

Developing a Self-Sustaining Oyster Population in Jamaica Bay, New York City

NYC[®]
Environmental
Protection



NYC Department of
Environmental Protection,
Billion Oyster Project
Hudson River Foundation
Dr. Ray Grizzle, UNH
Cornell Cooperative Extension
HDR Inc.



BOP & NY Harbor School

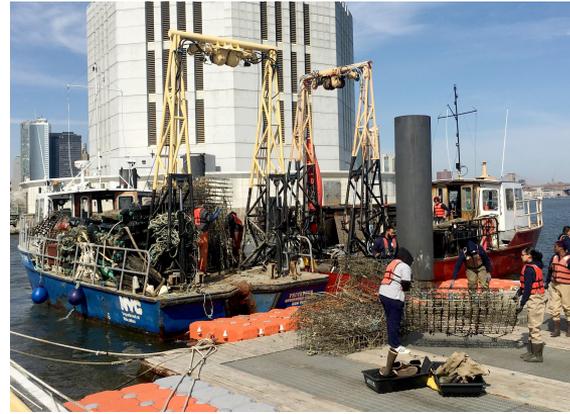
Professional Diving

Aquaculture

Vessel Operations and Alumni Crew

Marine Systems Technology

Interns



NYHS Vessel Operations interns and students



NYHS Aquaculture interns and students



NYHS Professional Diving interns and students

Models: ideal conditions for oyster growth and recruitment:
salinity, temp., DO, slower tidal dispersion rate

Limited by the lack of substrate and larval supply.

Objectives:

- 1. Site suitability survey and selection
- 2. Donor reef design and construction
- 3. Receiver reef design and construction
- 4. Monitoring and maintenance of reefs
- 5. Assessment of ecosystem services
- 6. Assessment of results in the context of future projects

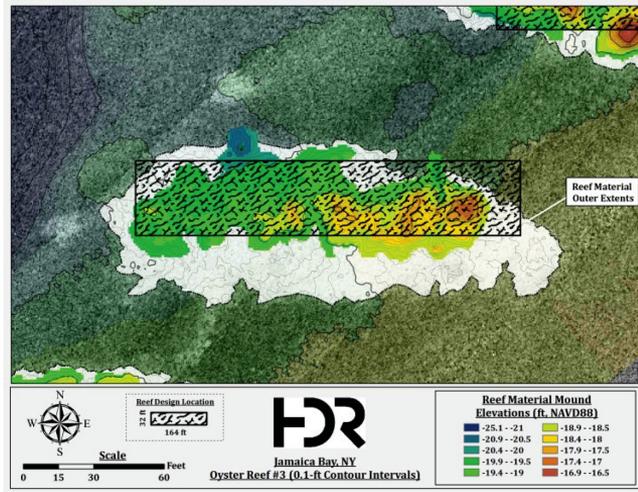
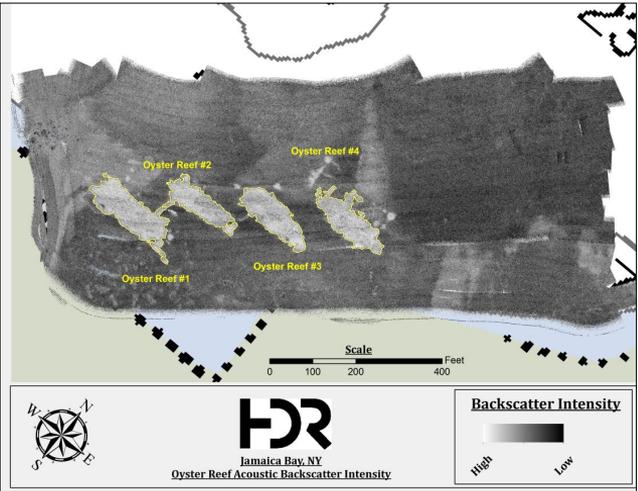


Figure 16. Expanded view of Reef #3 overlaid by design plan view reef dimensions for reference.

2016 reef outlines approximated.

Construction of four new hard-substrate reef bases

Installed Donor Reef
(35K adults)

Supplemented Donor Reef
(9K adults)

Sept 2016

Oct 2016

Oct 2017

Mar 2019

Installed 4 Receiver Reefs: ~1
acre. 700 cy clam, 180 cy
porcelain, 100 cy oyster

Oysters placed on
bottom



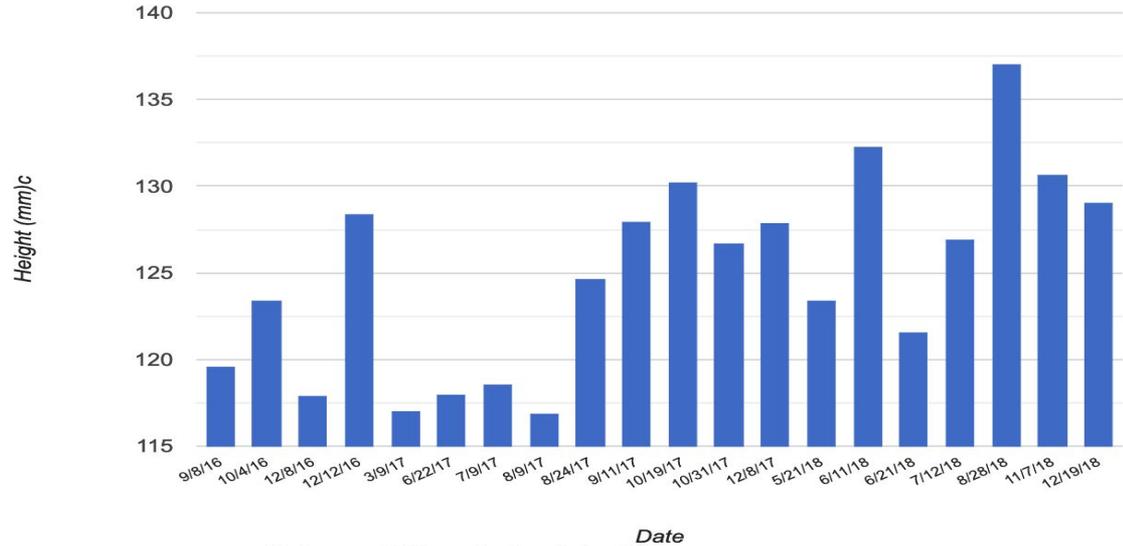
Oyster Growth

Both cohorts grew slowly but steadily
May - November of each year.

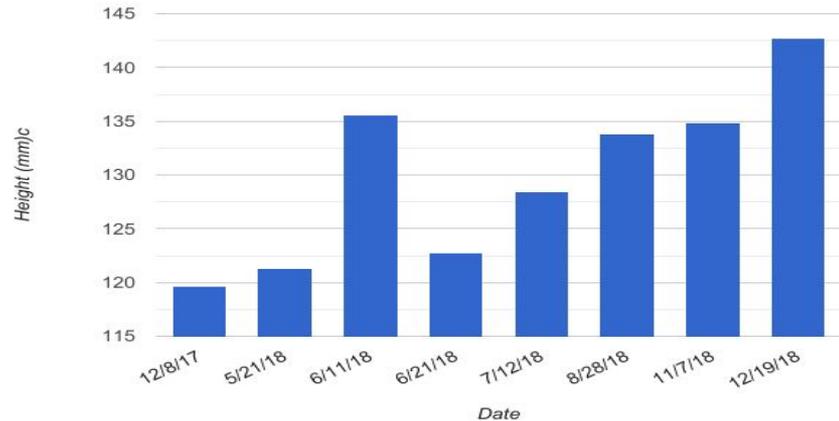
The older Island Creek cohort gained
approximately 19 mm Sept 2016 - Dec
2018.

The younger Merry Island cohort gained
approximately 24 mm.

Oyster growth Island Creek (cohort 1)



Oyster growth Merry Oysters (cohort 2)



Oyster Monitoring

Stony Brook MADL lab: **post-spawn** adults, good balance between male and female. **Excellent meat.**

In general, **MSX** was not epizootic and did not appear to cause excessive mortalities nor reduced condition indices.

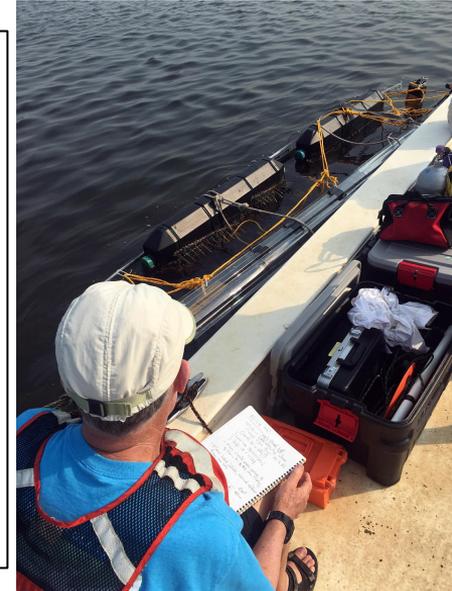
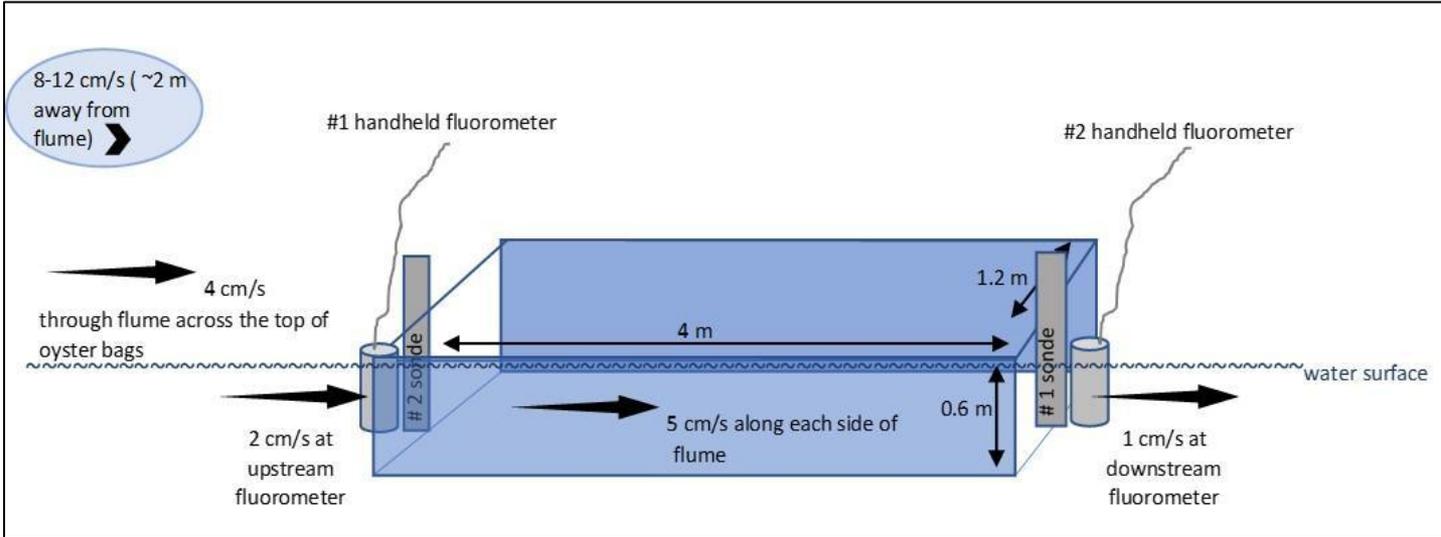
Dermo found in this study (medium prevalence, low intensity) was similar to levels found in most east coast farmed oysters. **Dermo is likely to have caused some of the mortality observed throughout the study and most, if not all, of the mortality that occurred in December, 2018.**



Water Quality Improvements: Fluorometry

Chlorophyll A removal as a measurement of water filtration.

Substantial water filtration: mean 10.9% (Grizzle, HRF).



Schematic illustrating water flow speed patterns in and around the flume.

Water Quality Improvements: Fluorometry

2017 -three areas along the eastern end of the longline on a flooding tide and four on ebb tide flows on the western end of the longline showing **consistent and substantial CHL depletion with overall removal rates ranging from 17.6% to 45.7%.**

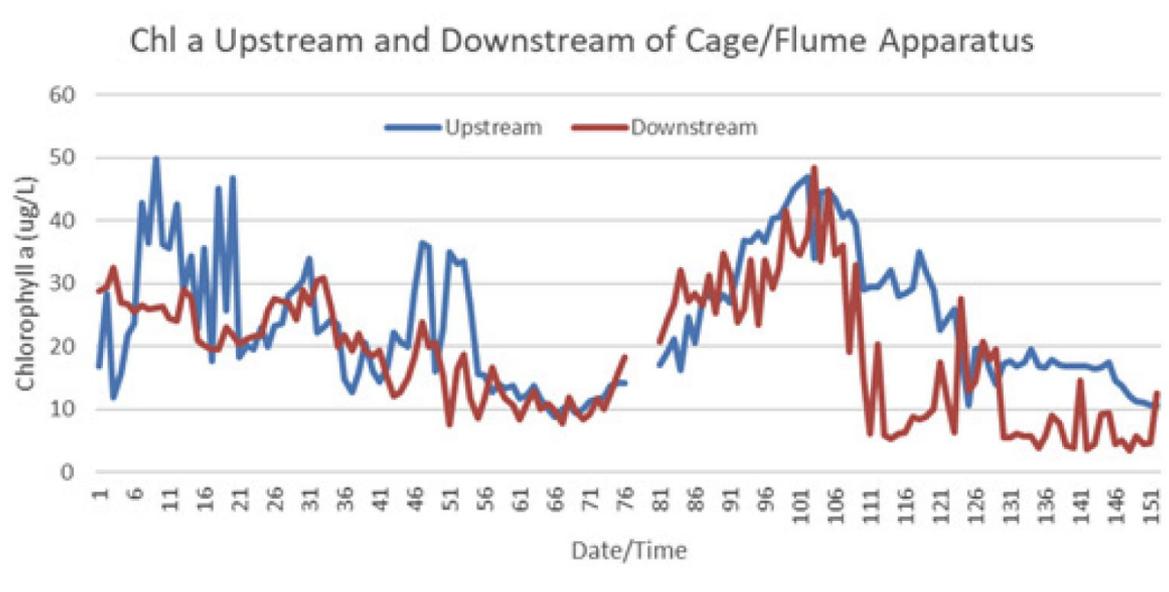


Figure 5.9 Time series (~40 hours total) of CHL measurements by two datasondes at 15-min intervals deployed on field flume.

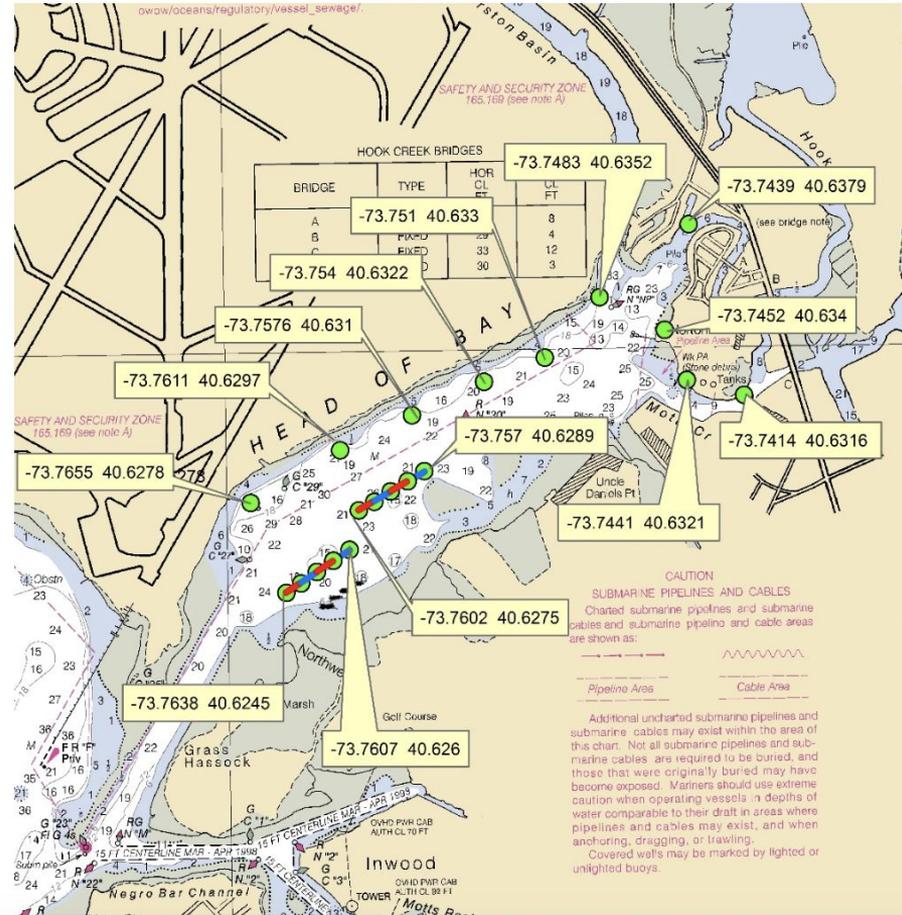
Spat Recruitment Monitoring



No recruitment found on spat collectors.

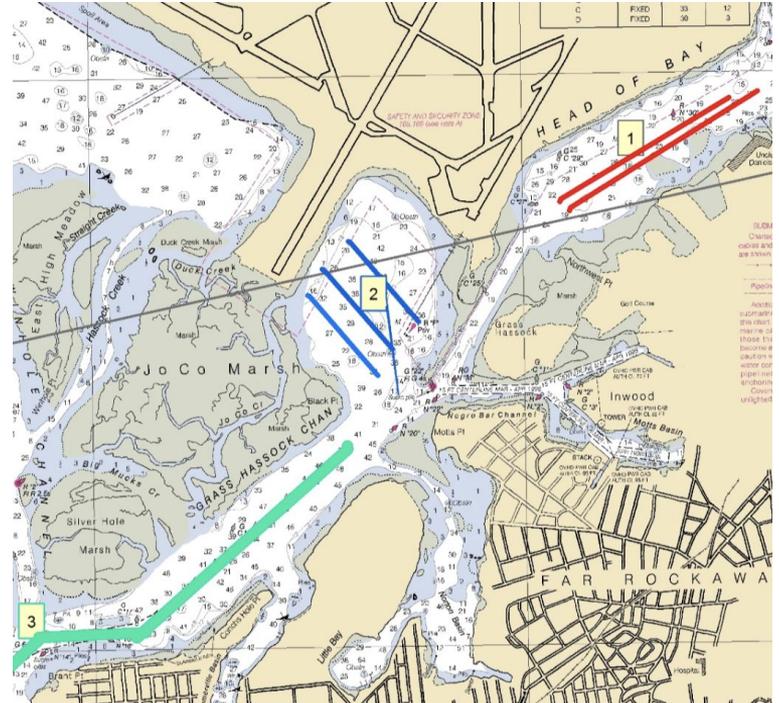
Three recruits on Donor Reef in 2018/19.

A few spat found in 2020.



Plankton Sample Collection

Plankton tows were conducted in 2018 and analyzed (Hare Lab) for presence/absence of *C. virginica* DNA.



Positive results suggest that at least **some larvae growing and persisting** in Jamaica Bay for over a week.

total by week	# samples analyzed	% positive	total positive	>180 micron
6/27	4	50	2	0
7/12	6	50	3	1
7/26	6	50	3	1
8/2	6	50	3	0
8/14	6	67	4	2
8/28	6	33	2	0
9/6	6	0	0	0

Table 5.7 *Crassostrea virginica* presence/absence assay results by sample week, including 2 PCR positive results that were not confirmed by sequencing.

Potential reasons for lack of observed recruitment:

1. Spatial scales of larval settlement/recruitment are not well understood and a much larger donor population (potentially orders of magnitude greater than that used for this study) may be required;
2. Oysters produced larvae but evidence that larvae are surviving prior to settlement is lacking.
3. Frequency and magnitude of plankton sampling not sufficient to estimate the larval loss rate (mortality + emigration) from the Head of Bay.

Reef as Functional Habitat

Habitat provision: data from the trays and diver observations confirmed that the constructed reef provided substantial habitat for fish, invertebrates, and macroalgae.



Important information obtained:

- Community interest helps safeguard the project
- Testing innovative materials (porcelain) and installation methods (salt spreader)
- Diving and video for observing mobile species
- Substantial habitat provision, good growth
- Strong filtration
- Larvae present and persisting... not recruiting



The imported oysters were big - avg ~5" ... some upwards of 8.5"

Recommendations

1. Study larval viability though later development stages would provide important insights into mortality rates and potential for recruitment;
2. Higher resolution plankton monitoring could provide a loss rate estimate to better scale the size of the donor population necessary to create a new self-sustaining population;
3. Monitor receiver reefs for new oyster recruitment.
4. Surf clam shells (and to a lesser extent oyster shell) are prone to breakage with excessive handling, reducing the overall suitability of substrate for spat settlement. Reduce handling as much as possible. Porcelain is more durable and represents a viable alternative substrate.



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