Casco Bay 2023 Clam Recruitment Monitoring Network Results

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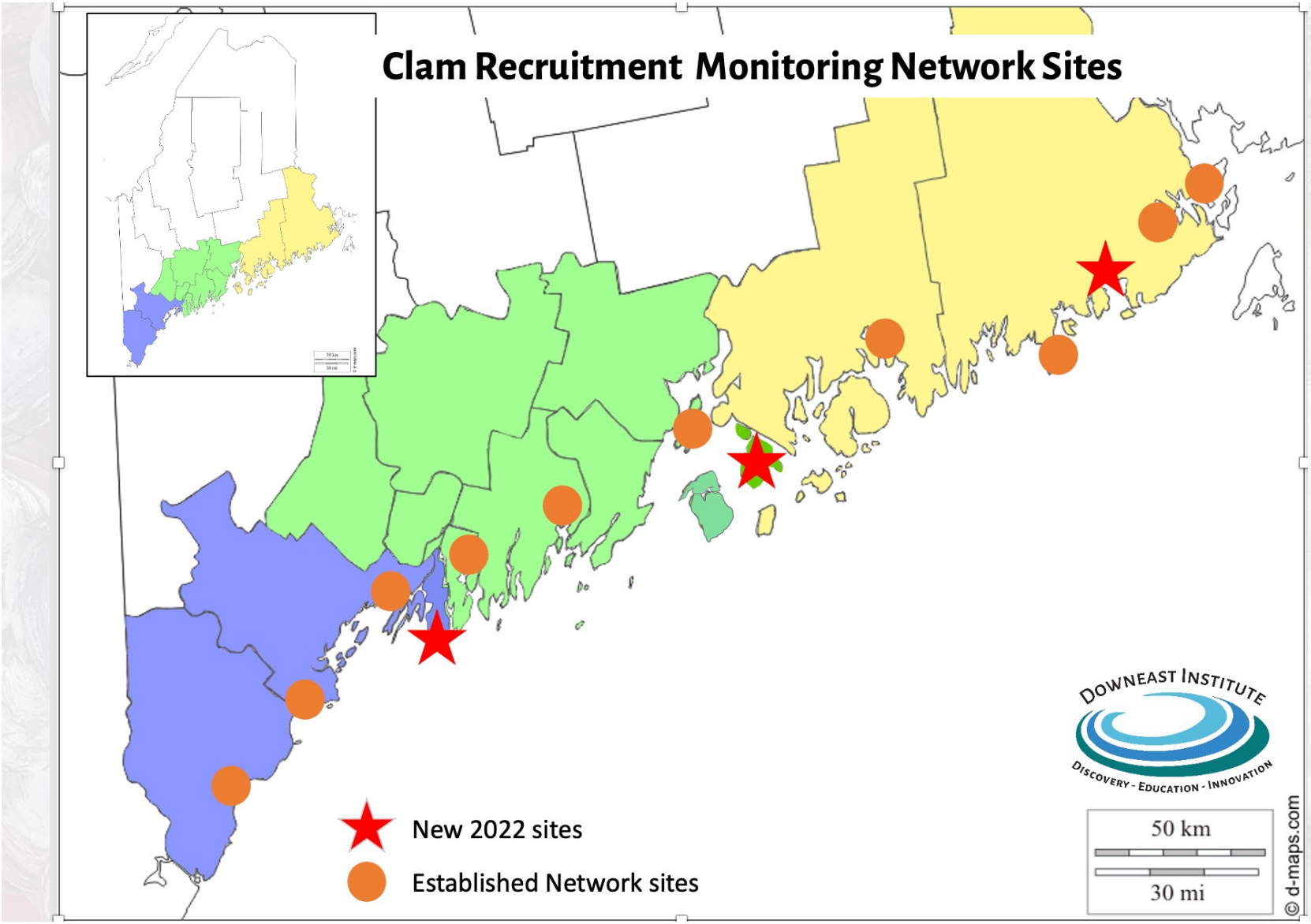
May 14, 2024



- Established in 2020
- 2 sites in each town

Recruitment is a critical stage in the life-cycle of the clam

- Robust commercial harvests rely on strong recruitment followed by relatively high survival.
- Because of their small size, recruits are extremely vulnerable to mortality.
- Mortality has increased with warming seawater temps.

Clam and quahog recruits.

Warming Seawater Drives Increased Predation

- Green crabs thrive in warming waters.
- Remaining commercial quantities of clams are limited to high intertidal (area closest to shore), particularly from Bar Harbor to NH border.

Tidal heights :

- High intertidal: exposed 2-3 hours before low tide
- Mid intertidal: exposed 1-2 hours before low tide
- Low intertidal: exposed 0-1 hours before low tide

It doesn't necessarily mean how far you are from shore.

- Repeated independent field research has found that non-human predation is the most important factor causing clam mortality (Beal et al. 2001, Beal & Kraus 2002, Beal 2006a, b, Beal et al. 2016, Beal et al. 2018, Beal et al. 2020a,b).
- Previous independent field research found that less than 1% of clam recruits survive to reach 1-year-old (Beal et al. 2018).

Journal of Shellfish Research, Vol. 37, No. 1, 1–27, 2018.

SPATIAL VARIABILITY IN RECRUITMENT OF AN INFAUNAL BIVALVE: EXPERIMENTAL EFFECTS OF PREDATOR EXCLUSION ON THE SOFTSHELL CLAM (*MYA ARENARIA* L.) ALONG THREE TIDAL ESTUARIES IN SOUTHERN MAINE, USA

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ABSTRACT The infaunal, suspension-feeding softshell clam (*Mya arenaria* L.) is a conspicuous member of the intertidal macrofauna in numerous northern temperate and boreal soft-bottom communities. Recruitment variability can affect the magnitude and scope of various ecosystem services provided by *M. arenaria*, including its role as a source of food and energy for organisms at higher trophic levels. Manipulative field experiments were conducted in the intertidal zone in 2014 and 2015 at three tidal estuaries in southern Maine, to investigate the importance of post-settlement processes in determining the strength of the annual 0-y class cohort across predator-exclusion treatments within and between tidal heights. Four short-term (4–5 mo), small-scale studies over both years in the Webhannet River (Wells, ME) and Fore River (Portland, ME), the two southernmost estuaries, demonstrated that clam recruits were up to 118× more abundant when predators were deterred versus controls. In a 7-mo study conducted in the Harraseeket River (HR; Freeport, ME) during 2014, recruits of *Mya* attained densities 899× greater in large-scale plots designed to exclude large (>6 mm) predators than in ambient, adjacent sediments where predators were undeterred. A novel, epibenthic settlement trap (0.15 m^2), initially containing no sediments and designed to deter both infaunal and epibenthic predators larger than 1.9 mm, was used to examine spatial variability in clam recruitment over a 6-mo period in 2015 in the HR. Traps showed a 60-fold difference in mean number of clam recruits between sides of the river only 600 m apart. Collectively, results suggest that post-settlement mortality rates of 0-y class individuals of *Mya* exceed 99% at these locations, severely limiting ecosystem services they would otherwise provide, and that these early losses are primarily responsible for explaining distribution and abundance patterns of ≥1-y class individuals.

KEY WORDS: *Mya arenaria*, post-settlement mortality, spatial variability, predator exclusion, field experiment

Survey Tool

- Changed everything we know –pulled the curtains back on what is happening in the intertidal.
- Through their use we have learned that dead mud may not actually be dead.
- **Recruitment boxes show us the minimum of what settled.**

East side of Harraseeket River →

Standardized data across 25 sites

- Mid-intertidal (area exposed 1-2 hrs before low).
- Deployed before clams begin to spawn.
- Sampled at end of clam growing season.
- Same size and number of boxes and samples.

Changes in 2023

- All boxes have fabric (groundcover) bottoms instead of mesh (Petscreen).
- 12 boxes instead of 16 at each site.

2023 Clam Recruitment and Fall Survey Results- Southern ME

Town	Flat	Density (Clams ft ^{2})	Average size (mm)	Size Range (mm)	Fall Survey Density	Average size
Wells	Upper Landing	1	**26.4**	16 – 38mm	0.8	2.52
	Dolphin Lane	**55**	**26.5**	2 – 43.8	1.7	2.46
Scarborough	Jones Creek	**46.6**	17.2	1.6 – 31.2	1.7	4.7
	Winnock Neck	4.69	10.3	2 – 26.3	0	n/a
Brunswick	Harpswell	0.67	12	1.5 – 19.5	0	n/a
	Thomas Point	**63.3**	7.7	1.5-40	0	n/a
Phippsburg	Atkins	16.7	**25.2**	13-38	6.3	2.3
	The Branch	5.2	13	1-28	1.3	4

*1 in= 25.4mm, 2 in =50.8 mm

2023 Clam Recruitment and Fall Survey Summary by Region

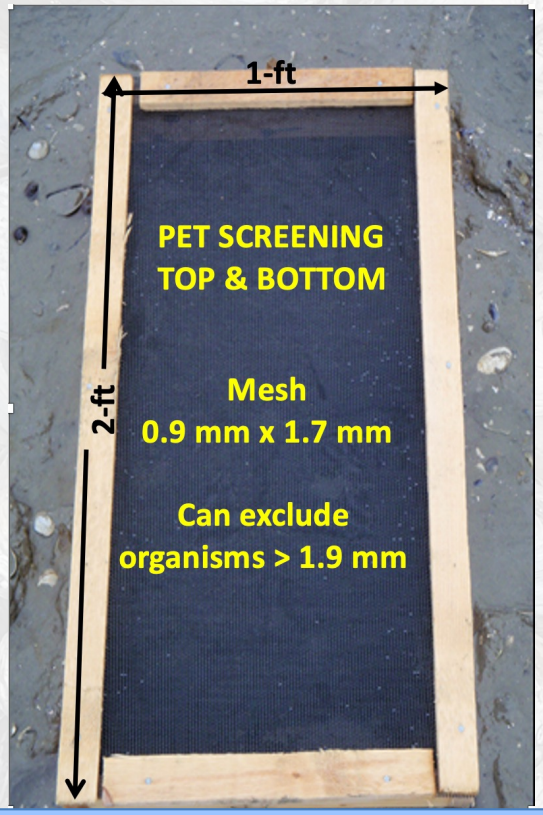
Region	Avg. Density (clams ft^2)	Average size (mm)	Size Range (mm)	Fall Survey Density	Average size (mm)
Southern	24.1	17.3	1– 43.8	1.5	2.1
Midcoast	28.26	14.7	1.5– 40	0.7	1.9
Downeast	**75.34**	6.2	0.9– 28.5	0.5	6.4

*1 in= 25.4mm, 2 in =50.8 mm

Highlights of 2023 Clam Recruitment

- Machiasport had the highest density of clam recruits
  1) Sanborn Cove– 331 recruits/ft ^{2}
  2) Randall Cove– 156.5 recruits/ft ^{2}
- 4 flats had densities over 100 recruits/ft ^{2} and they were all located downeast (Machiasport, Gleason Cove in Sipayik and Perio Point in Beals).
- Islesboro had the next highest densities ~ 75 recruits/ft^2 at both sites.
- Thomas Point Beach recorded the highest densities in southern ME with 63 recruits/ft ^{2}

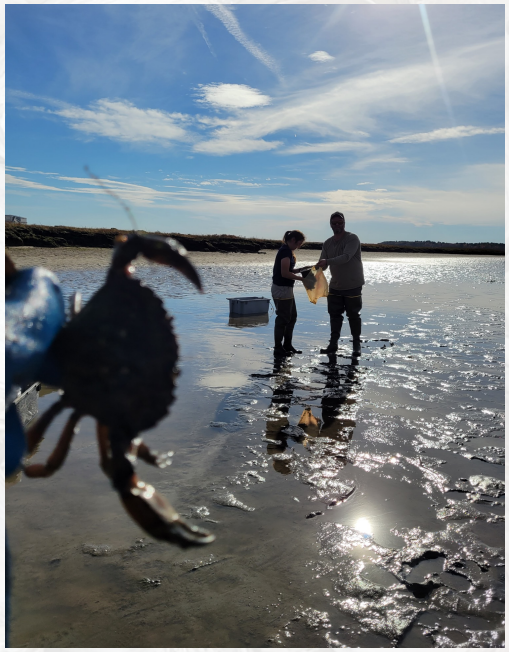
“Green crab monitoring network”



Recruitment Box

Crabs get in and feast on clams, growing too big to get back out through the mesh.

- Comprehensive green crab data.



* When crabs exceed 10mm (~1/2 inch) few live clam recruits are found in boxes.

2023 Green Crab Densities and Sizes- Southern

Town	Flat	Average Density (crabs ft^2)	Average size (mm)
Wells	Upper Landing	**29**	15.6
	Dolphin Lane	**12.7**	10.8
Scarborough	Jones Creek	**13.3**	9.5
	Winnock Neck	0.36	7
Brunswick	Harpswell Cove	1.34	22.5
	Thomas Point	0.56	13.3
Phippsburg	Atkins	5.3	13
	The Branch	5.5	11

*12.7mm= ½ inch. 1 in= 25.4mm

It's the crabs you can't see that are causing the majority of damage to shellfish populations

Crabs that entered a recruitment box at 1.9mm or less, then grew after eating these recruits. Samples from Ryder Cove in Islesboro, 2021.

VS

Large green crab

2023 Green Crab Summary

- **Southern ME had the highest densities of green crabs on average**, downeast the lowest.
- The highest average density of green crabs was found in Wells at Upper Landing (29 green crabs/ft^2).
- 6 locations had densities at or higher than 10 crabs/ft^2: Both Wells sites, Sanborn in Machiasport, Jones in Scarborough, Little Broad in Islesboro, and Dobbins in Beals.
- The top 5 towns with the lowest green crabs densities were downeast (Burnt and Marion in Edmunds, Half Moon in Sipayik, and Hog and Racoon in Frenchman's Bay). All had 0.3 crabs/ft^2 or less.

Upper Landing, Wells sampling, 2023

2024

- Deployment finished in April.
- 5th year.
- Clam harvests will be lower than ever in Casco Bay.

Atkins Bay, Phippsburg