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# Oyster Aquaculture Gear as Fish Habitat

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NEFSC Milford

&

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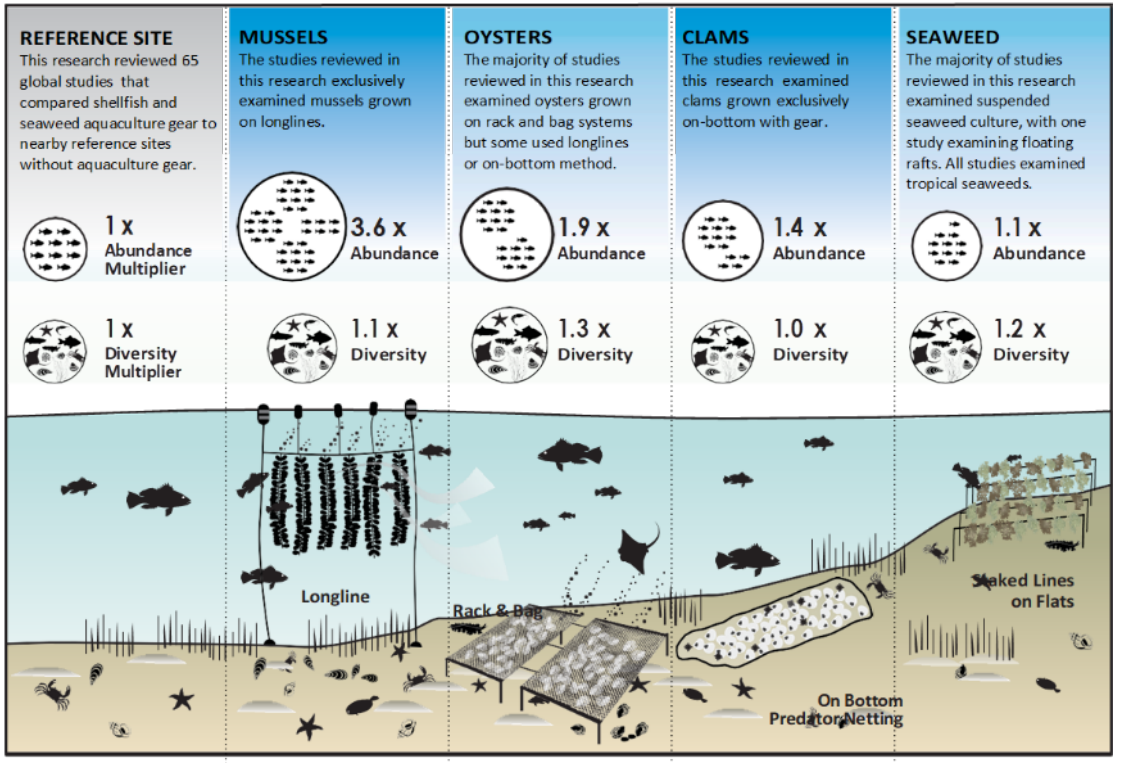
GARFO

# Oyster cages as fish habitat




*Theuerkauf et al. 2021 Reviews in Aquaculture*

Anecdotal and scientific evidence

Shellfish farms may function much like artificial reefs

# Project goals

- Identify habitat services provided by oyster cages
- Provide data to regulators & resource managers who make decisions about aquaculture practices
- Make video and methods available to the public



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# Thank you to our GoPro Project Team

- Renee Mercaldo-Allen
- Julie Rose
- Yuan Liu
- Lisa Milke
- Paul Clark
- Erick Estela
- Gillian Phillips
- Dylan Redman
- Ian Robbins
- Arthur Allen
- Bill DeFrancesco
- Calandria DeCastro
- Mark Dixon
- Keith Golden
- Pete Hudson
- Jerry Prezioso
- Barry Smith
- Adam Armbruster

## Project advisors

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## Collaborators

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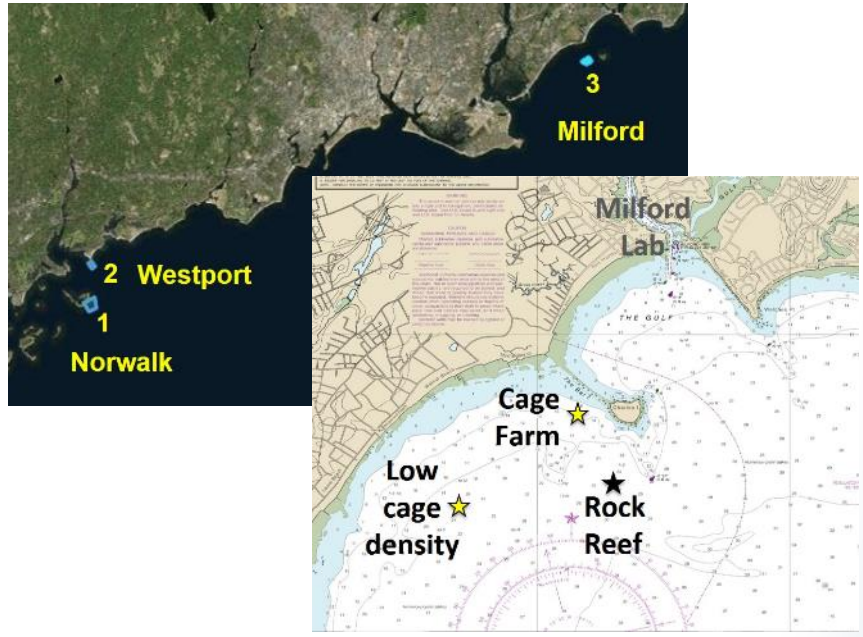
Jon Grabowski

Kelsey Schultz




# Industry partners:

Atlantic Clam Farms
Charles Island Oyster Farms
Copps Island Oysters
CT Bureau of Aquaculture
Fishers Island Oyster Farm
G&B Shellfish
Hummock Island Oyster Farm
Indian River Oysters
John Pinkowski
Niantic Bay Shellfish Farm
Noank Aquaculture Coop
Robert Granfield



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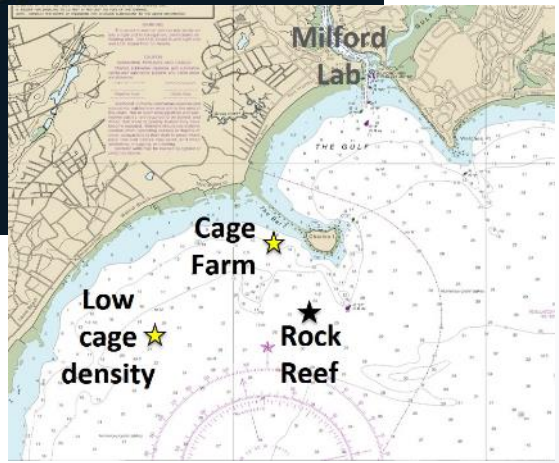
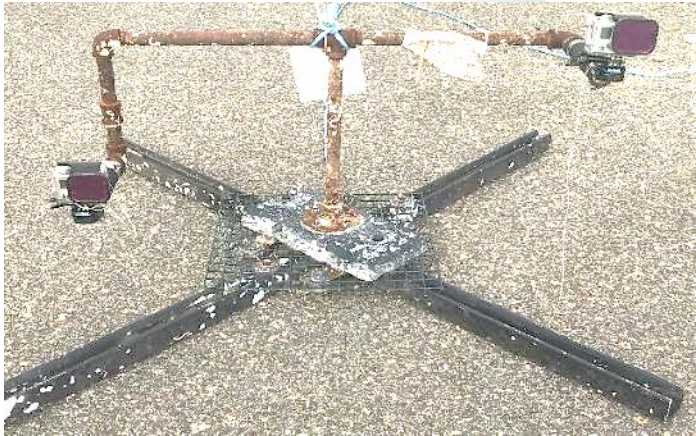
3
Milford
2 Westport
1
Norwalk


Milford
Lab
Cage
Farm
Low
cage
density
Rock
Reef



# Fish interacting with oyster aquaculture cages



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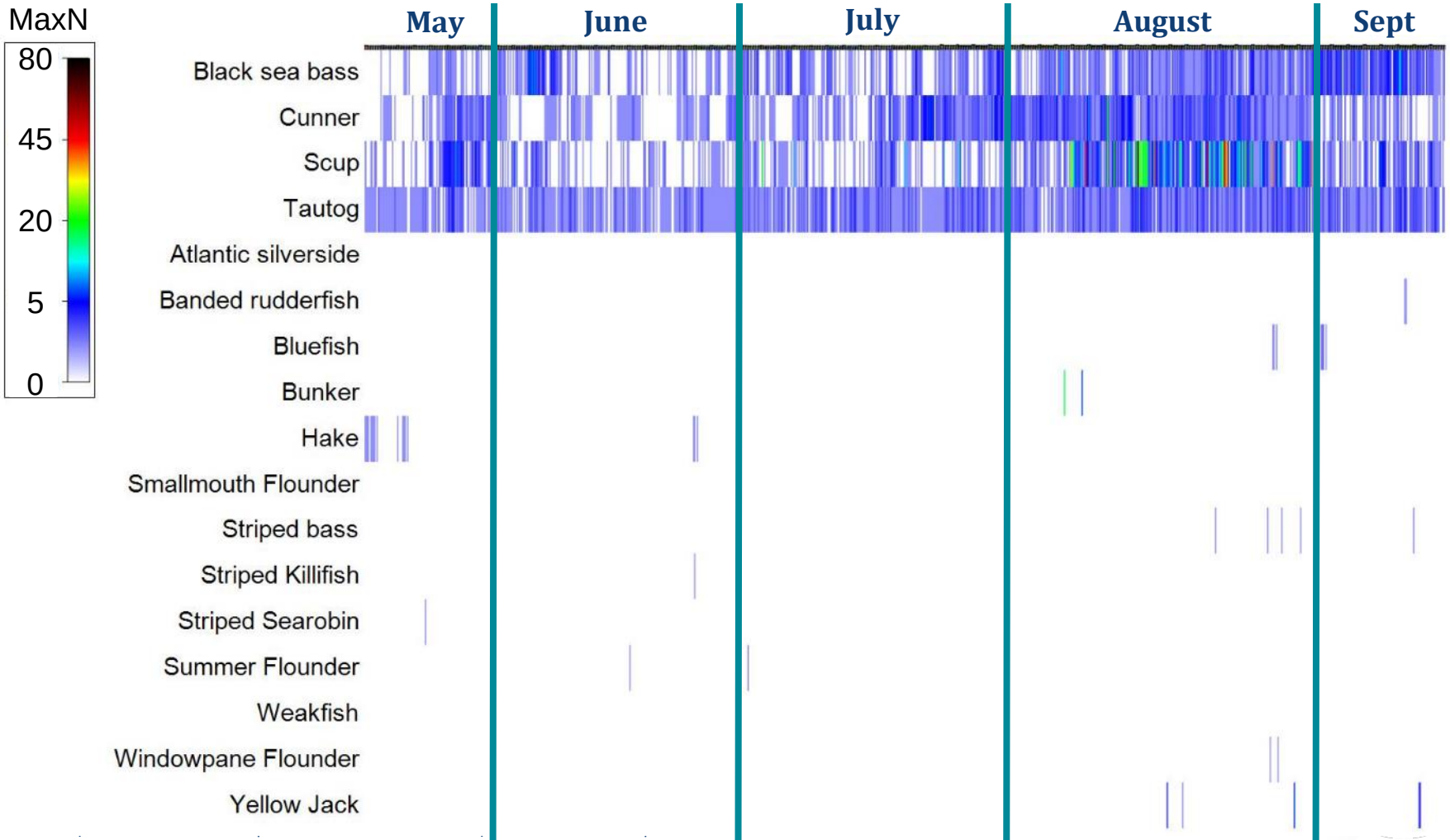
# High frequency of fish activity at Milford farm

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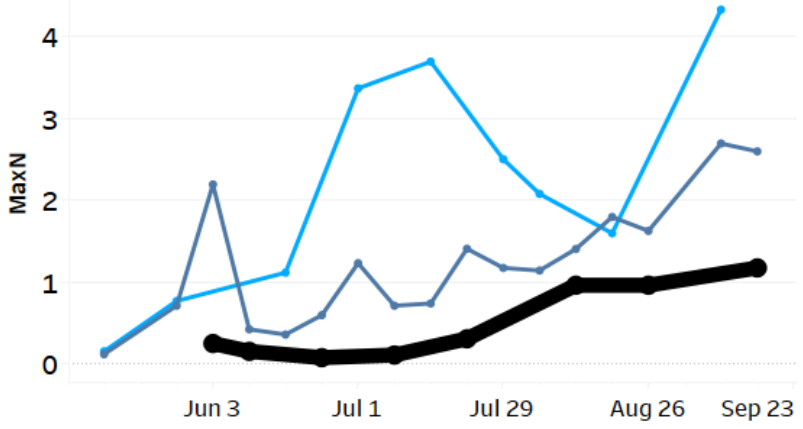
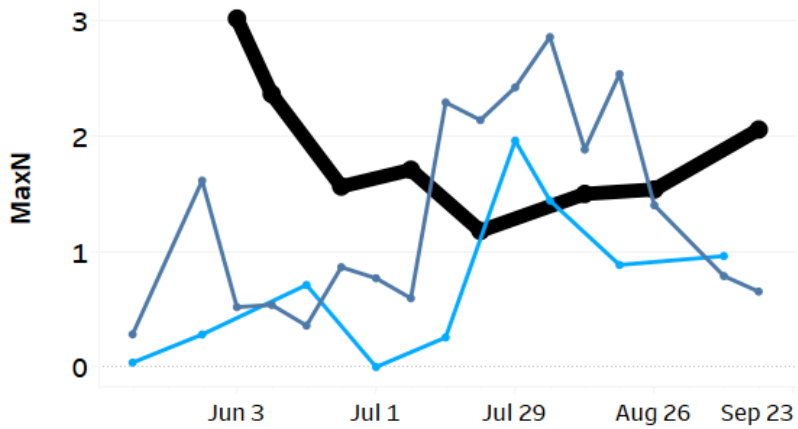
# Comparing abundance on rock reef vs. cage sites

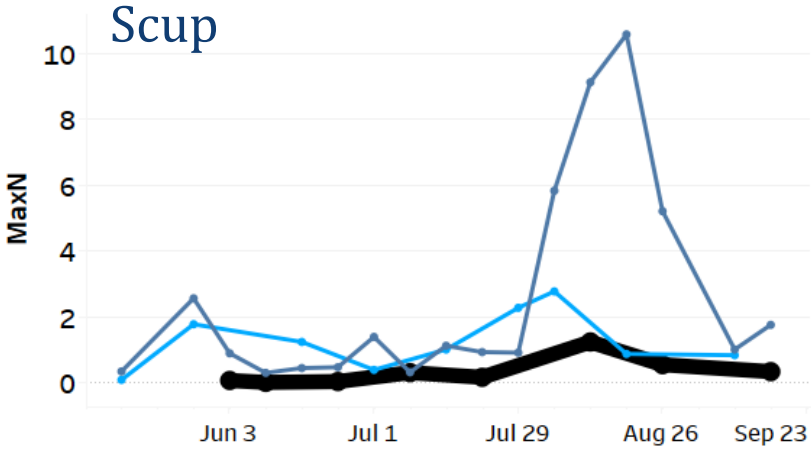
## Black sea bass



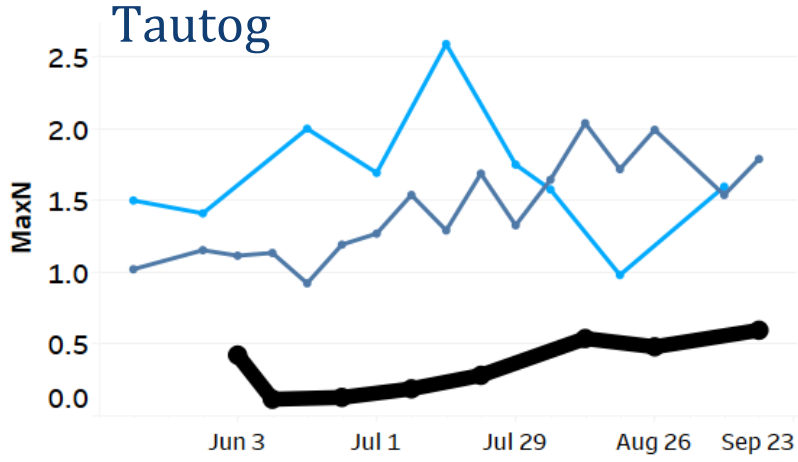

## Cunner




## Scup




## Tautog



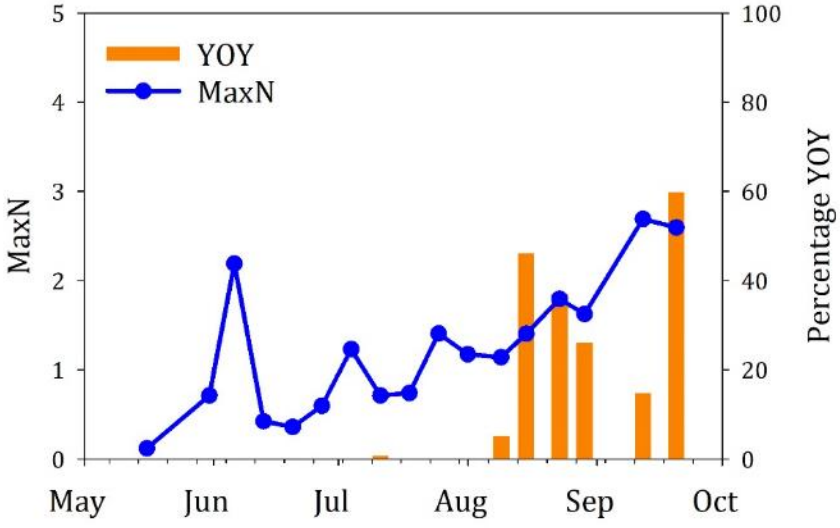

Rock Reef

Milford Low Cage Density

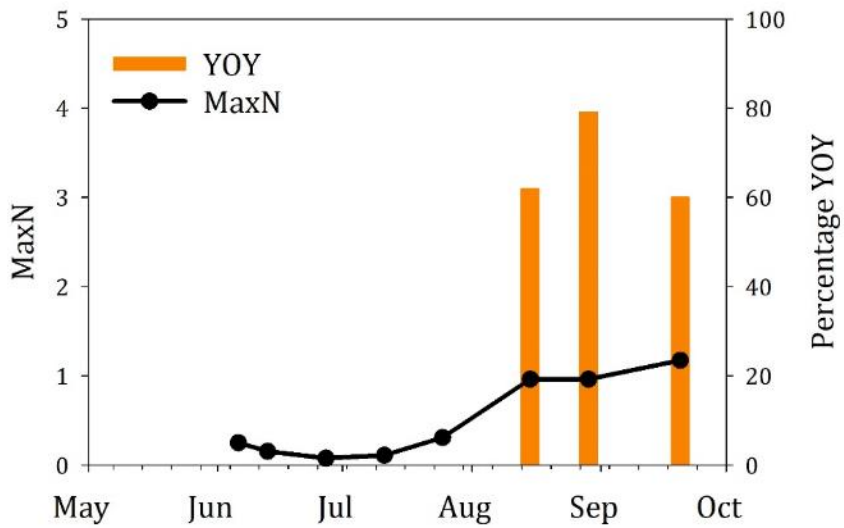
Milford Farm

# Black sea bass

## Farm

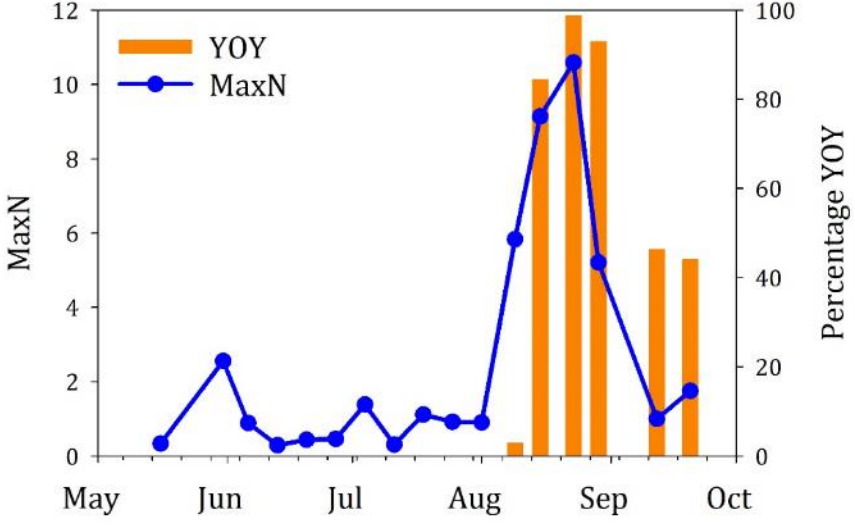



## Rock Reef

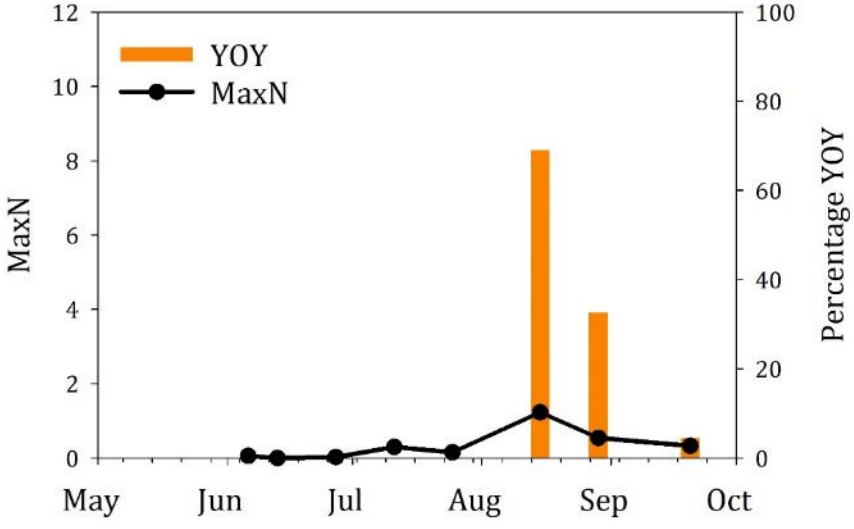



# Scup

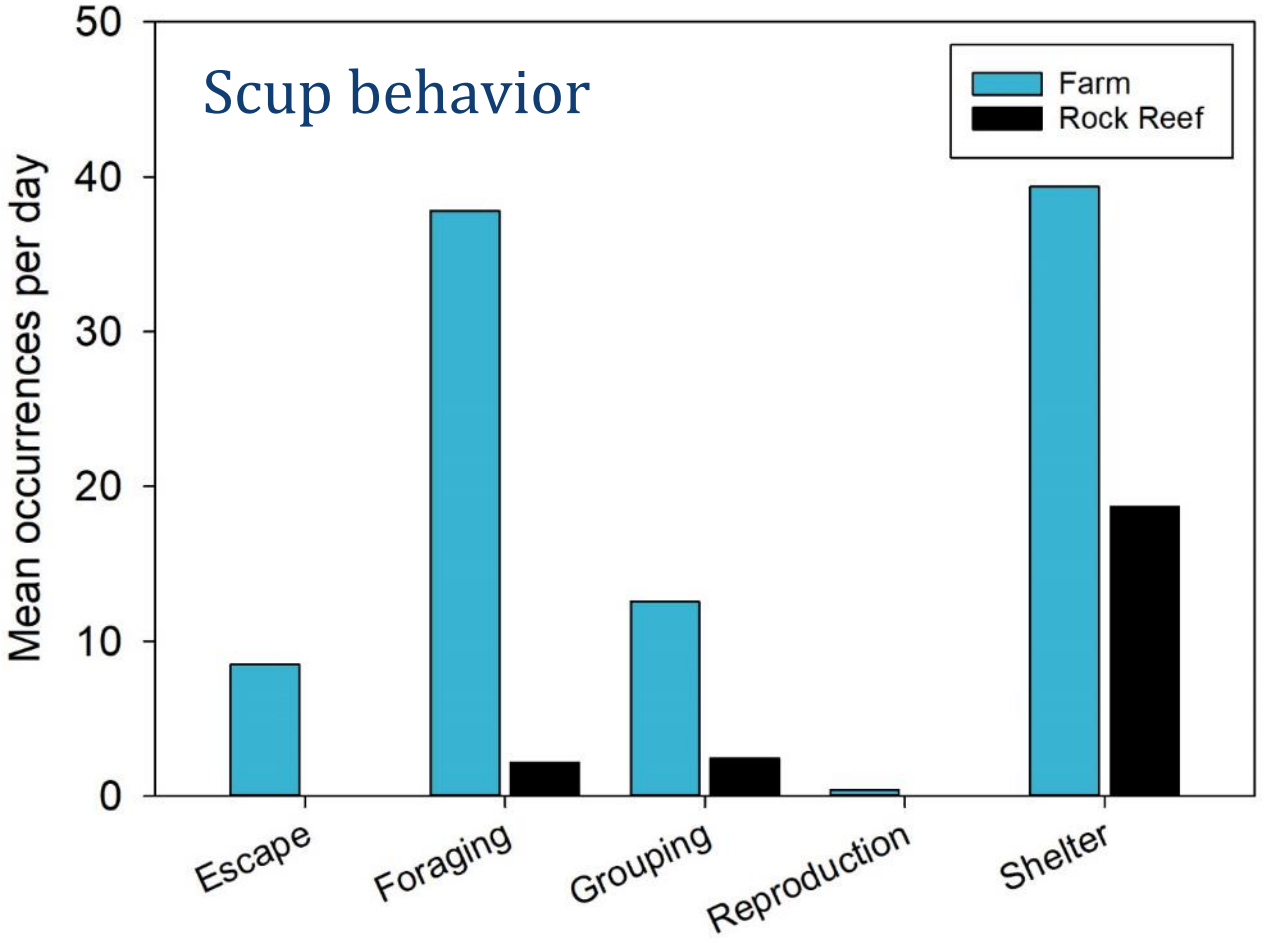
## Farm




## Rock Reef



# How are fish using gear?



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Study site: Rose Cove
Little Egg Harbor Region of Barnegat Bay, NJ


Opportunistic camera deployments collected continuous footage across tidal cycle during active farm operations from July-September 2018 & 2019

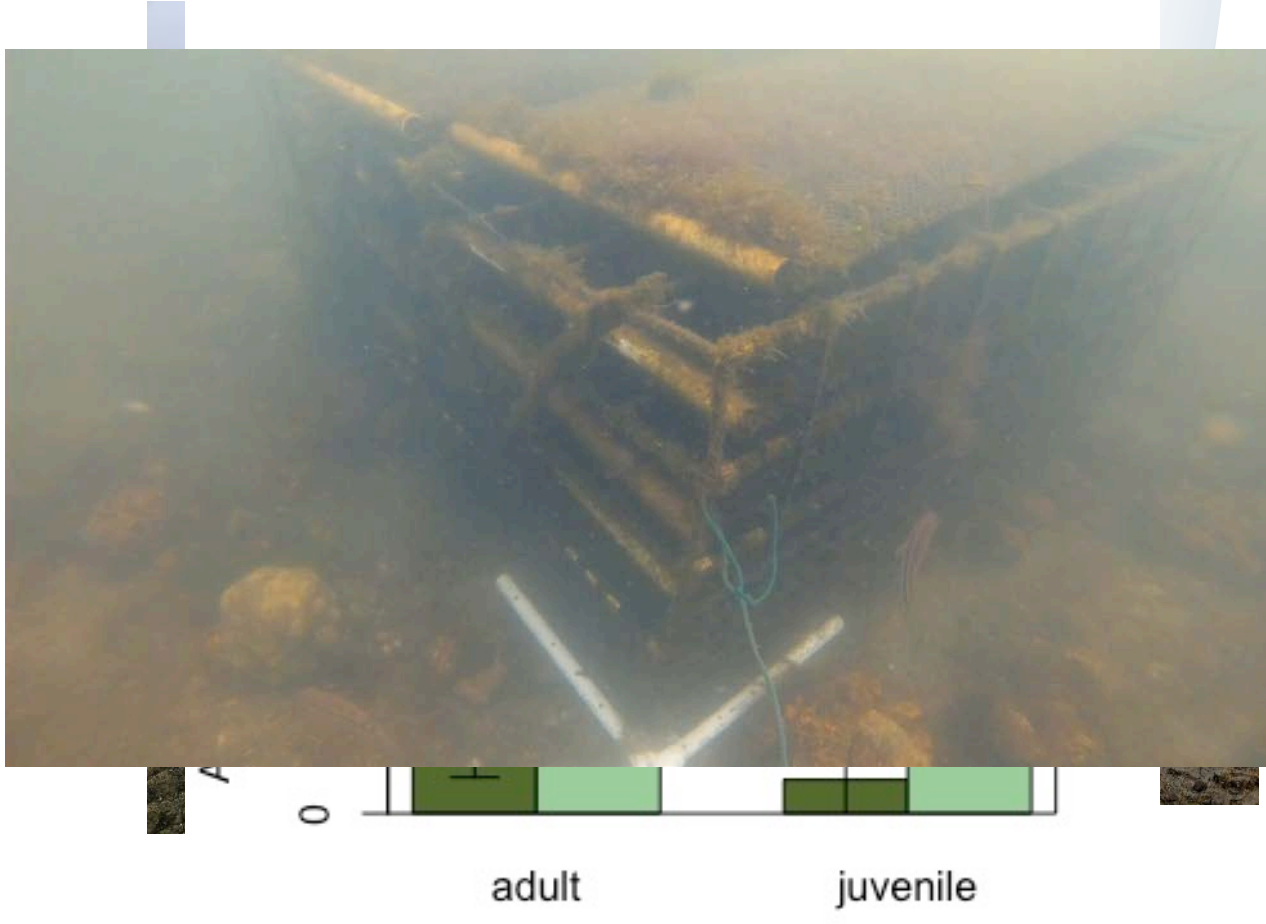
- Videos were recorded in 80-minute segments
- Seven sampling dates in each year


- Sampled habitats included:
- Floating bags
- Off-bottom cages
- Natural marsh edge (vegetated
- by *Spartina* spp. and ribbed
- mussels)

Commercially important juvenile species use farm gear as habitat

# Addressing constraints to shellfish aquaculture through quantifying ecosystem services and public perceptions

- Comparison of fish production and use of different gear types to natural habitats north and south of Cape Cod
  - **Island Creek Oysters**: Mostly striped bass & horseshoe crabs
  - **Cotuit Oyster Company**: Adult & juvenile black sea bass, tautog, scup, striped bass, and blue crabs



# Making the connection between science and management

- Science and management don't always align.
- Collaboration between the Milford Lab and the Greater Atlantic Regional Office has allowed for the study to address the questions that we (GARFO-Habitat) have as resource managers in a meaningful way.
- This collaboration provides us the opportunity to address management questions systematically so that we can directly apply the study results in our EFH consultations.



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# Is aquaculture gear EFH?

- For black sea bass – Yes!
  - "…Juvenile black sea bass are usually found in association with rough bottom, shellfish and eelgrass beds, man-made structures in sandy shelly areas; offshore clam beds and shell patches may also be used during the wintering."
  - Adult: "…Structured habitats (natural and man-made), sand and shell are usually the substrate preference…"
- For red hake – maybe.
  - …"Shell beds, soft sediments (mud and sand), and artificial reefs provide essential habitats for adult red hake."
- For other species…..?



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# Is aquaculture gear EFH? *continued*

- Scup EFH
  - Juvenile: "… EFH is the demersal waters… in association with various sands, mud, mussel and eelgrass bed type substrates…"
  - Adult: "… EFH is the demersal waters…" There is no benthic substrate component in the text description.
- It is more than just BSB - a LOT of species have been identified at the cage farms and the same "top 4" species are identified at both cage farms and the boulder reef.
- But….there are differences between the cage farms and boulder reef. The question is why – what is driving these differences and are they meaningful for EFH?



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# Ongoing and upcoming work

- What is driving the differences between the cage farms and boulder reef?
- Continue to analyze existing data
  - Evaluate YOY versus adult life history stages
  - Evaluate environmental parameters (temp, current velocity, light)
- Expand (and repeat) current study
  - Addition of stereoscope imagery – able to size fish
  - Repeat at another boulder reef?



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# For more information

**Connecticut**:
Project website with videos, methods, and preliminary results
Mercaldo-Allen et al. 2021. Exploring video and eDNA metabarcoding methods to assess oyster aquaculture cages as fish habitat. Aquacult. Environ. Interact. 13: 277-294

**New Jersey**:
Video showing various species of fishes and invertebrates interacting with oyster farm and natural structured habitats
J.P. Shinn, D.M. Munroe, J.M. Rose. 2021. A fish's-eye-view: accessible tools to document shellfish farms as marine habitat in New Jersey, USA. Aquacult Environ Interact13: 295-300

**Massachusetts**:
Feature story and video highlighting TNC and Northeastern research program

# Questions?



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# Additional Information on collaborative research projects

RUTGERS

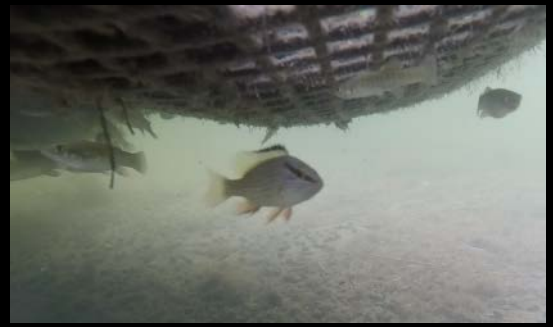
**Video observations collected in 2018 & 2019**

| Common name | Species | Commercial fishery* |
|---|---|---|
| Atlantic silverside | *Menidia menidia* | X |
| eastern mud sail | *Tritia obsoleta* | |
| mummichog | *Fundulus heteroclitus* | X |
| feather blenny | *Hypsoblennius hentz* | |
| blue crab | *Calinectes sapidus* | X |
| hermit crab | *Pagarus spp.* | |
| Atlantic needlefish | *Strongylura marina* | |
| grass shrimp | *Paleomonetes spp.* | X |
| sheepshead | *Archosargus probatocephalus* | |
| naked goby | *Gobiosoma bosci* | |
| silver perch | *Bairdiella chrysoura* | |
| striped bass | *Morone saxatilis* | X |
| permit | *Trachinotus falcatus* | |
| ctenophore | *Mnemiopsis leidyi* | |
| menhaden | *Brevoortia tryannus* | X |
| cunner | *Tautogolabrus adspersus* | |
| Atlantic mud crab | *Panopeus herbstii* | |
| American eel | *Anguilla rostrata* | X |
| summer flounder | *Paralichthys dentatus* | X |
| northern kingfish | *Menticirrhus saxatilis* | |
| diamond back terrapin | *Malaclemys terrapin* | |
| Atlantic croaker | *Micropogonias undulatus* | X |
| eastern oyster drill | *Urosalpinx cinerea* | |
| inshore lizard fish | *Synodus foetens* | |
| mangrove snapper | *Lutjanus griseus* | |
| tautog | *Tautoga onitis* | X |
| mullet | *Mugilidae spp.* | |
| northern pufferfish | *Sphoeroides maculatus* | X |
| striped killifish | *Fundulus majalis* | |
| skillet fish | *Gobiesox strumosus* | |
| spider crab | *Libinia emarginata* | |
| spot | *Leiostomus xanthurus* | X |

*commercial fishery exists in the Mid-Atlantic region

Atlantic needlefish

Mummichog



Juvenile gray snapper swimming below floating oyster bags

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