# Implementing a New Stocking Program in Unchartered Waters: Developing Optimal Release Strategies For Winter Flounder in Massachusetts, USA


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SCORE
SCIENCE CONSORTIUM FOR OCEAN REPLENISHMENT

Sea Grant
New Hampshire

NOAA
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
U.S. DEPARTMENT OF COMMERCE

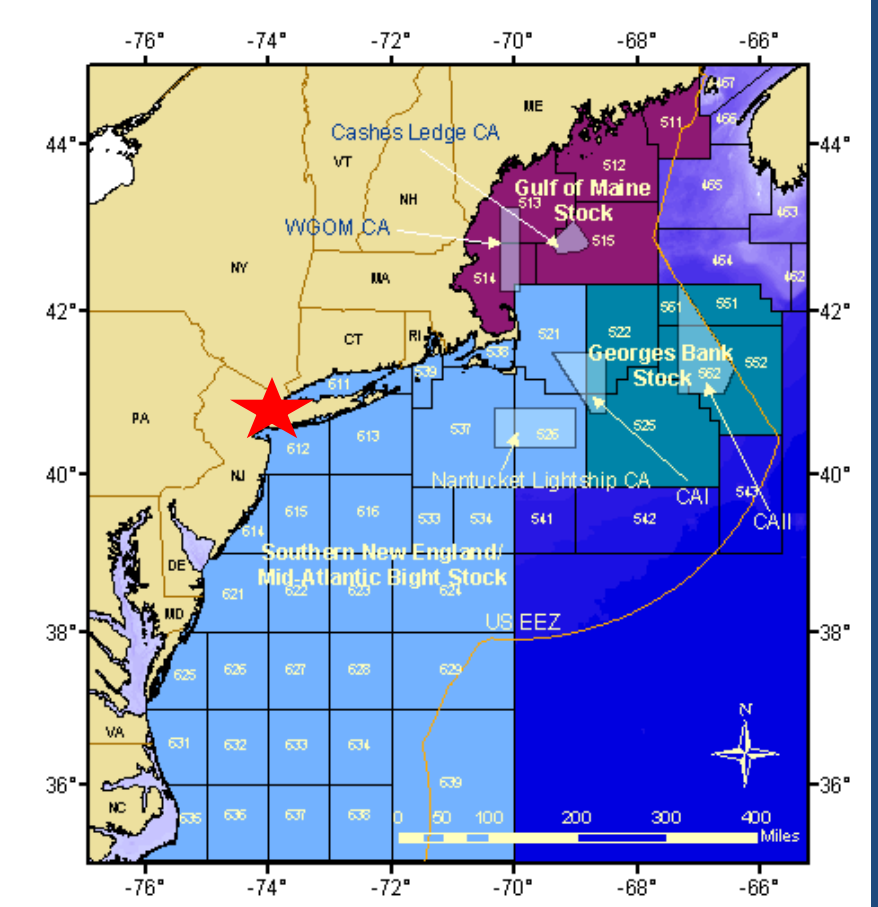


Figure 11.1. Statistical areas used to define the Gulf of Maine, Georges Bank, and Southern New England/Mid-Atlantic Bight winter flounder stocks.

## Federal Waters:

- No possession of SNE fish for federal multi-species permit holders

## Coastal Waters:

- Addendum I to FMP (ASMFC): help rebuild inshore stocks, protect spawning stocks
- Daily limits

| STOCK | COM. | REC. |
|---|---|---|
| SNE/MA | 22.5 kg | 2 fish |
| GOM | 112.5 kg | 8 fish |
| GB | 112.5 kg | 8 fish |

**If F = 0 for 2009-2014, only 1% chance stock can be rebuilt by 2014**

(GARM III Report, NEFSC, 2008)

# Winter Flounder Stock Enhancement Research at UNH

## Bringing Back Winter Flounder

Hatchery reared winter flounder are tagged with fluorescent red Visible Implant Elastomer to distinguish them from wild fish after release. Dr. Fairchild releases the flounder into shallow coastal waters at a length of about 40 mm.

The winter flounder *Pseudopleuronectes americanus* is an important commercial and recreational fish along much of North America's Atlantic coast. Inshore habitat degradation and overfishing contributed to stock declines throughout their range, leaving catches at a fraction of historical levels. Reducing fishing mortality and protecting essential habitat have helped stocks to begin recovery, but they still have a long way to go.

To accelerate the recovery of winter flounder, researchers in New Hampshire, led by Dr. Elizabeth Fairchild, are developing and evaluating a stock enhancement program. They have established the culture techniques for winter flounder, determined the optimal size for releasing juveniles for predator avoidance[1] and evaluated release sites[2]. They are now evaluating how well the released fish contribute to the natural populations and developing strategies to maximize post release survival[3].

An essential aspect of the investigation is the ability to identify individuals derived from the release program. This is achieved using NMT's Visible Implant Elastomer (VIE). Critical characteristics of VIE include the ability to tag small fish, the capacity to identify different batches of fish, the rapid rate of tagging that can be achieved, and the low cost tag.

Please contact us to discuss our systems for tagging aquatic organisms.

1. Fairchild EA, Howell WH. 2000. J. Sea Research 44(1-2):81-90.
2. Fairchild EA et al. 2005. Aquacul. Res. 36(14):1374-1383.
3. Fairchild EA, Howell WH. 2004. J. Fish Biol. 65:69-87.

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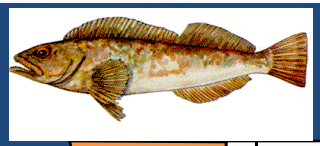
# SCIENCE CONSORTIUM FOR OCEAN REPLENISHMENT



# Responsible Approach to Enhancement

- Core issues associated with developing and evaluating stock enhancement programs
- Broad, integrated view of how to do it
- Blankenship and Leber (1995) and Lorenzen et al. (2010)

1. Initial appraisal & goal setting
2. R & D, including field studies
3. Implementation & adaptive management

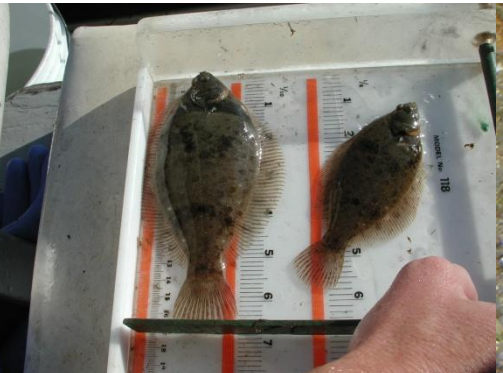
# Research Phase - Experimental Releases

- ✓ Culturing techniques established
- ✓ Tagging studies completed
- ✓ Acclimation needs researched
- ✓ Acclimization benefits known
- ✓ Release strategies (mostly) determined

**Next step…large-scale pilot releases to validate experimental studies**

# Overall Goals

- Determine if winter flounder stocking is a viable management tool
- Use Martha's Vineyard, MA as the demonstration site
- Restore local winter flounder fishery



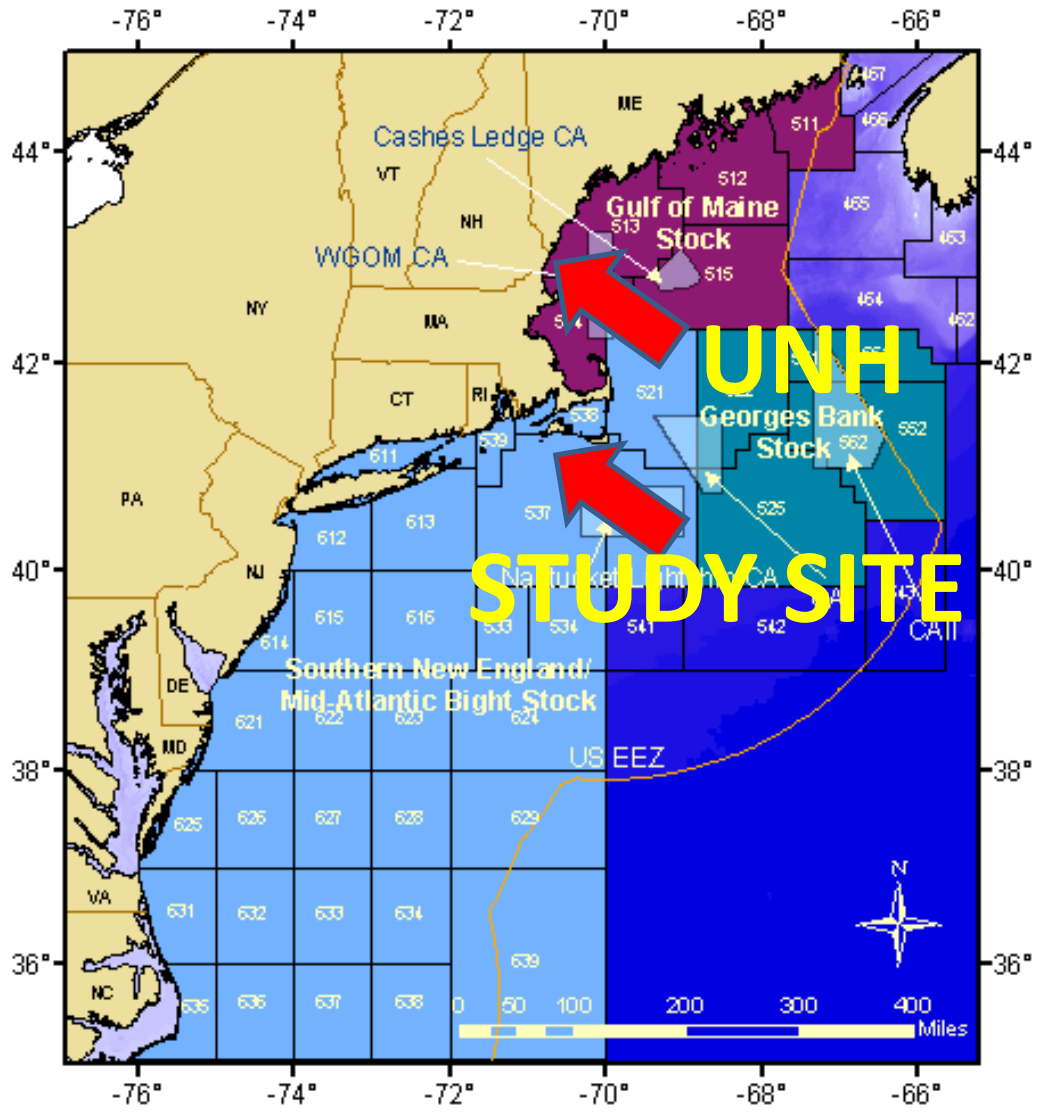

# Determine Appropriate Stocking Strategies for Winter Flounder

- Where to release?
- When?
- How?
- Potential problems & mitigation
- What size fish to release?
- Tags

Site- Specific



# Project Locations



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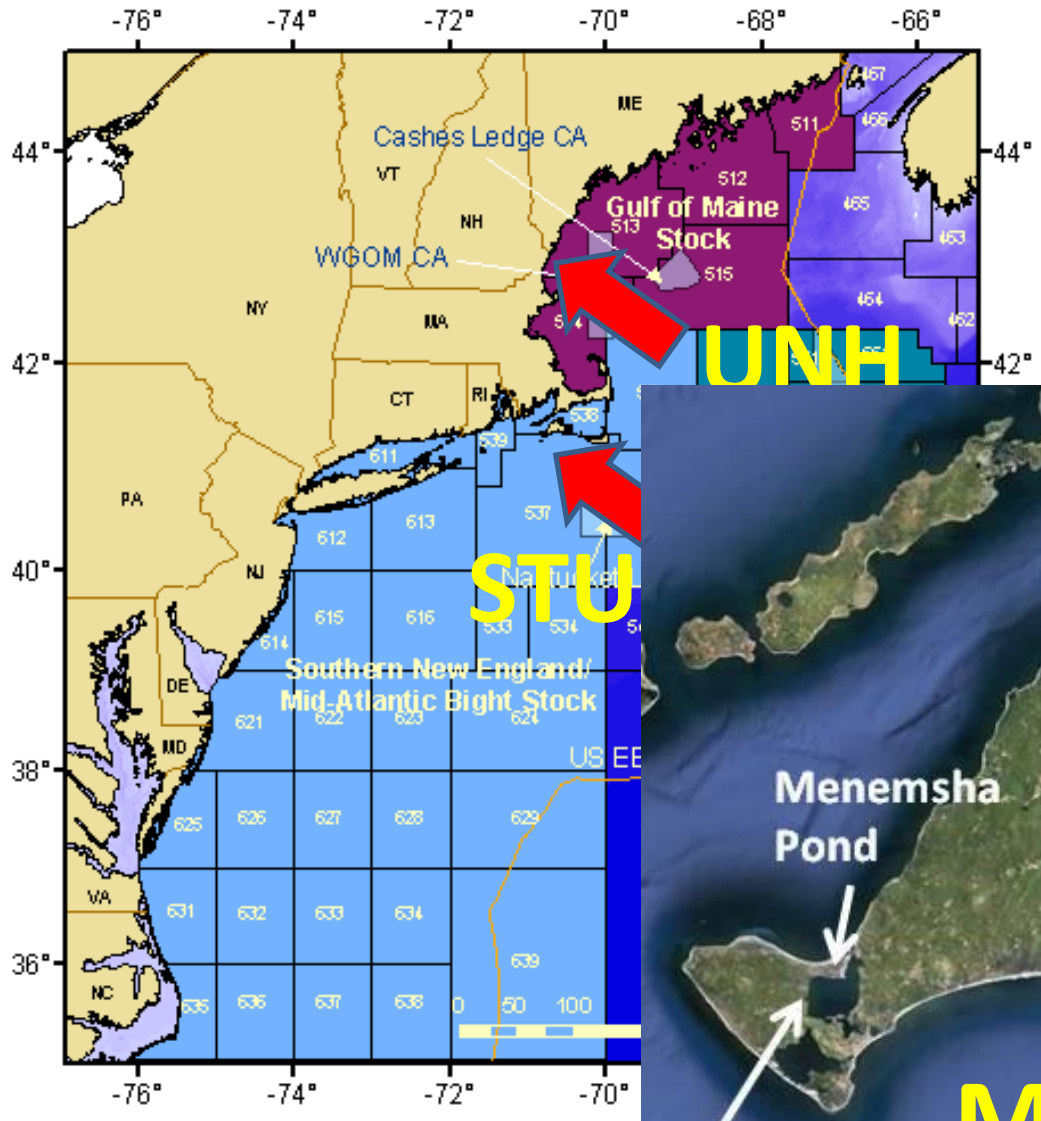


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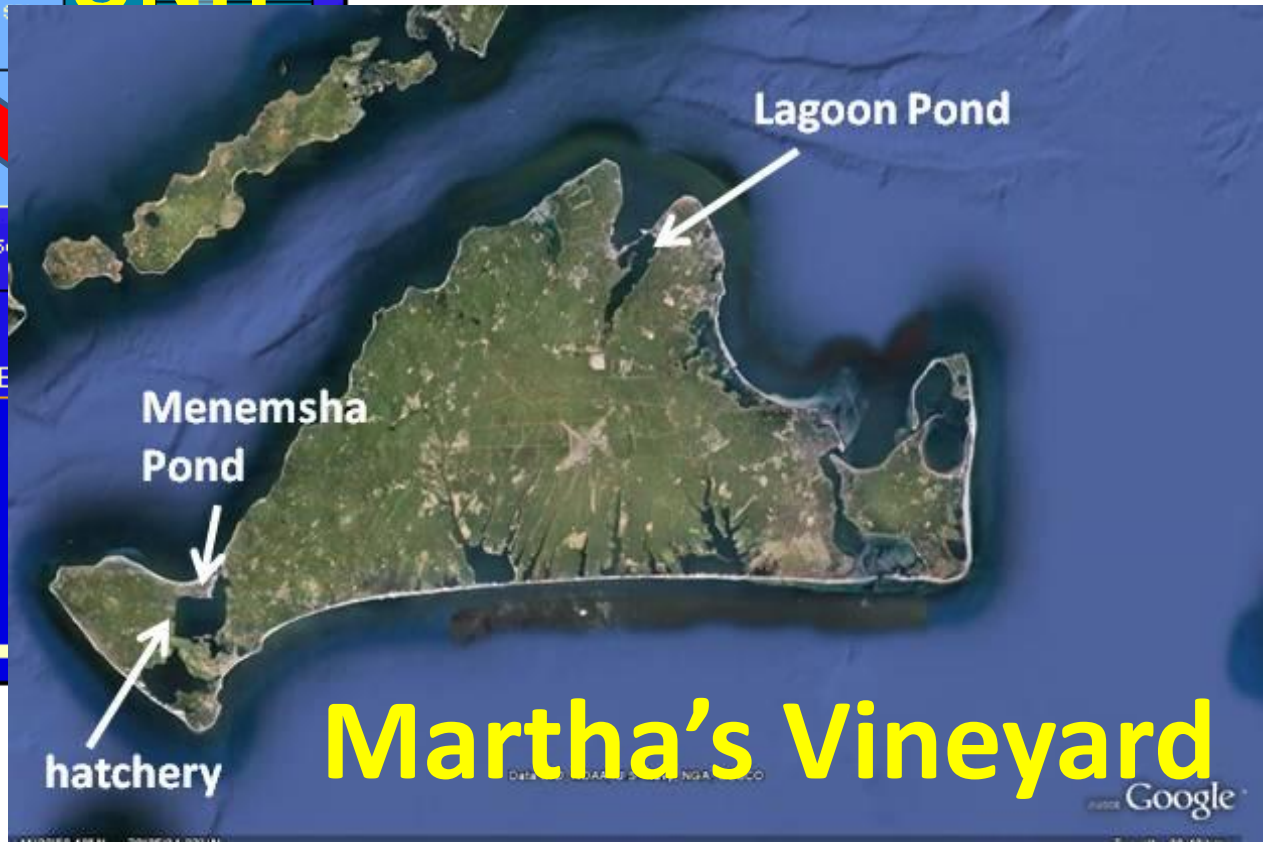


# Ecosystem Analyses

- **Quantitatively determine optimal release strategy through extensive sampling program**
- **Site and Season**
  - **wild winter flounder populations**
  - **potential predators**
  - **available prey**
- **When and How – based on predators**
- **Size – determined by season**
- **Tag – determined by size**

# Sampling Sites

## Lagoon Pond


## Menemsha Pond


**4 sites/estuary sampled biweekly for 12 months**

# Site and Season

## Water quality

- Fixed stations and when sampling
- Temp, salinity, dissolved oxygen

## Beam trawl and beach seine

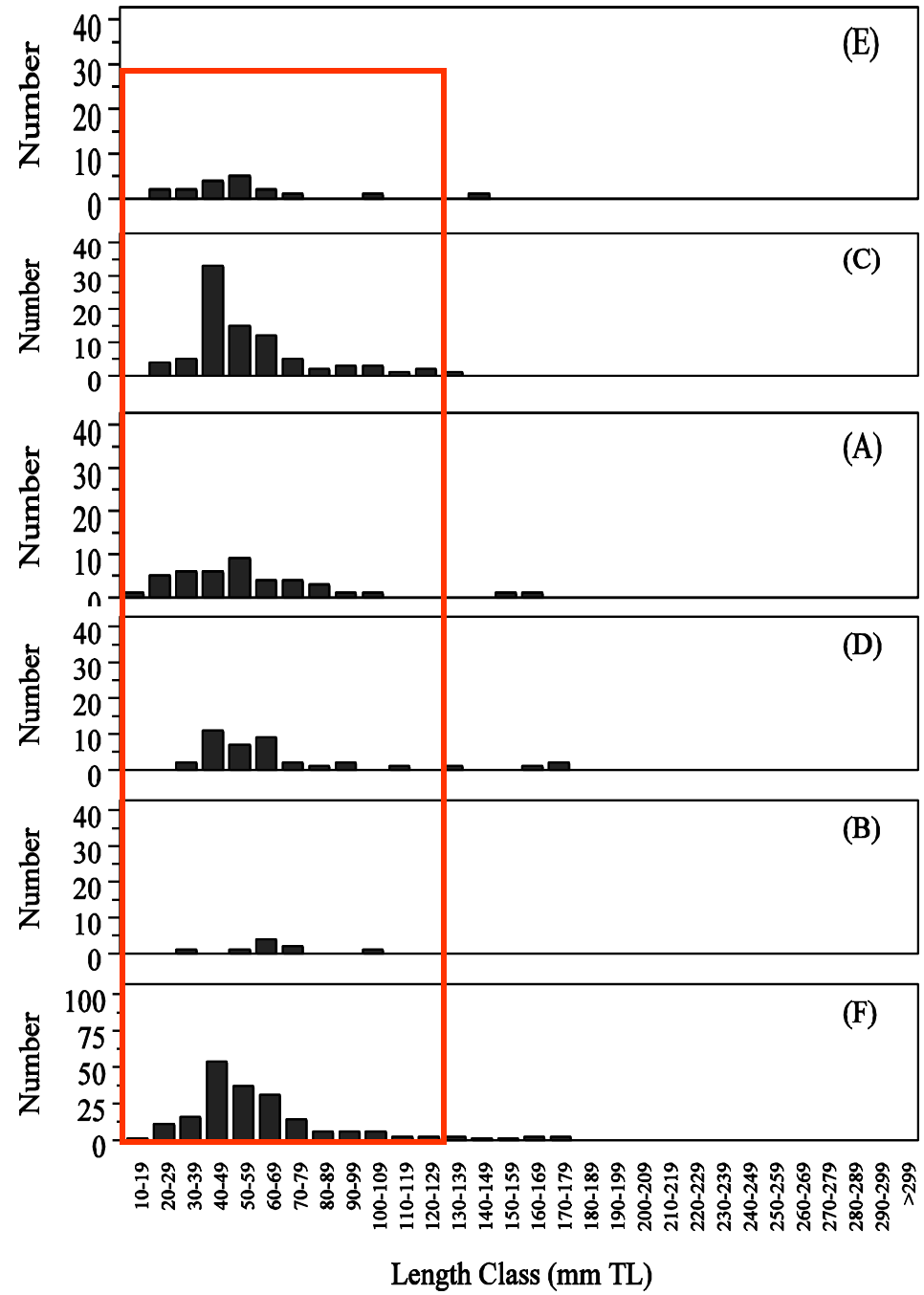
- To know what fish and macro-invertebrates are in the estuaries
- Winter flounder, their predators, their competitors…


# Site and Season

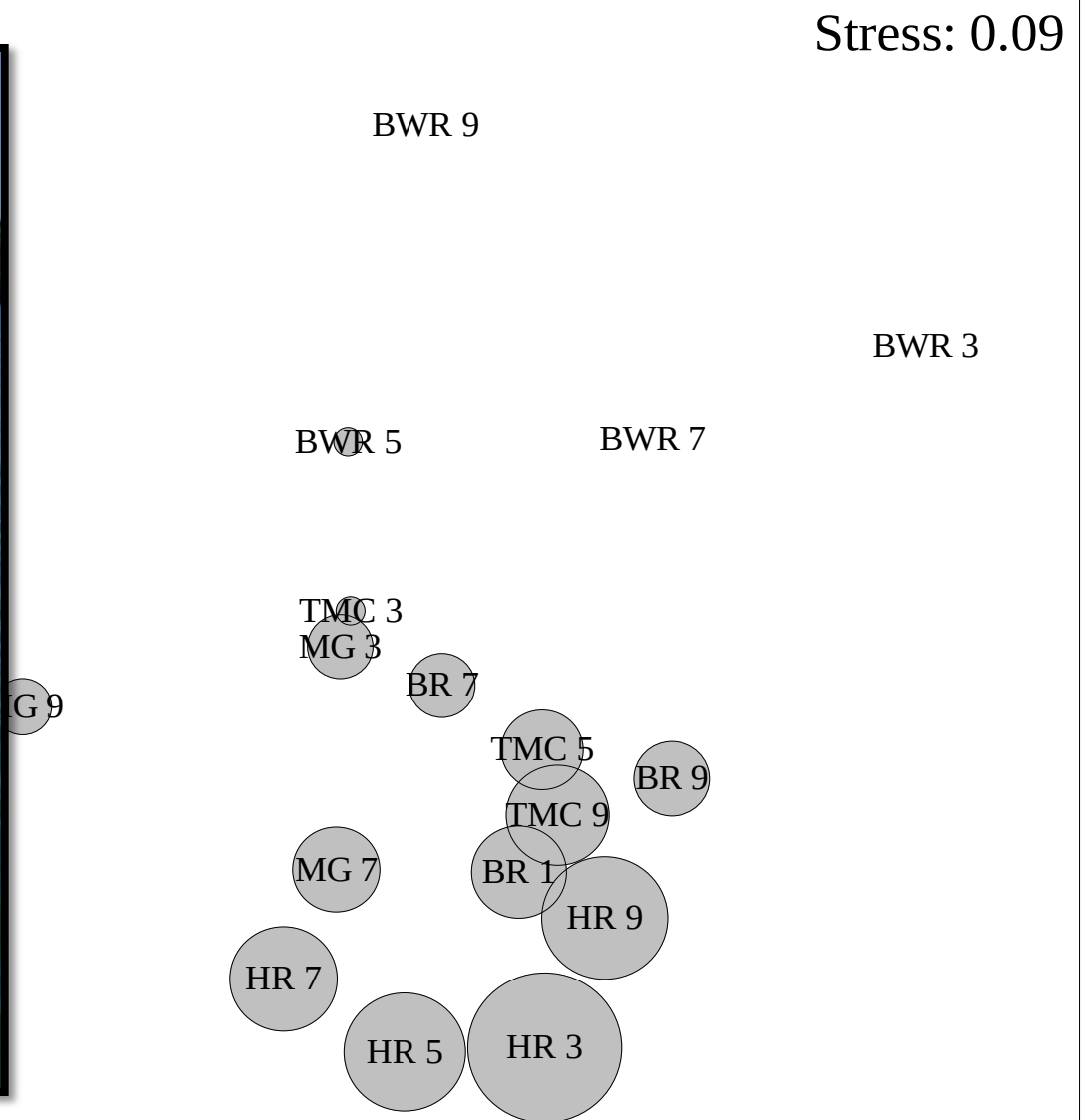
## Benthic Cores

- To know juvenile winter flounder food availability
- Carrying capacity (k)

# Site and Season
## (based on wild flounder)




# Site and Season
## (based on prey availability & wild flounder)

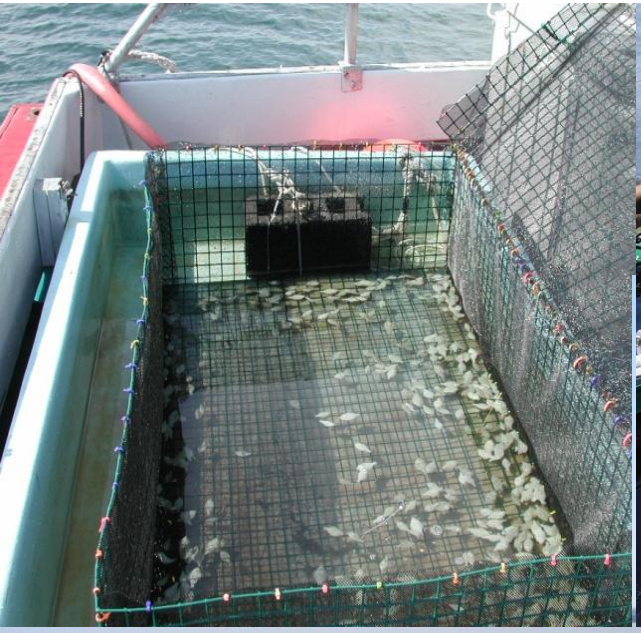


# Season

- **“Timing is everything”**
  - **When prey are most abundant**
  - **Predators least abundant**
  - **In synchrony with wild population**
- **Will vary by latitude and the natural seasonal progression of wild populations**



# Conditioning/Acclimation Necessary?

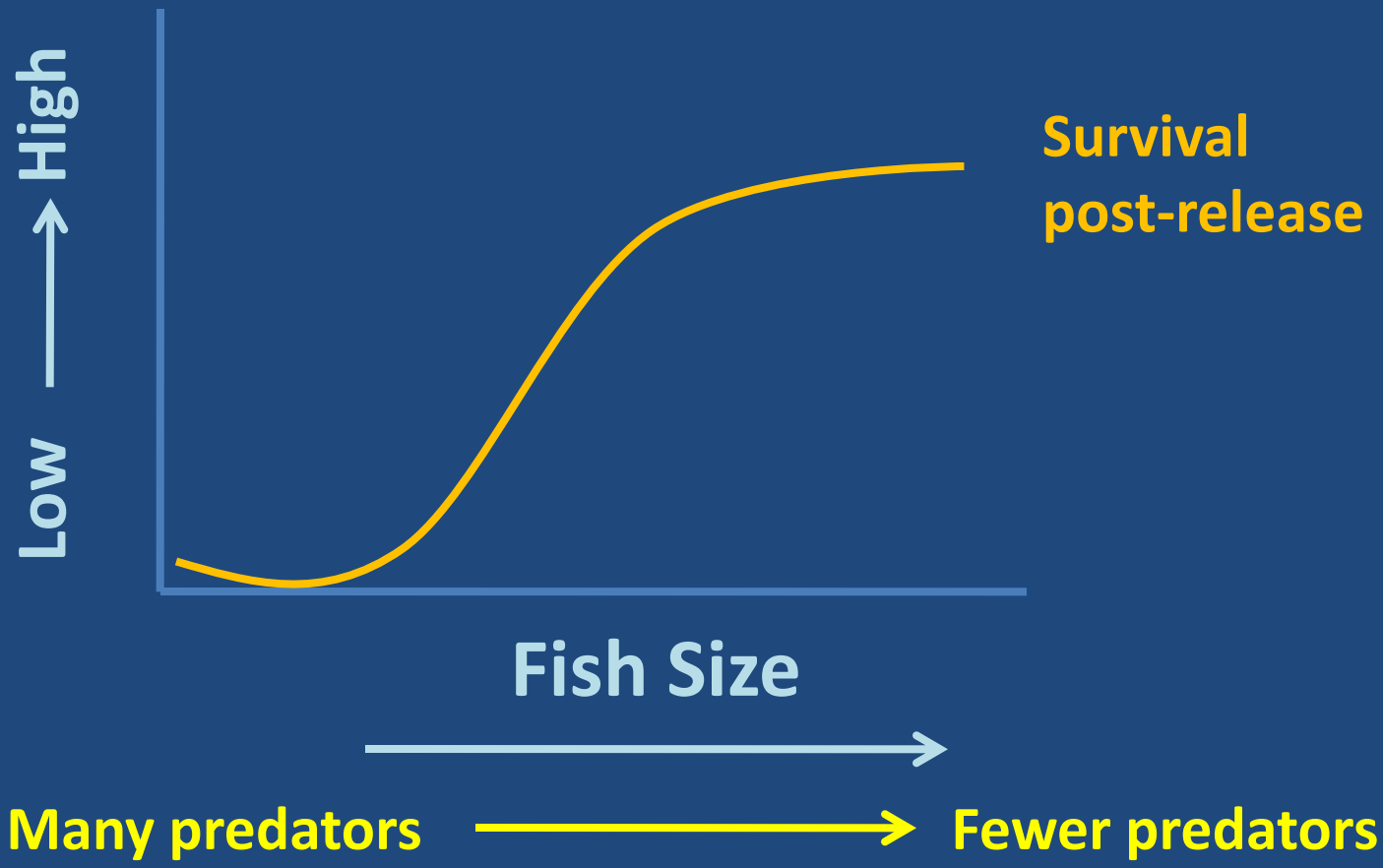



**Dependent on:**

1. **Predator complex and behavior**

2. **Release size**

# Size at Release



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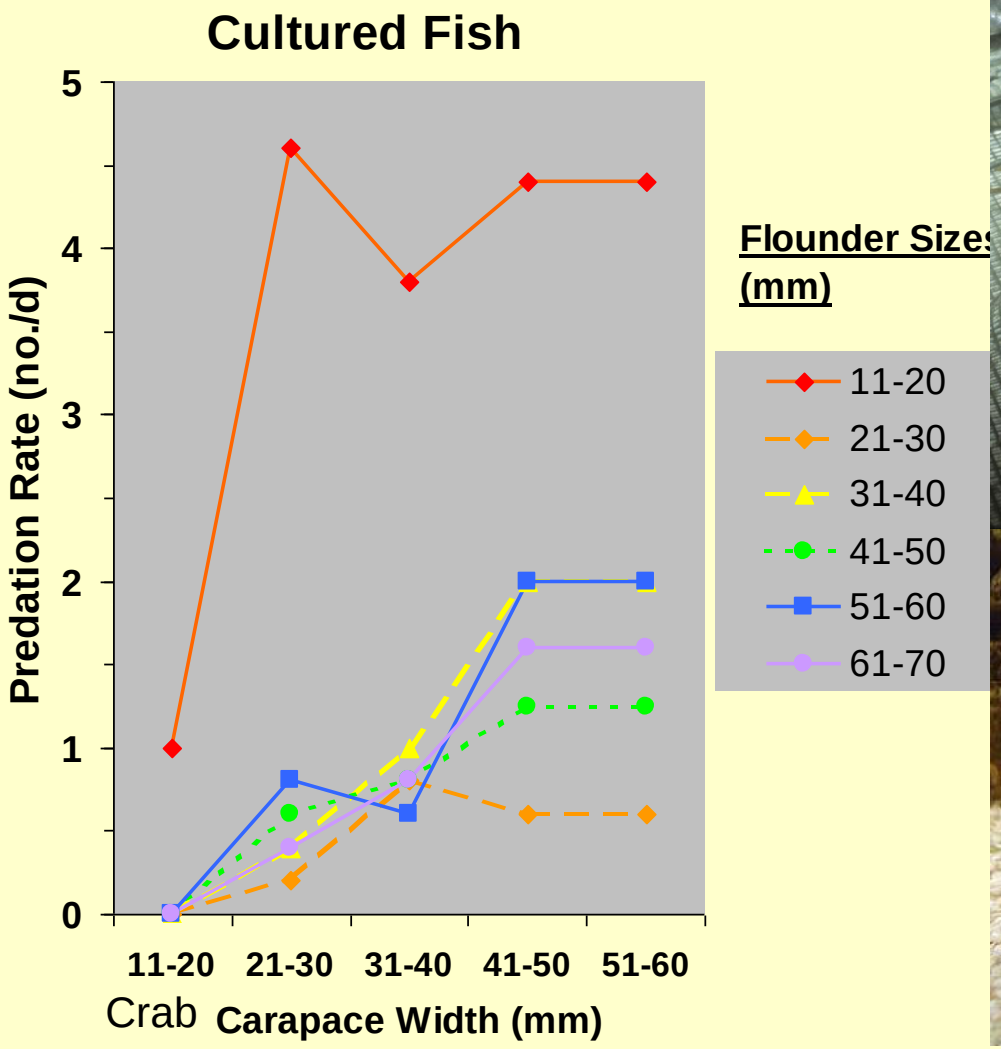



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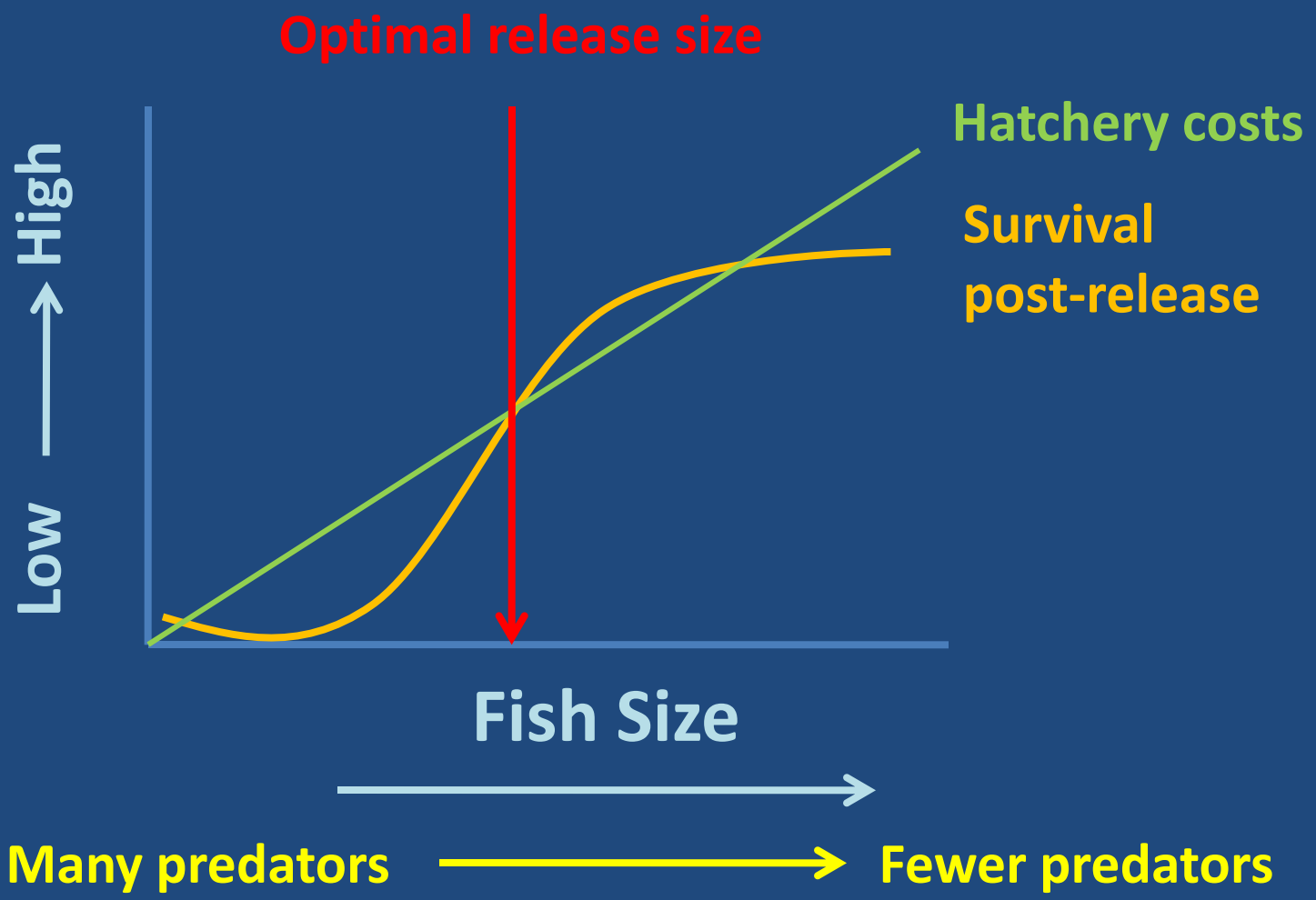


# Tags: VIElastomer



**Northwest Marine Technology, Inc.**

# Tags: T-bar


**Hallprint Fish Tagging Solutions**

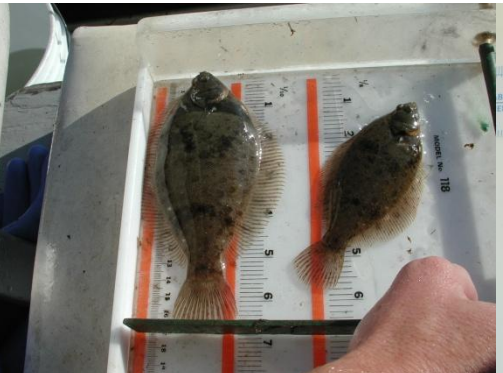
# Project Timeline

- **Ecosystem Analyses**
  - November 2010 through October 2011
  - Finishing 6th month
  - Analyses to be completed December 2011
- **Hatchery Phase**
- **Large-scale Pilot Release**
- **Evaluate Success**



# Determine Appropriate Stocking Strategies from Surveys

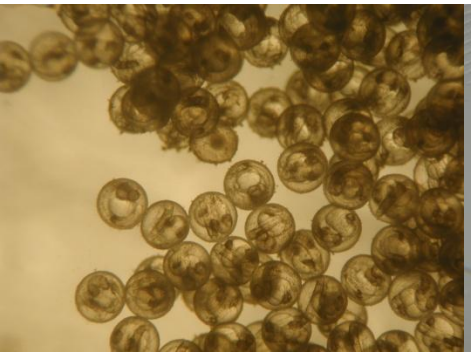
- Identify which season(s) and site(s) show promise for winter flounder stockings.
- Determine the most successful size-at-release for cultured winter flounder.
- Select best tag for released fish.





# Large-Scale Pilot Release

- Rear, tag, and release 50,000 fish
- Test and compare two different release strategies (acclimated vs. direct)
- Evaluate success of the releases




# Evaluate Success

- **Estimating the mortality (survival) of released fish.**
- **Describing the diet transition in released fish.**
- **Studying the movements of released fish.**

**LOTS OF POST-RELEASE SAMPLING!!!**




# Will it work???

## STAY TUNED…

## To be continued at the 5th ISSESR!




# Acknowledgements


## Vineyard Participants:

Town of Tisbury, MA

Town of Oak Bluffs, MA

Town of Chilmark, MA

Wampanoag Tribe of Aquinnah (Gay Head)

Dukes County/Martha's Vineyard Fishermen's Assoc.

Many volunteers

## UNH Staff:

Nate Rennels

Shelley Edmundson

Kristin Garabedian

Kim Little

Ken La Valley

Erik Chapman

Michael Chambers

Jon Pennock

Numerous undergraduates!






謝謝
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# More Resources

1. http://winterflounderenhancement.blogspot.com/ Blog about this project
2. www.amac.unh.edu

   Atlantic Marine Aquaculture Center
3. www.StockEnhancement.org

   Science Consortium for Ocean Replenishment (SCORE)