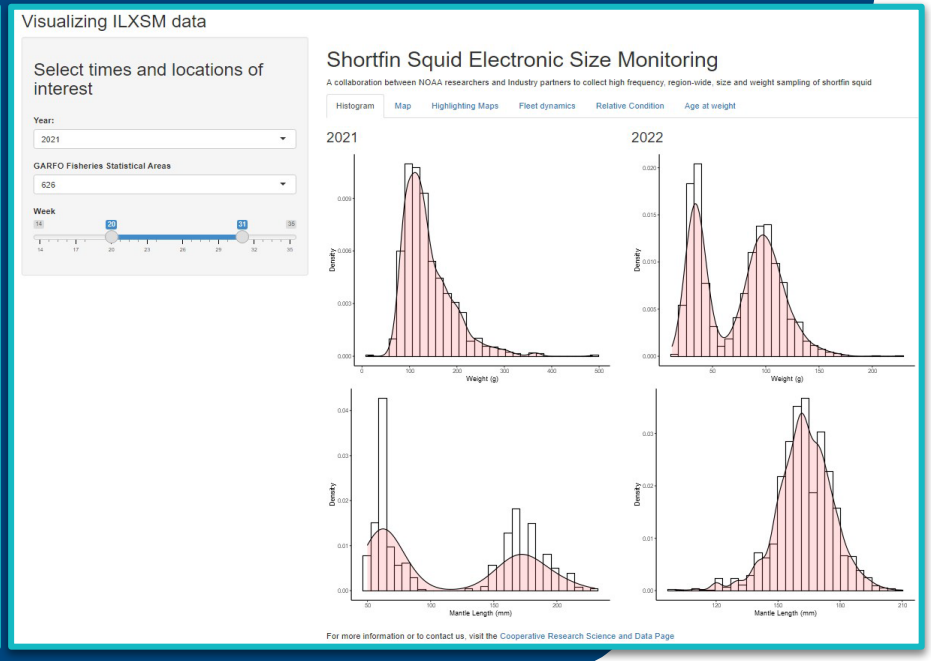


Current work

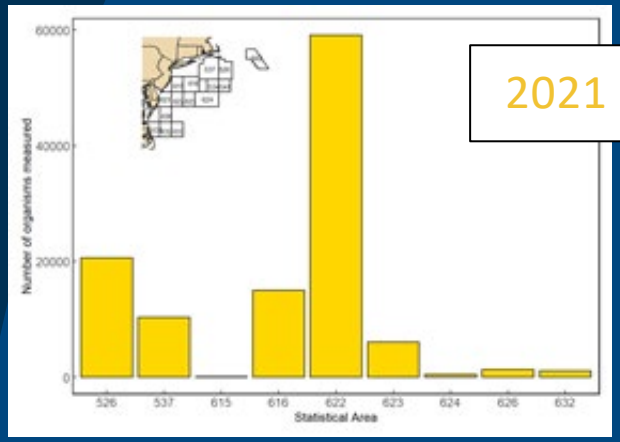
ILXSM: Paired length and weight data analysis

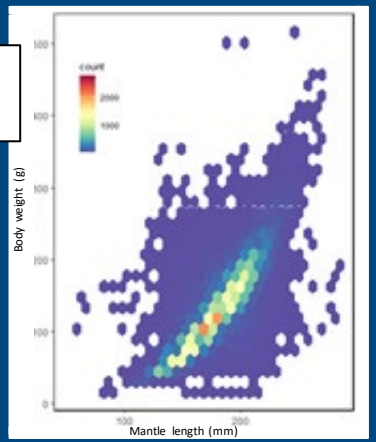
- Partnered with the 6 largest shortfin squid processors ranging from New Bedford, MA to Hampton, VA
- Near real-time (within 72 hours) length and body weights of individual *Illex*

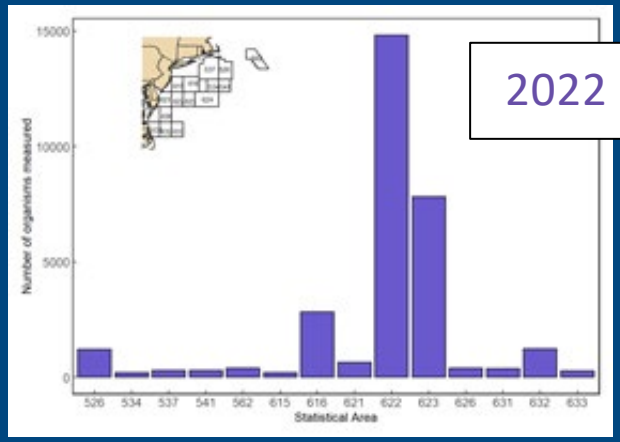


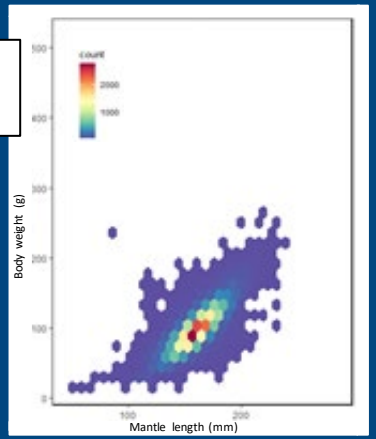


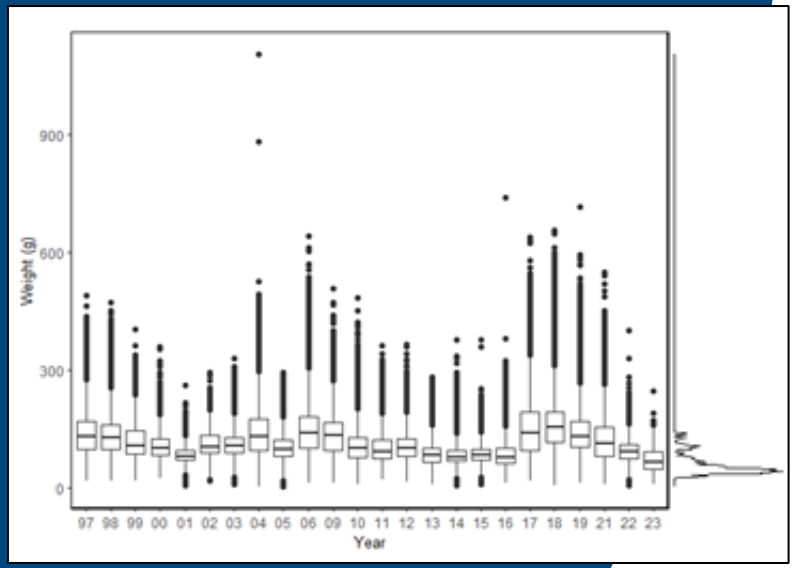
Current work











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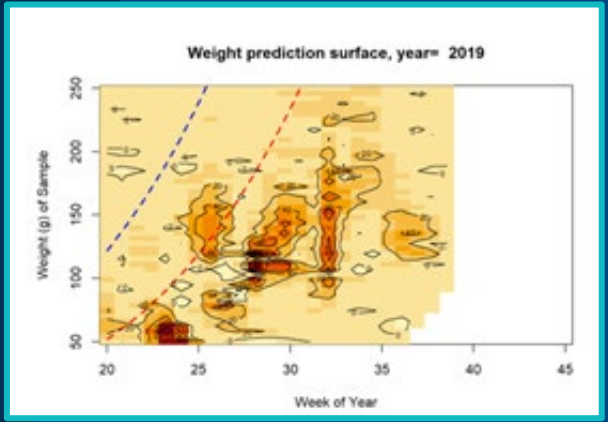
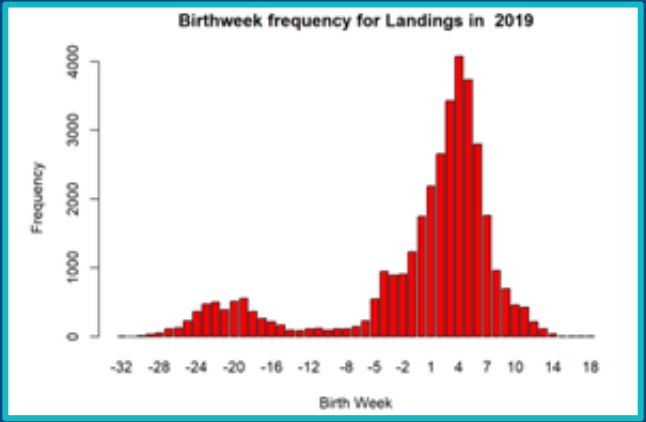
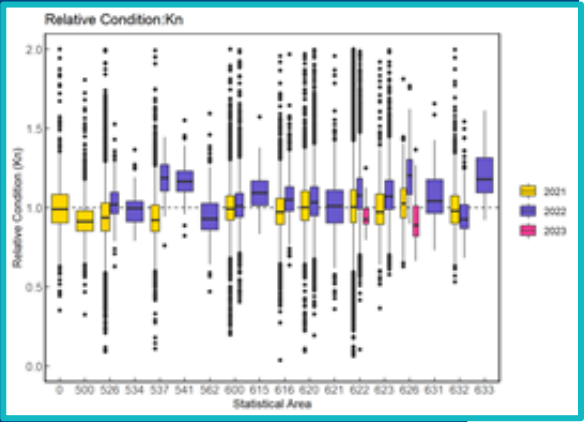
Potential analyses

ILXSM: Weight frequency analysis and evidence of cohorts, relative condition







Feedback: What analyses are most useful to support management goals?

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MAFMC Priorities

Collect: Demographic Information

Analyze: Availability changes due to oceanography

Examine: Oceanographic and abundance correlates

Investigate: Feasibility of dynamic forecasting

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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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