

# Science and Management of the Narragansett Bay Quahog: A Review



**M. Conor McManus**



**Rhode Island Quahog Commission**

**October 24, 2023**

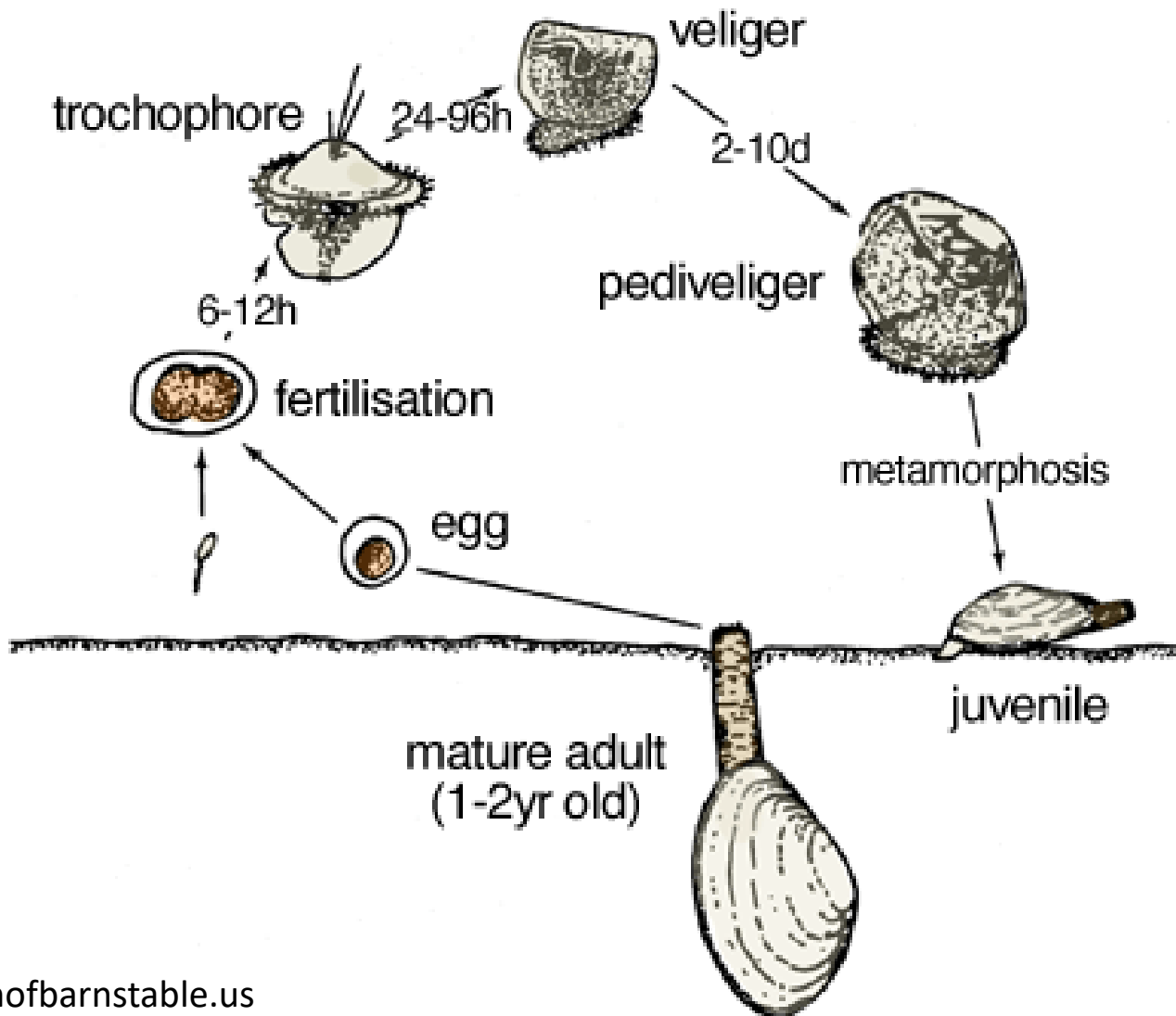
# Hard clam, or Quahogs

- Filter-feeding bivalves
- Prefer complex-sandy substrate.
- Strong recreational, commercial, and cultural significance.
- Various market classes
  - Chowders
  - Cherry Stones
  - Top Necks
  - Little Necks

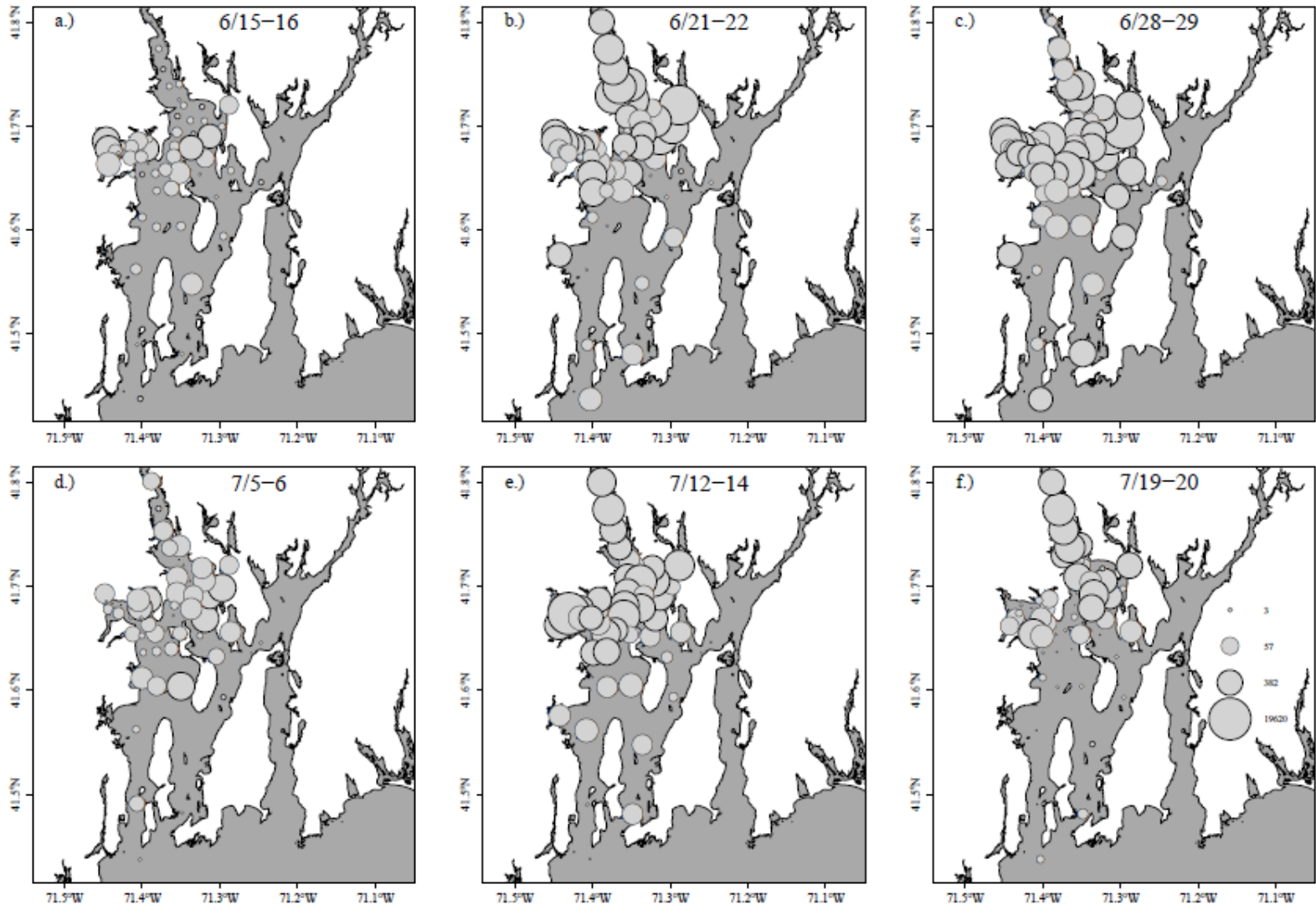
↑  
Increase in size



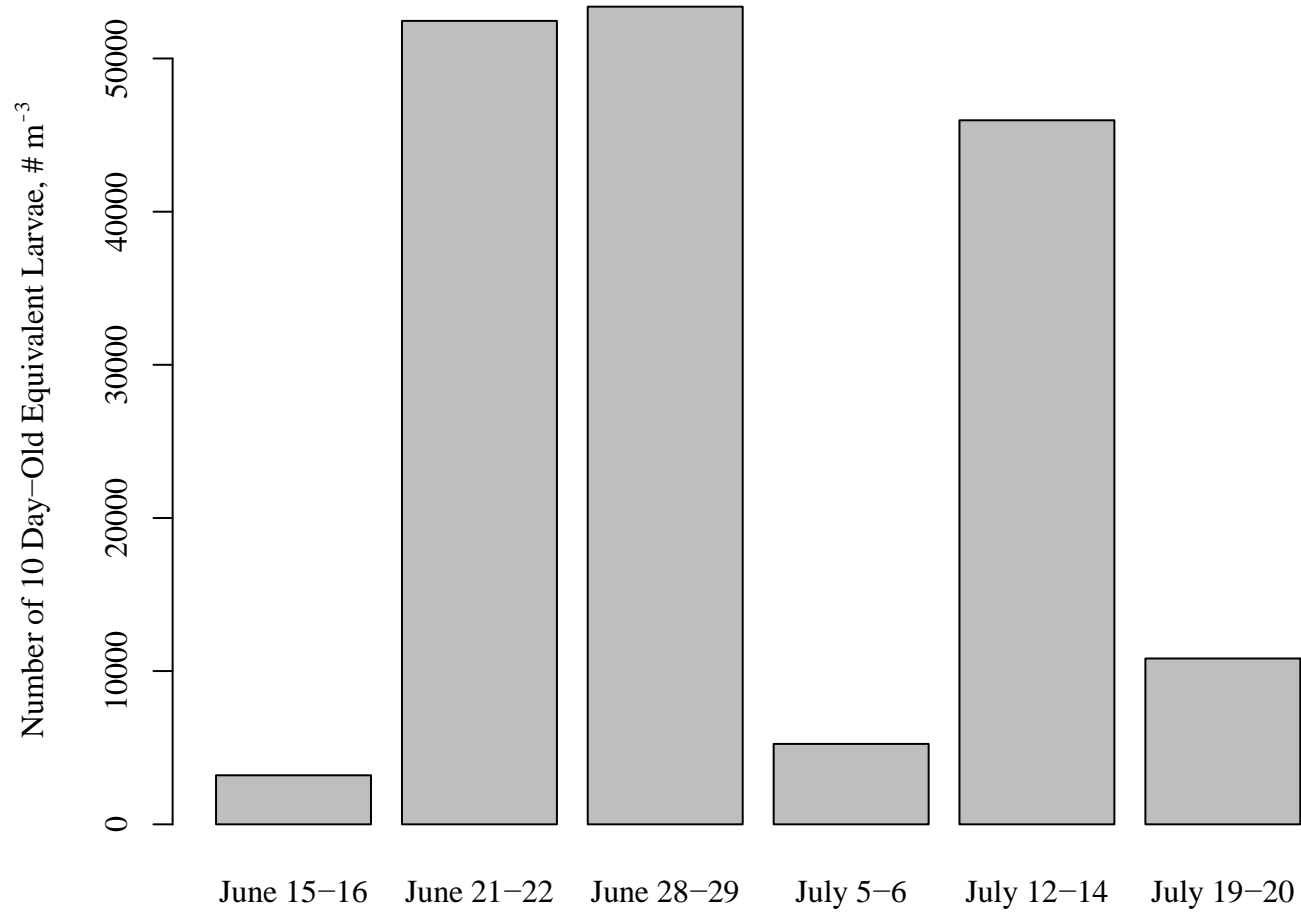
# The Quahog Life Cycle



# Quahog Spawning



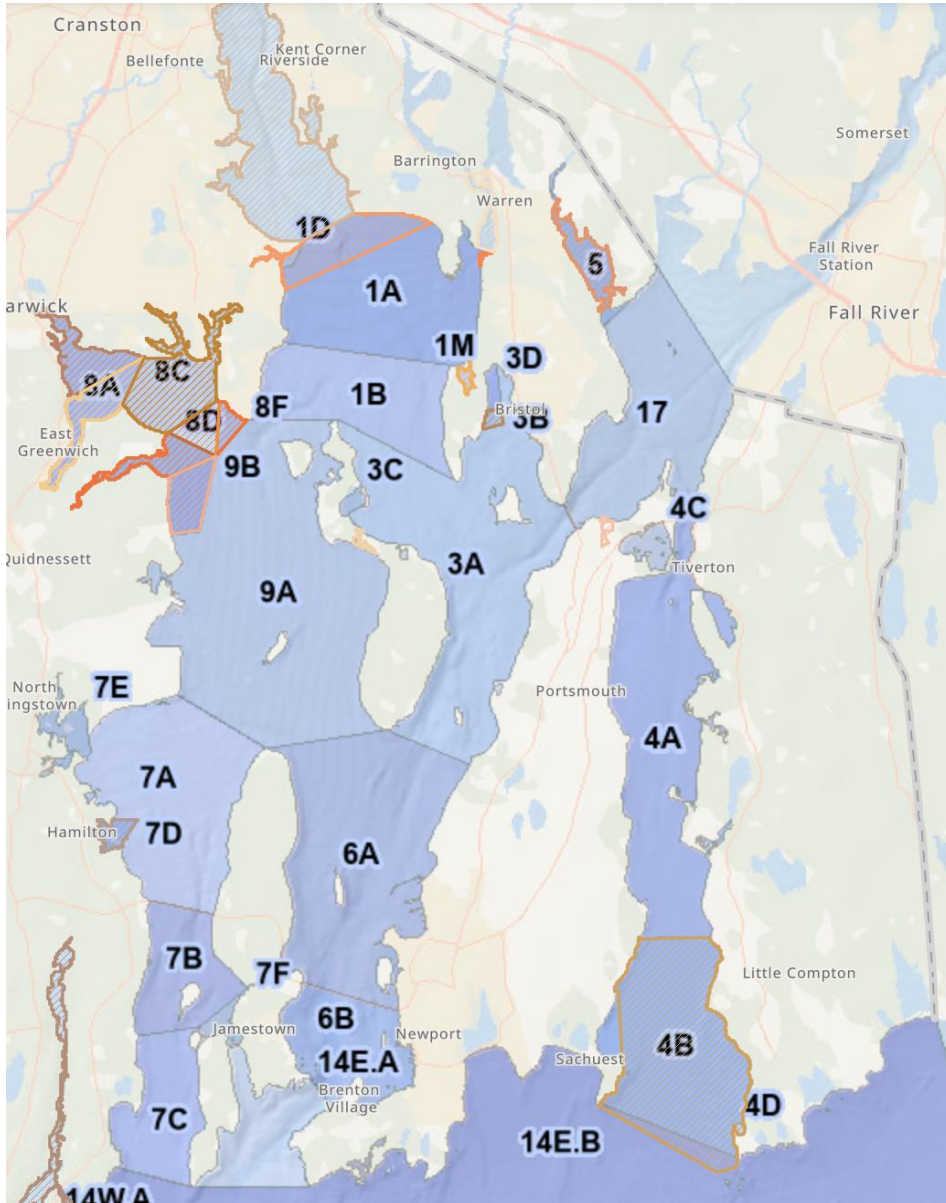
# Quahog Spawning



# RI Shellfish Management

## Shellfish Management Areas

- Implement regulations on harvesting quahogs.
  - Size (1" hinge width).
  - Possession limit (bushels).
  - Weekly and seasonal openings.
- Areas where shellfish are harvested are reported to dealers to track fishing effort spatially.



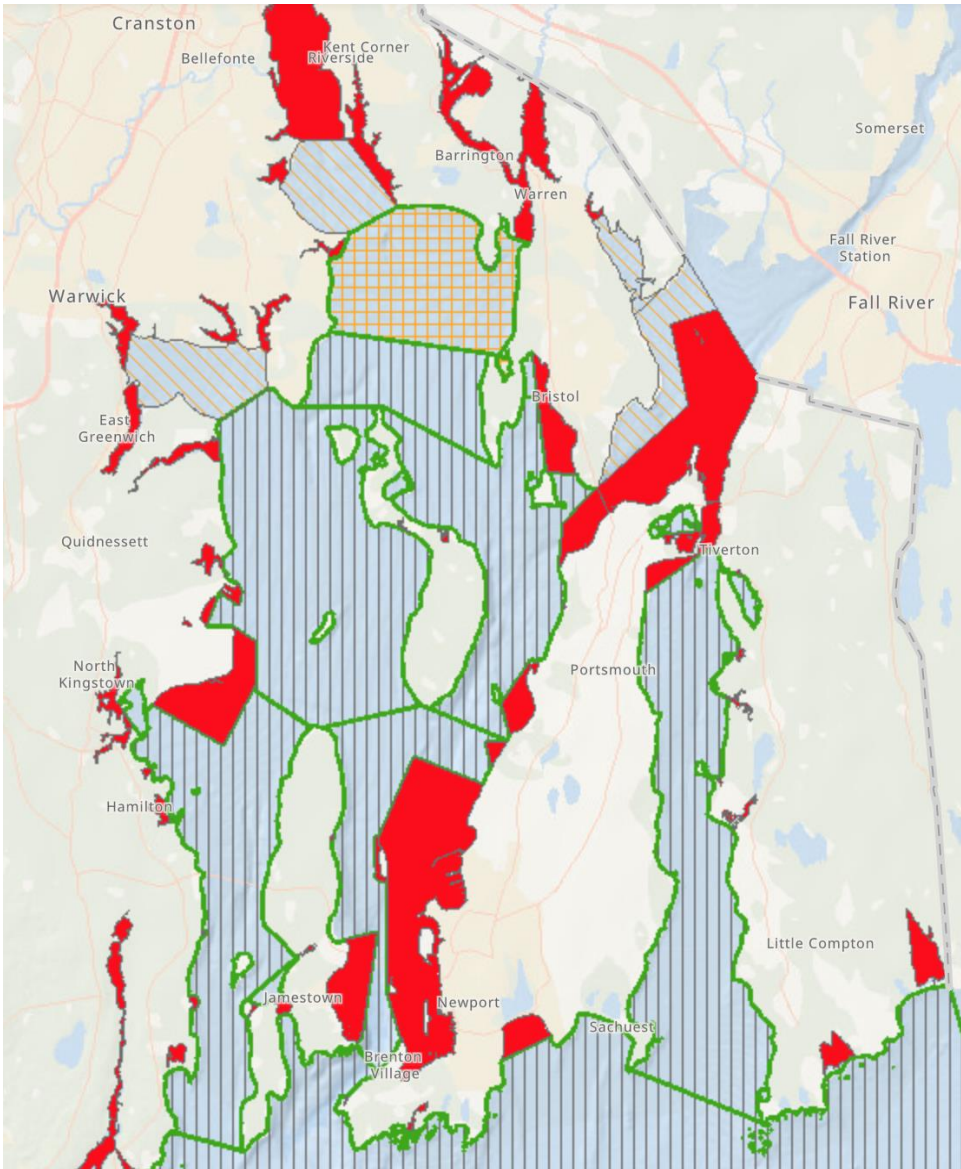
# RI Shellfish Management

## Shellfish Management Areas

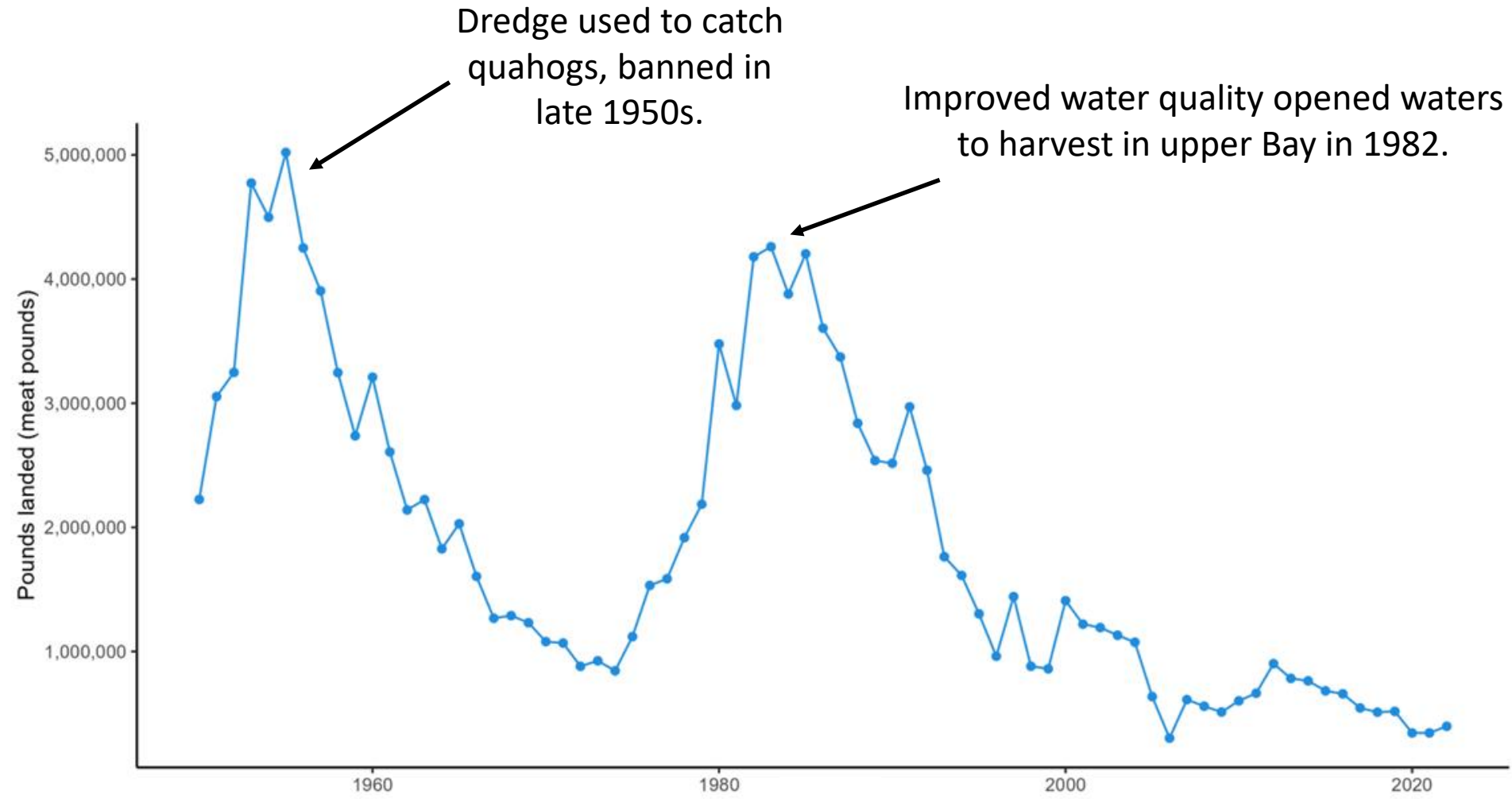
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## Water Quality

- Areas permanently closed to shellfish harvest due to effluent runoff. (Greenwich Bay Coves).
- Conditionally closed during high rainfall events and increased effluent loading (Lower Providence River, Upper Narragansett Bay).



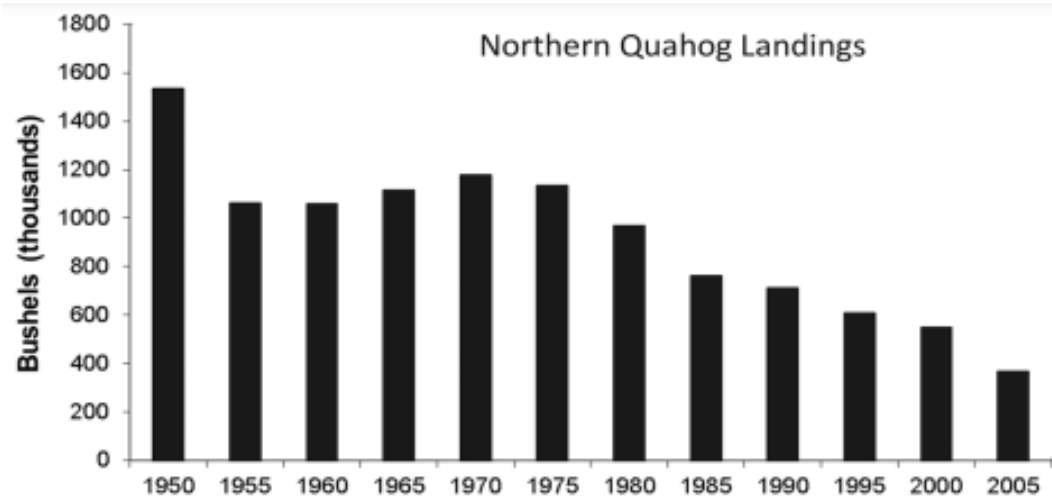
# Harvesting History – Rhode Island Quahog Landings



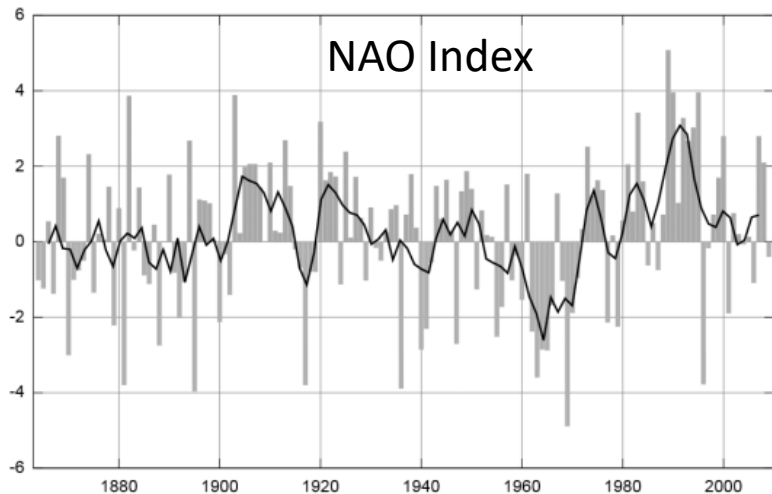


# Synchrony in Shellfish Declines?

- Overtime, many Atlantic states have seen similar declines in quahog landings.
- Similar declines have also been observed in other shellfish (oysters, bay scallops, soft shell clams).



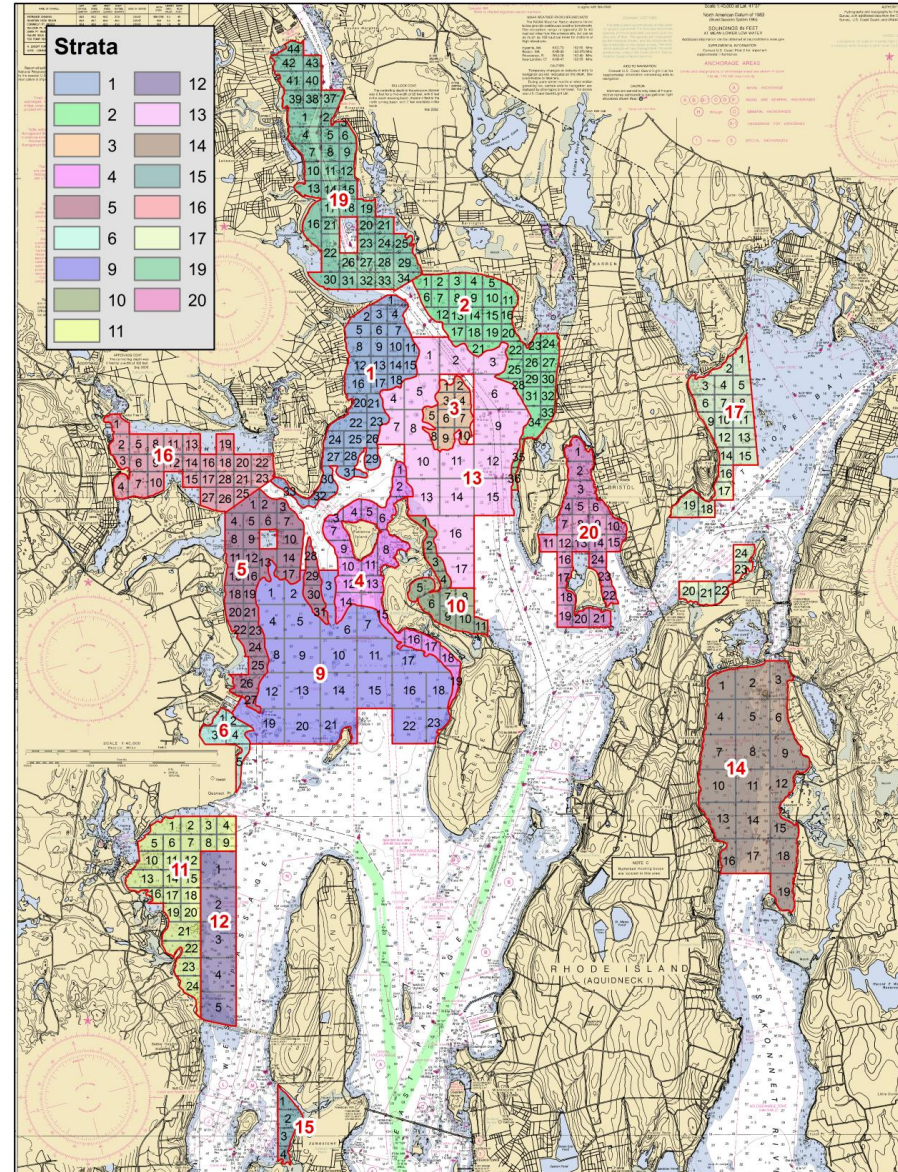
Year	MA	RI	NY <sup>2</sup>	NJ	VA	Total
1950	167.8	185.0	643.0	423.0	115.0	1,534.5
1955	88.3	418.3	221.4	260.0	74.0	1,062.0
1960	117.0	267.0	324.0	212.6	138.4	1,059.0
1965	88.3	169.0	495.6	156.1	207.3	2,982.0
1970	104.8	90.0	658.8	214.6	110.8	1,179.0
1975	92.5	93.3	722.0	135.0	90.7	1,133.8
1980	133.2	289.8	412.3	70.4	62.8	968.4
1985	114.3	345.4	156.4	86.3	59.8	762.1
1990	91.7	209.6	205.3	103.1	129.9	739.5
1995	83.3	108.6	219.0	118.8	78.7	608.4
2000	62.5	117.0	196.0	135.0	37.0	547.5
2005	37.2	53.5	134.7	154.3	16.0	395.7
2010	75.0	50.0	117.0	127.6	12.7	382.3



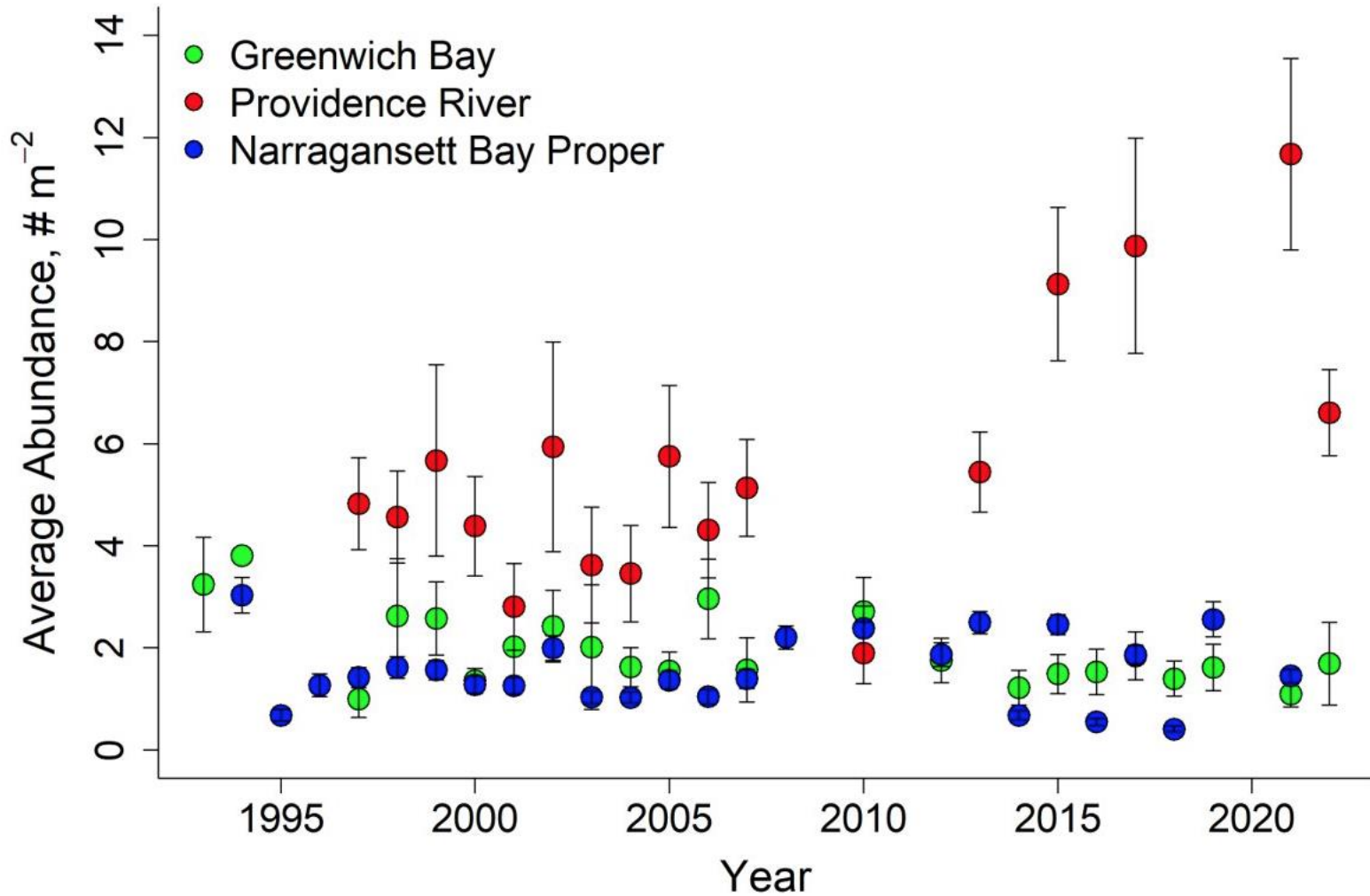
Theory: shellfish landings linked to larger scale climate conditions (North Atlantic Oscillation).

# Scientific Monitoring – Dredge Survey

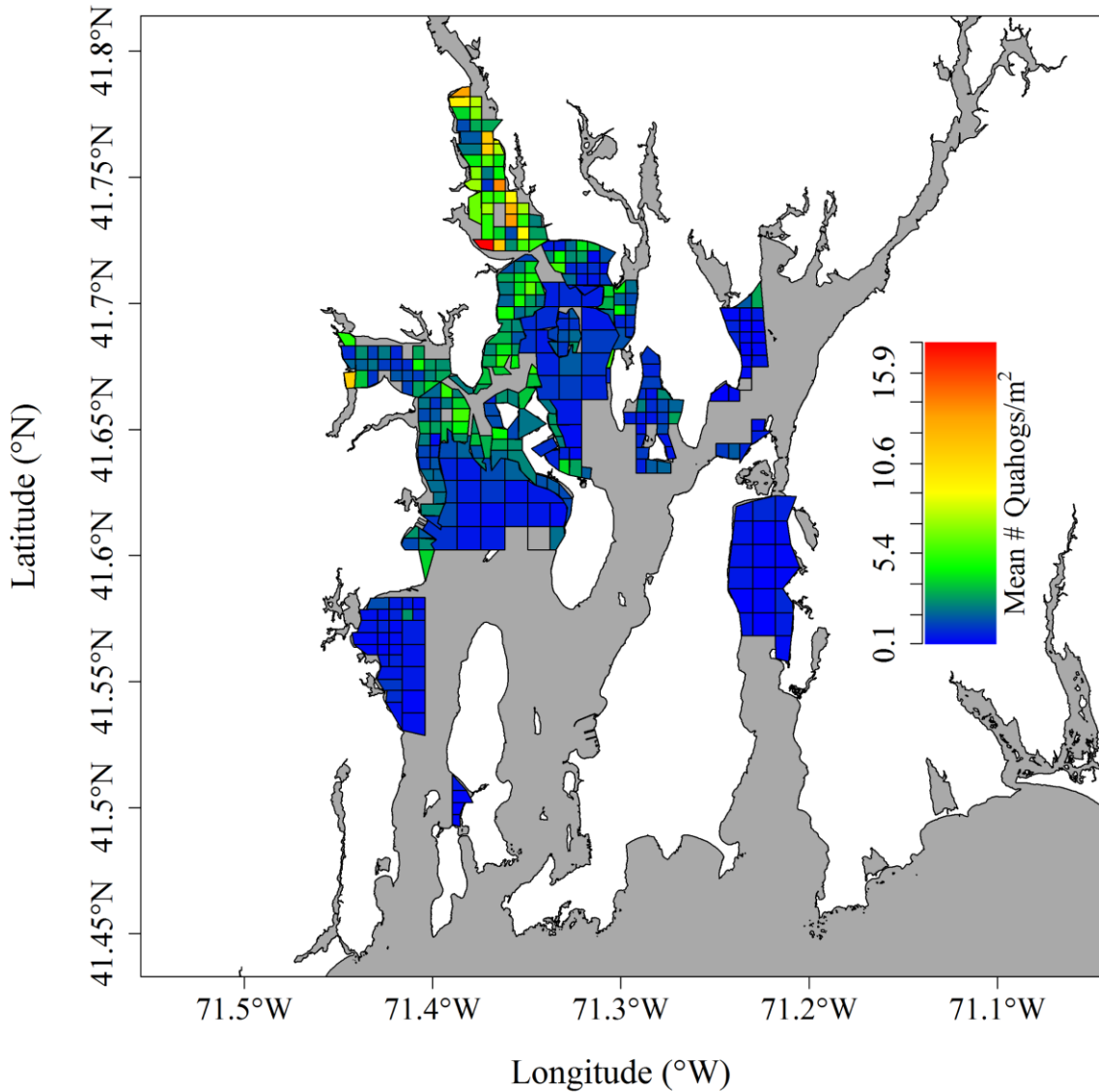
- Use hydraulic dredge to sample adult populations.
- Began in early 1990s.
- Sampling at discrete stations across Narragansett Bay.
- Count and measure quahogs (i.e. abundance and size information).



# Dredge Survey - Abundances Over Time



# Dredge Survey - Abundances Over Space



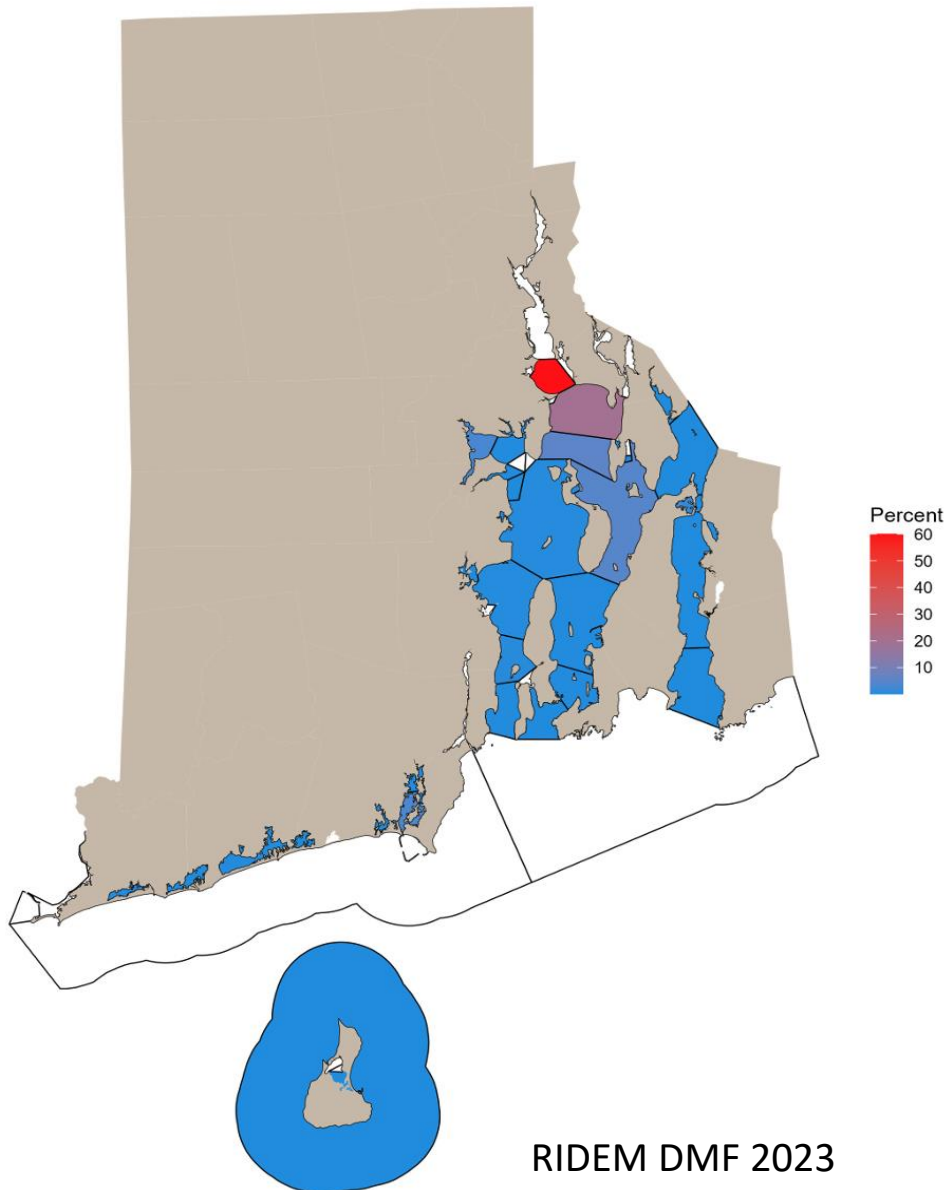
Abundance greatest in northern and inner parts of Narragansett Bay.

These areas are often tied to those with:

- Greater nutrient and plankton concentrations.
- More influence from rivers.
- Warmer waters.
- More stratification.
- More low-oxygen events.

Upper Bay areas are consistently more closed than lower Bay areas due to water quality (i.e. no harvest permitted).

# Quahog Landings - Landings Over Space

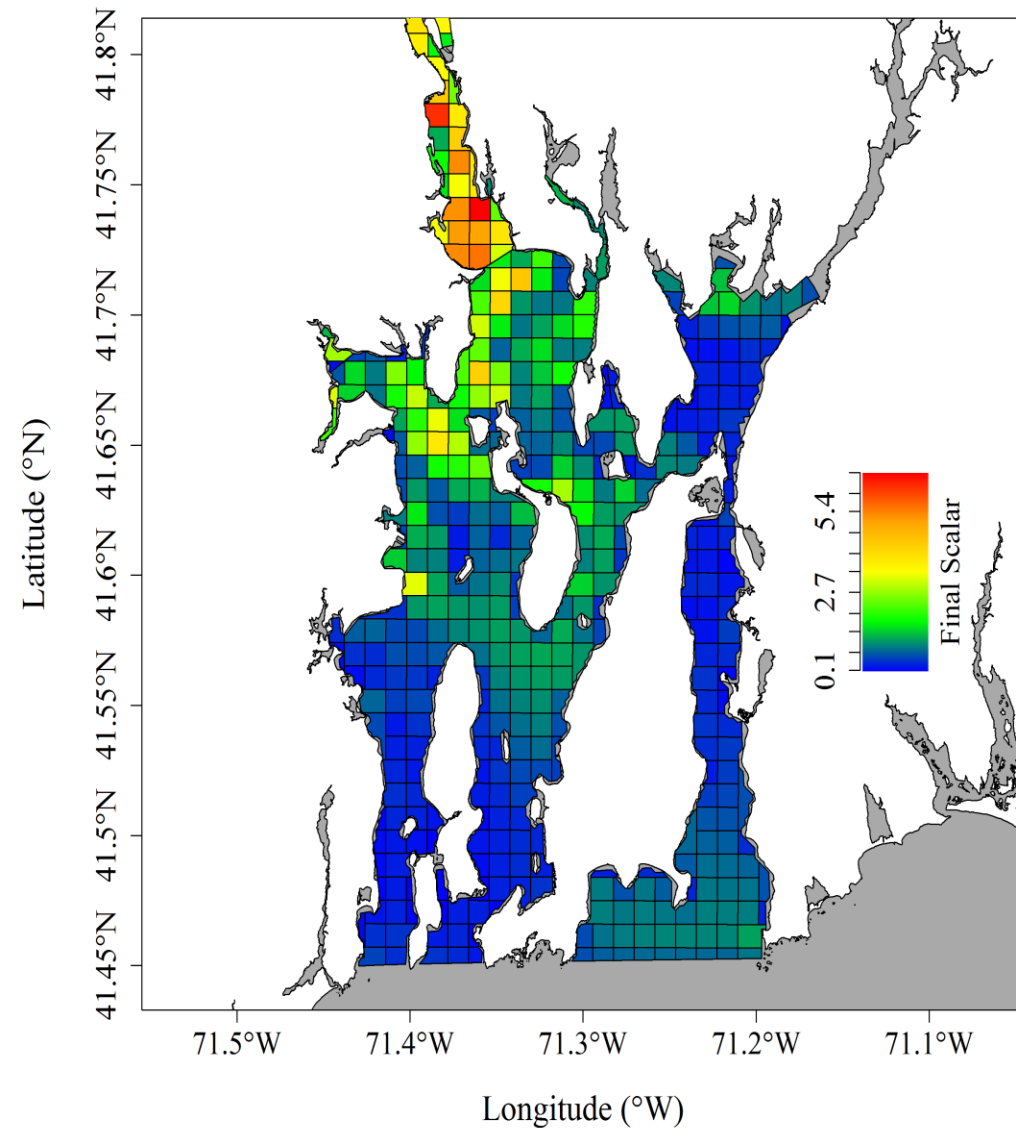


Greenwich Bay and Upper Narragansett Bay have long been major harvest areas.

High abundance areas from the dredge survey have generally corresponded to where landings occur.

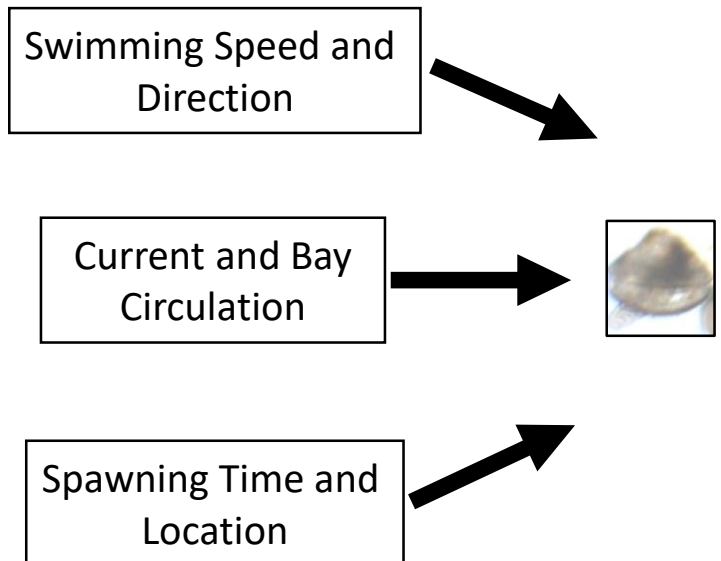
Since opening the lower Providence River, this area can now constitute up to 60% of landings annually (2022), but largely dependent on rain closures.

# Quahog Larval Transport: Population Connectivity



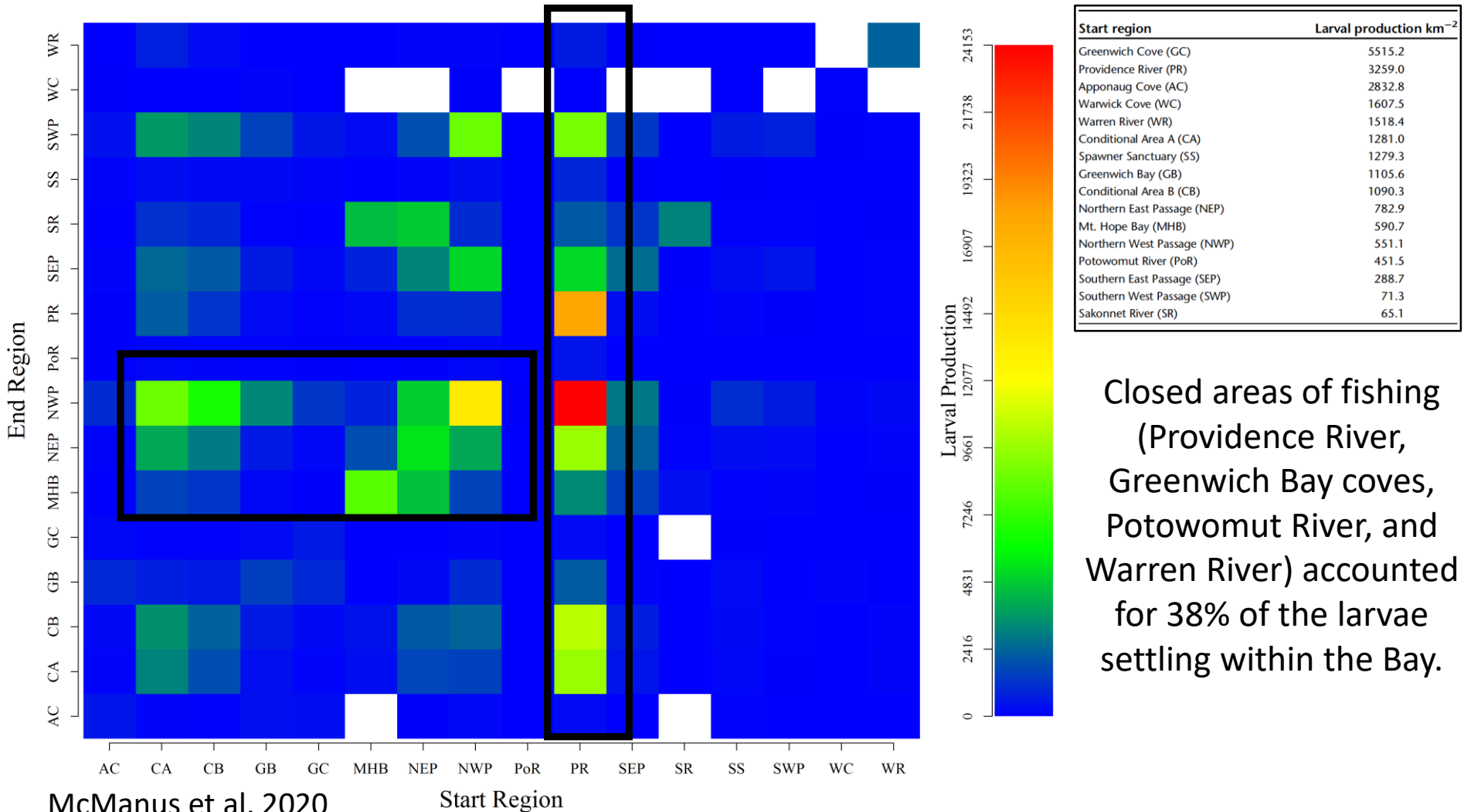
As previously closed areas are opened to harvest with improved water quality, what could that mean for areas that rely on a closed areas to provide larvae (i.e seed)?

Using ocean circulation models, we looked to understand connectivity between quahogs across the Bay through larval transport.

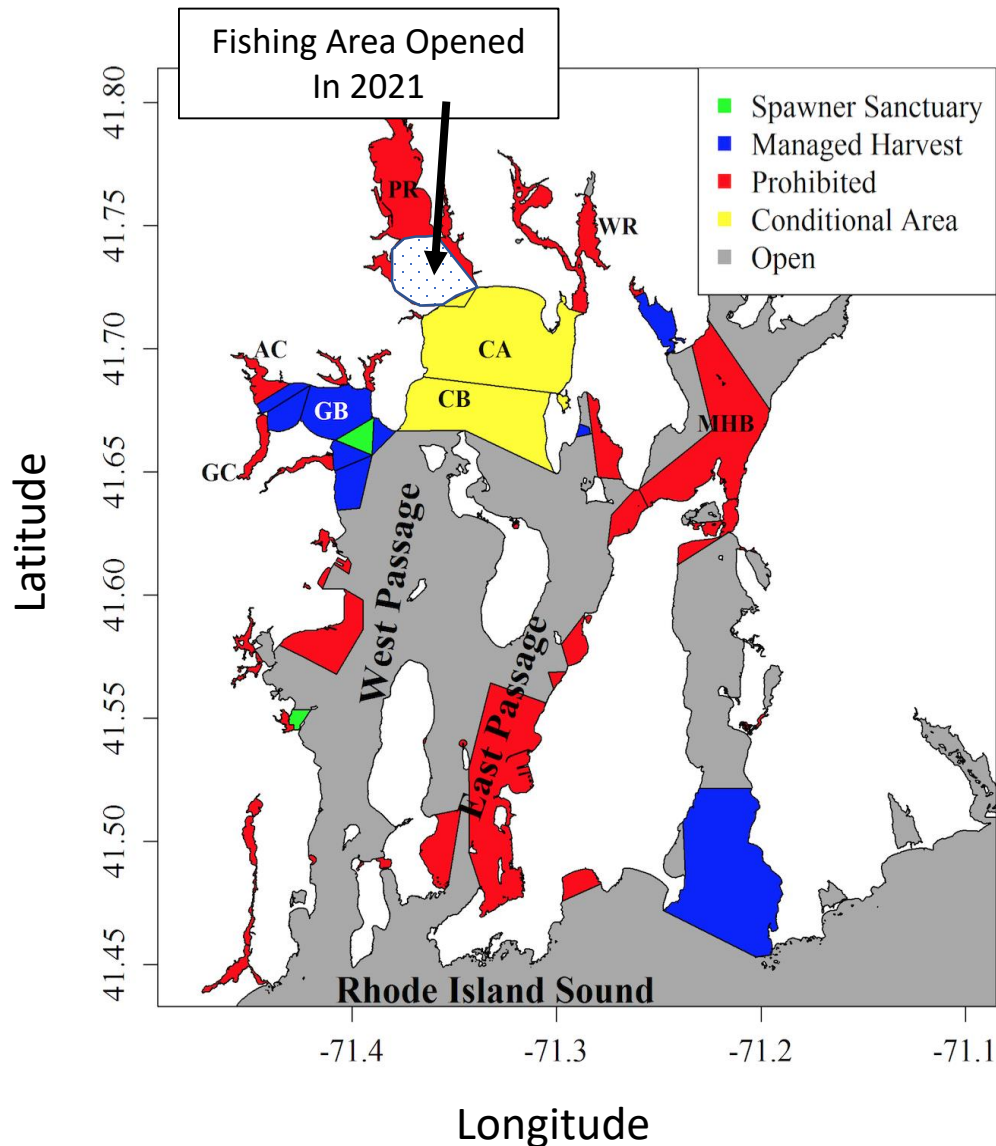


# Quahog Larval Transport: Population Connectivity

The Providence River is the dominant single-source contributor for larval production.



# Quahog Larval Transport: Population Connectivity

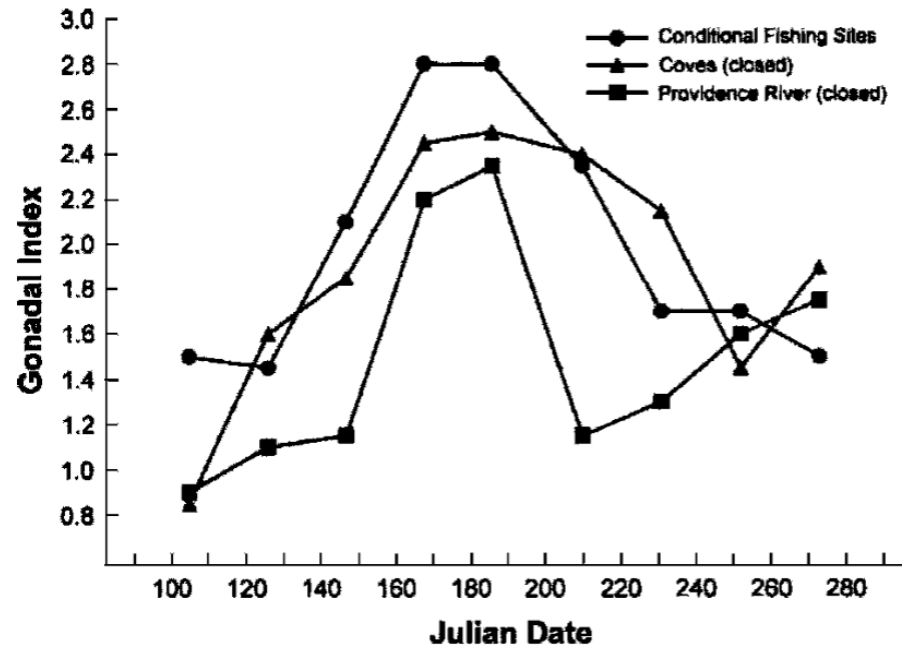
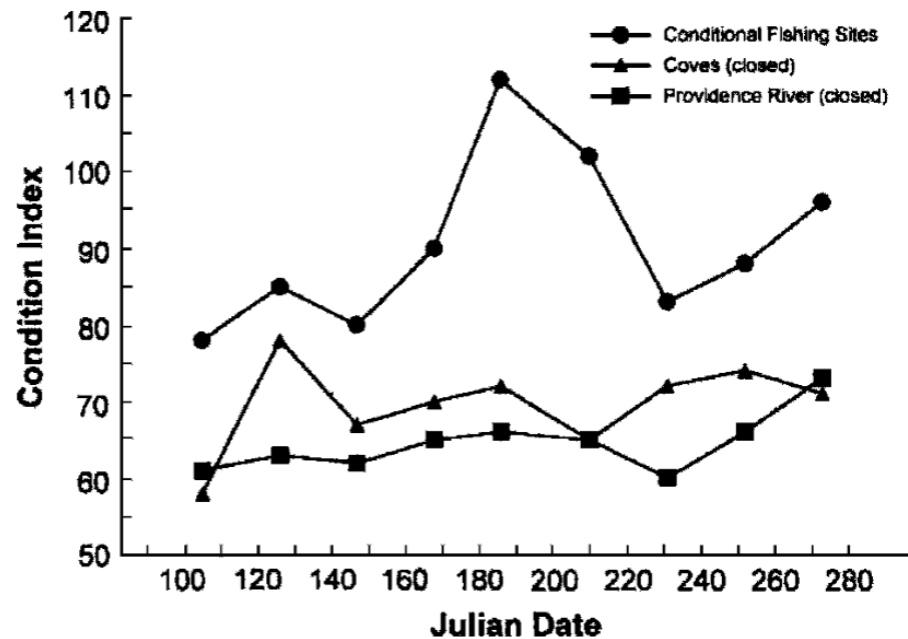


- Closed/prohibited areas are likely significant sources of larvae for areas throughout the Bay.
  - *de facto* sanctuaries.
- Harvest in one can impact the future harvest of multiple areas.
- Do current spawner sanctuaries serve meaningful roles?
- As water quality improves in Narragansett Bay and areas possibly opening for harvest, how should the Providence River be managed to account for its importance for down-Bay areas?



# Quahog Condition: Are those from Closed and Open Areas the Same?

Quahogs from closed areas of Narragansett Bay have been found to have lower condition and gonadal fitness than those from open areas.

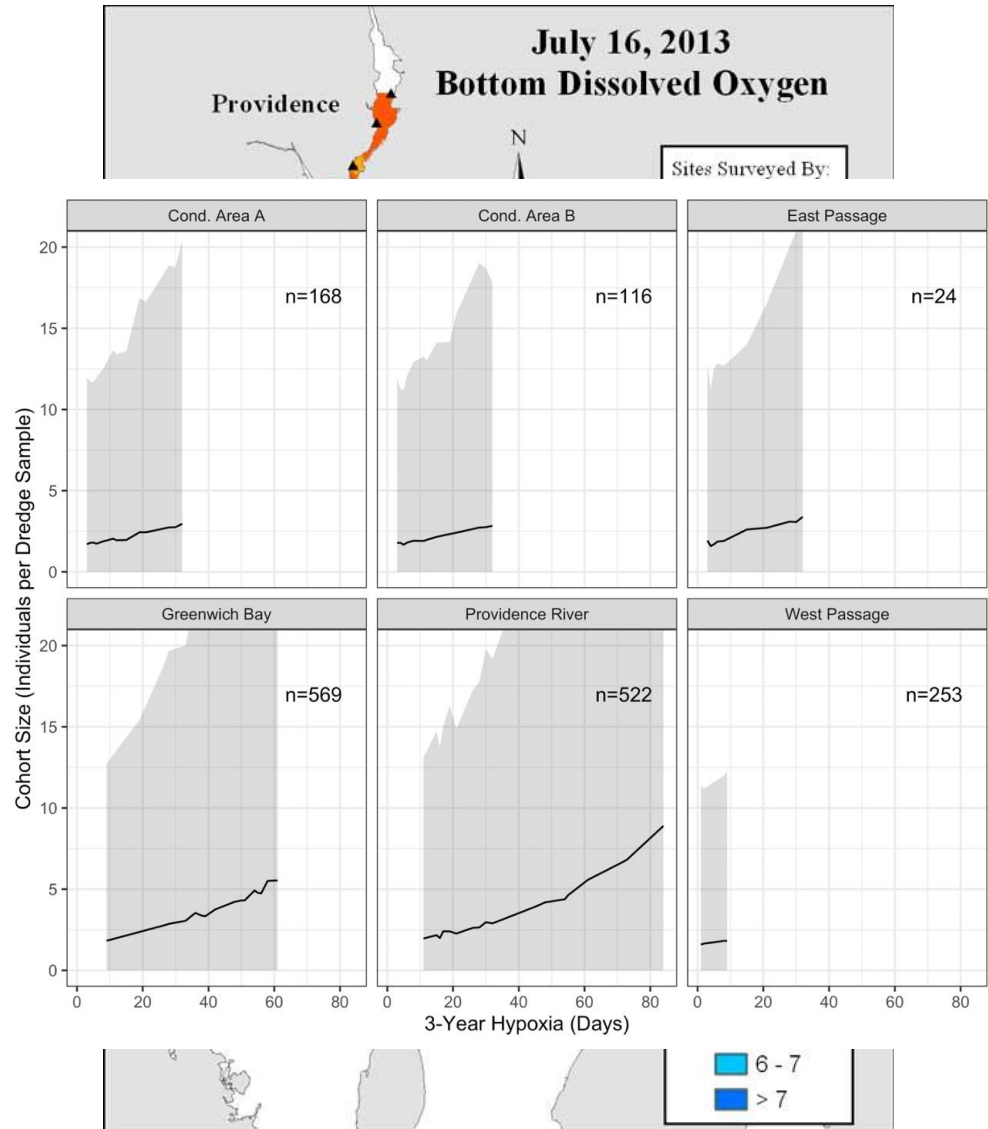


# Hypoxia: An Ecosystem Benefit for Quahogs?

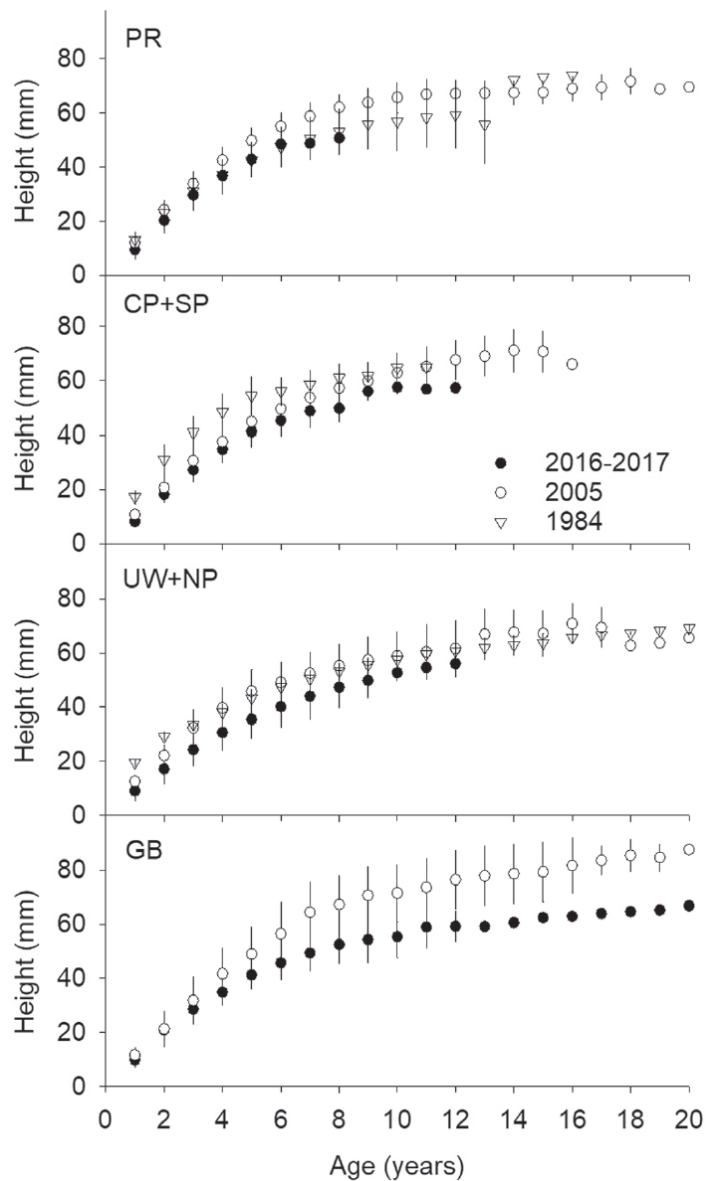
Hypoxia (low-oxygen events) can occur throughout the Bay in the summer, most commonly in the upper-Bay/coves.

Theory that quahog survivorship can increase under hypoxia given predators forced to leave (i.e. hypoxia-induced predation refuge).

Quahog cohorts were larger when they had been exposed to low oxygen conditions as juveniles, but uncertainty in response suggests this is one of just several factors influencing cohort survival.

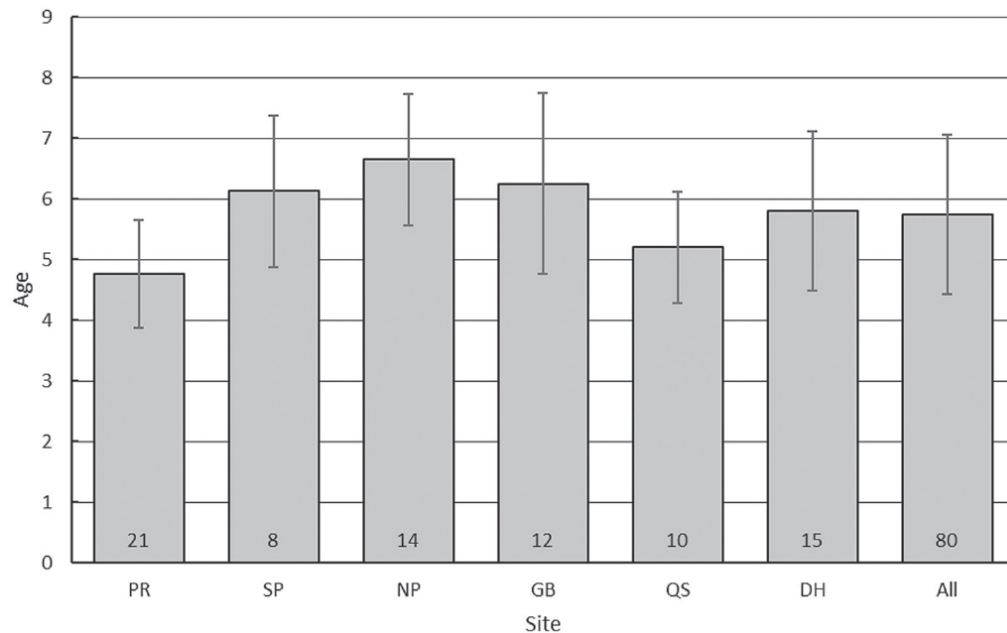


# How Has Quahog Growth Changed with Nutrient Loading?



Reexamined growth rates in years post-nutrient reduction (2016-2017) to see if less nitrogen may have impacted growth.

No statistical changes in growth over time, but a continued difference in growth over space.



# Summary

Quahog landings history highlights numerous fluctuations, with declining catch over the last two decades.

Quahogs are typically found in northern areas of Narragansett Bay.

Recent research has provided new insights on the life history and ecosystem science for quahogs (need more!)

Collaborative approach with various experts (scientists, managers, stakeholders) is key.



# Acknowledgements

## DEM

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