



Technical
Report #5

2023 SHELLFISH RECRUITMENT MONITORING RESULTS

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2023 Shellfish Recruitment Monitoring Network Results



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IN PARTNERSHIP WITH:

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Scarborough Shellfish Conservation Committee
Brunswick Marine Resources Committee
Phippsburg Shellfish Conservation Committee
Bremen Shellfish Conservation Committee
Islesboro Shellfish Conservation Committee
Stonington & Deer Isle Shellfish Conservation Committee
Frenchman's Bay Regional Shellfish Conservation Committee
Machiasport Shellfish Conservation Commission
Beals Shellfish Conservation Committee
Sipayik Environmental Department
Unorganized Townships of Washington County

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TABLE OF CONTENTS

Overview, Objectives & Goals.....	i
Introduction and Methodology.....	1
Southern Maine Results	
Wells.....	5
Scarborough.....	9
Brunswick.....	13
Phippsburg.....	17
Midcoast Results	
Bremen.....	21
Islesboro.....	25
Stonington/Deer Isle.....	29
Downeast Results	
Frenchman Bay.....	33
Beals.....	38
Machiasport.....	42
Edmunds/Trescott (Unorganized Territories of Washington County).....	46
Sipayik.....	50
Overall Results	
Temperature.....	54
Clam Recruitment Densities.....	55
Size of Recruits	56
Density and Size of Green Crabs.....	58
Relationship between Largest Crab Size and Clams Per Box.....	59
Further Acknowledgments & References.....	60
Appendix A: 2020-23 Spring & Fall Survey Data: Soft-shell Clam Density.....	A-1
Appendix B: 2020-23 Spring & Fall Survey Data: Soft-shell Clam Size Ranges.....	B-1
Appendix C: 2020-23 Recruitment Data: Soft-shell Clam Size & Density.....	C-1
Appendix D: 2020-23 Recruitment Data: Green Crab Size & Density.....	D-1
Appendix E: Seawater Temperatures.....	E-1
Appendix F: Clam Recruitment Density Results.....	F-1
Appendix G: Clam Recruit Size-Frequency Distributions.....	G-1
Appendix H: Green Crab Size Distributions.....	H-1
Appendix I: Relationship Between Largest Crab and Number of Clam Recruits.....	I-1





OVERVIEW

This year, the **Soft-shell Clam Recruitment Monitoring Network** partnered with twelve community shellfish programs spanning the coast of Maine to conduct intertidal monitoring to increase understanding of the dynamics of the clam fishery. We measure densities of young-of-the-year soft-shell clams, and other commercially important species recruiting to the mudflats, determine how much the recruits grew in their first year of life, conduct shellfish surveys in the spring and fall, record seawater temperatures, and estimate recruit survival rates. We also measure densities of green crabs, a major clam predator.

This report details the 2023 results of this effort.

OBJECTIVES & GOALS

We are building a long-term database to better understand local, regional, and coastwide trends in clam production. Our goal is that this information will be used to sustain the fishery for current and future generations of clammers and coastal communities.

This information is crucial to understanding the impacts of a warming marine environment on clam populations, and equips managers for the challenges of sustaining and enhancing clam populations under these warming conditions.

INTRODUCTION and METHODOLOGY

What is Clam Recruitment?

Clams have two major life history stages — 1) a planktonic (swimming) larval stage that has three major developmental components: trochophore (0.075 mm), veliger (0.1 mm), and pediveliger (0.175 mm); and, 2) a settlement stage (0.2-0.25 mm) where the swimming larvae encounter (i.e. “settle onto”) the seafloor bottom (typically a mudflat) followed by a rapid metamorphosis into a miniature (juvenile) version of the adult. Once settled, juvenile clams may be moved around on the mudflats by physical forces such as tidal or wind-driven currents, but will reside in sediments for the rest of their lives where they will, in time, grow into adult clams.

After clams settle out of the water column and onto the mudflat they are called “recruits” when scientists sample them. Specifically, recruitment involves the process of settling onto the mudflat, and then a period (days, weeks, months) of post-settlement survival prior to being sampled. Therefore, the size of a clam recruit could be anywhere from a microscopic speck to a half-inch or larger animal depending on the length of time between when the clam settled and when the clam is sampled from the mudflat. Recruits also are referred to as “0-year class individuals” because they are not yet 1-year old. They are also called “young-of-the-year.”

Why is the Fate of Clam Recruits Important?

Recruitment is a critical stage in the early life-history 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. Previous independent field research conducted in three southern Maine towns (Wells, Portland, and Freeport) found that less than 1% of clam recruits survive to reach 1-year-old (Beal et al. 2018). Repeated field research through the years has found that predation is the most important factor causing clam mortality on flats along the entire coast of Maine (Beal et al. 2001, Beal & Kraus 2002, Beal 2006a,b, Beal et al. 2016, Beal et al. 2018, Beal et al. 2020a,b, Beal 2023). While the invasive green crab, *Carcinus maenas*, is credited correctly as being the major predator of soft-shell clams along the Maine coast, other predators (most of which are native) exist, and most focus their activities on juvenile (shallow-burrowing) clams. These include, but are not limited to: milky ribbon worms (*Cerebratulus lacteus*), moon snails (*Euspira heros* & *Euspira triseriata*), sand shrimp (*Crangon septemspinosa*), mummichogs (*Fundulus heteroclitus*) and killifish (*Fundulus majalis*) as well as common eider and black ducks (*Somateria mollissima* and *Anas rubripes*, respectively).

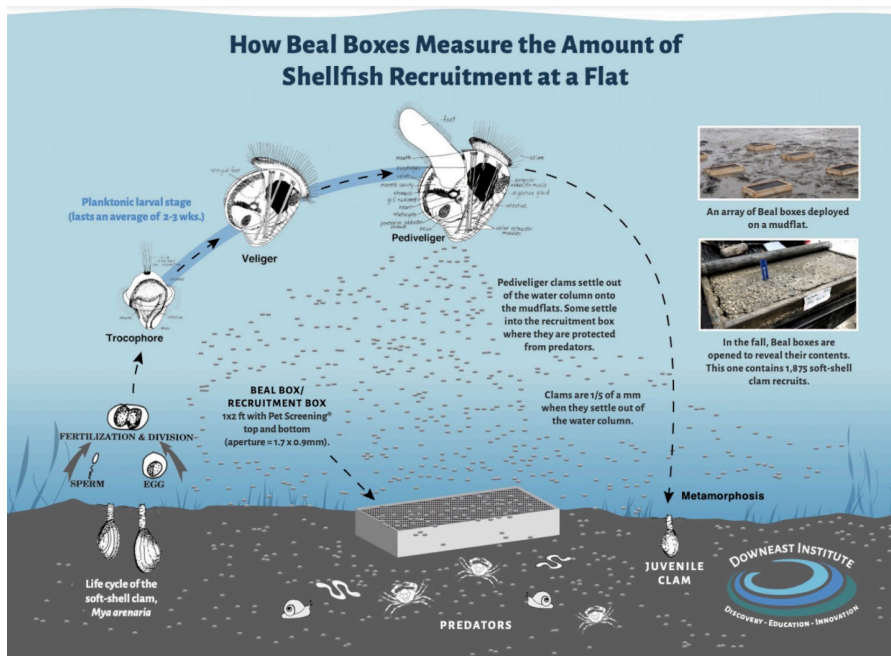
The Gulf of Maine has been warming for the last 40 years (Pershing et al. 2015), and the warming is changing Maine’s marine environment. Ecological processes in the intertidal zone where clams live are being altered due to the proliferation of predators such as the invasive green crab, which thrives in

warmer waters. In addition, warming has the effect of increasing the metabolism of native and non-native shellfish predators, resulting in higher predation rates. Adding to that problem, as summertime and fall seawater temperatures continue to warm, invertebrate predators especially will respond by increasing their foraging rates on clams and other infaunal organisms (Papastamatiou et al. 2015, Huey & Kingsolver 1989). This means it is even more important than ever to monitor annual clam recruitment abundance and distribution (i.e. how many and where) as well as the number of clams that survive their first year of life.

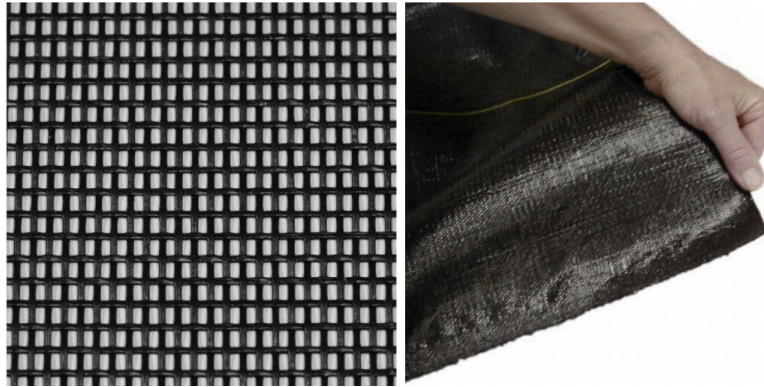
Using Beal Boxes to Monitor Clam Recruitment

In 2015, Downeast Institute (DEI) invented a simple, low-tech method to measure clam recruitment and estimate survival of 0-year class clams. Recruitment boxes, also called Beal boxes, are affixed to the mudflat surface and passively collect settling clams. The 0-year class clams that settle into them are protected from most predators, and therefore are able to survive and grow.

Boxes are 1-ft x 2-ft x 3-inches deep wooden frames with mesh on the top and a piece of polyethylene ground cover on the bottom. All boxes (12 at each site) in the Soft-shell Clam Recruitment Monitoring Network have **PetScreen® mesh** tops. Pet-Screen® has an aperture size of 1.7 x 0.9 mm, or 0.067-inches x 0.035-inches (0.002 in²). This size is large enough so that approximately 50 settling soft-shell clams could all fit through one of the thousands of apertures in the screening at the same time.



Juvenile clams settle into recruitment boxes where they are protected from most predators and are able to survive the growing season (April to November).



PetScreen® mesh (left) and ground cover fabric (right).

2023 Site Deployment

12 boxes were deployed at each of two mudflats within the 12 participating communities near the lower mid-intertidal during April/May 2023. Recruitment boxes were deployed in a line parallel to the incoming tide at all monitoring sites before clams began spawning. All boxes were affixed onto the mudflat surface at each site by driving wooden laths into the mud to a depth of 20-inches at the short end of each box, and then pounding small, galvanized nails through the laths and into the ends of the box.

Spring Shellfish Site Surveys

To establish density (# clams/ft²) and size range of clams occurring at each site at the beginning of the monitoring season, 12 core samples were taken at each of the sites (with a coring device that has a surface area of 0.1963 ft²) on the same day that Beal boxes were deployed. Cores were taken to a depth of 8-inches or to a hardpan layer, whichever came first, with each sample weighing about 10 lbs.

Samples were tagged with location information and transported from the mudflat to a location where each was washed with seawater through a sieve (1-mm mesh) to remove the mud, detritus, and other debris. Commercially important shellfish 1-mm or larger were identified, counted, measured (to the nearest 0.01 mm using digital calipers), and then the data was recorded. Clam predators (milky ribbon worms and green crabs) also were counted and the carapace width of each green crab was measured.

Site Temperatures

As in previous years, temperature loggers (HOBOS) were deployed at each site to determine site-specific seawater temperatures throughout the tidal cycle for the duration of the monitoring period. Loggers recorded air (low tide) and seawater (high tide) temperatures every 30 minutes.

[Appendix E](#) contains graphs showing how **seawater temperatures** changed throughout the deployment period (April-November). Each point represents an average of five temperature recordings taken thirty minutes apart – one at high tide, two prior to, and two following each high tide. The resulting graphs show seawater temperature only around the high tide period.

End of the Year Sampling: Recruitment Boxes and Fall Shellfish Survey

In each community, at the end of the clam growing season (late October/early November), the 12 recruitment boxes from each flat (N=24) were retrieved, and an additional 12 benthic core samples per flat (same size and technique as the spring survey) were taken haphazardly adjacent (2 m) to the boxes.

For each flat in each community, the contents of all 12 recruitment boxes and 12 core samples were individually processed by washing samples through a 1-mm mesh sieve (as described above) so that any commercial shellfish species as well as green crabs larger than 1 mm would be retained on the screen, identified, counted, and measured. In addition, a representative sample of up to 20 clams was taken from each recruitment box and the shell length (the longest anterior-posterior distance) of each measured to the nearest 0.01 mm using a digital caliper. All green crabs in each recruitment box were counted, and the carapace width of each measured to the nearest 0.01 mm. This report details the results from these activities.

Results from the fall survey show the number of soft-shell clams and other commercially important shellfish present in the lower mid-intertidal area of the monitoring site at the end of the clam growing season. Comparing clam densities from the fall core survey (i.e. clams not protected from predators) to clam densities from the recruitment boxes (i.e. clams somewhat protected from predators) provides an estimate of how predators affect abundance and size of young-of-the-year clams.

SOUTHERN MAINE WELLS



Site locations: Upper Landing and Dolphin Lane

CLAMMING PROFILE:

- 511.2 intertidal acres (DMR Acreage by Town, 2016).
- Wells has no commercial clamming program; instead, it has a strong recreational program, with 135 recreational licenses allocated in 2023.

Beginning (Deployment) Date: April 8, 2023

Ending (Fall Sampling) Date: October 25, 2023 (200 days total duration)

SEAWATER TEMPERATURE

Site	2020 Seawater* Temperatures	2021 Seawater Temperatures	2022 Seawater Temperatures	2023 Seawater Temperatures
Upper Landing	Max: 21.8°C (July 11) Min: 5.7°C (May 10)	Max: 21.9°C (August 26) Min: 7.3°C (May 2)	Max: 22.5°C (August 26) Min: 5.9°C (April 28)	Max: 22.4°C (July 23) Min: 5.1°C (April 9)
Dolphin Lane	Max: 21.4°C (July 24) Min: 5.6°C (May 10)	Lost recorder	Max: 22.8°C (August 28) Min: 6.2°C (April 23/28)	Max: 22.0°C (July 23) Min: 5.2°C (April 9)

*Seawater temperature was calculated from five temperature recordings taken around both high tides each day: 60 minutes and 30 minutes prior to and after high tide, as well as at high tide.

Analysis of how seawater temperatures changed through the season can be found in [Appendix E](#).

2023 SITE CORE SURVEY RESULTS - Fall and Spring

Below is a summary of the spring vs. fall site survey results (core samples) for Wells (n=12 for each flat and season). Clam densities are reported as the average number of clams per square foot (ft²), and is accompanied by its 95% confidence interval (CI)* in parentheses.

Site	Density of clams found in surveys		Difference between Spring and Fall densities	Average size of clams sampled	
	Spring	Fall		Spring	Fall
Dolphin Lane	4.67 (±3.77) clams/ft ²	1.7 (±2.11) clams/ft ²	Loss of 2.97 clams/ft ²	4.27 mm [0.17 in]	2.46 mm [0.10 in]
Upper Landing	4.67 (±2.57) clams/ft ²	0.85 (±1.26) clams/ft ²	Loss of 3.82 clams/ft ²	5.35 mm [0.21 in]	2.52 mm [0.10 in]

*Confidence intervals are used by ecologists to understand the boundaries that capture the true mean. It is used because the actual ("true") average of clam numbers/ft² cannot be known unless every inch of mud on the flat is processed through a 1 mm sieve. The most common type of confidence interval is the 95% CI, which is usually listed with the plus/minus symbol (±). Using the spring 2023 survey results from Dolphin Lane as an example, CI can be understood thusly: the best estimate of the true mean is the sample mean (4.67 clams per square feet), and we are 95% confident that the true mean lies between $4.67 + 3.77 = 8.44$ clams/ft², **and** $4.67 - 3.77 = 0.9$ clams/ft². This means that the true mean would, with 95% confidence, fall somewhere between 8.44 and 0.9 clams per square foot.

In 2023, the average clam density was higher in the fall survey at Dolphin Lane than Upper Landing, but the same in the spring survey. Both sites experienced a loss in average clam density from the spring to the fall which was the same from 2020-2022. Additional data on the densities of surveyed clams across all years and sites can be found in [Appendix A](#).

The average size of soft-shell clams was larger at Upper Landing than Dolphin Lane, which was similar to results observed in the previous 3 years. Additional data on the size distribution of surveyed clams across all years and sites can be found in [Appendix B](#).

2023 RECRUITMENT BOX RESULTS

Summary of Average Soft-shell Clam Recruit Density

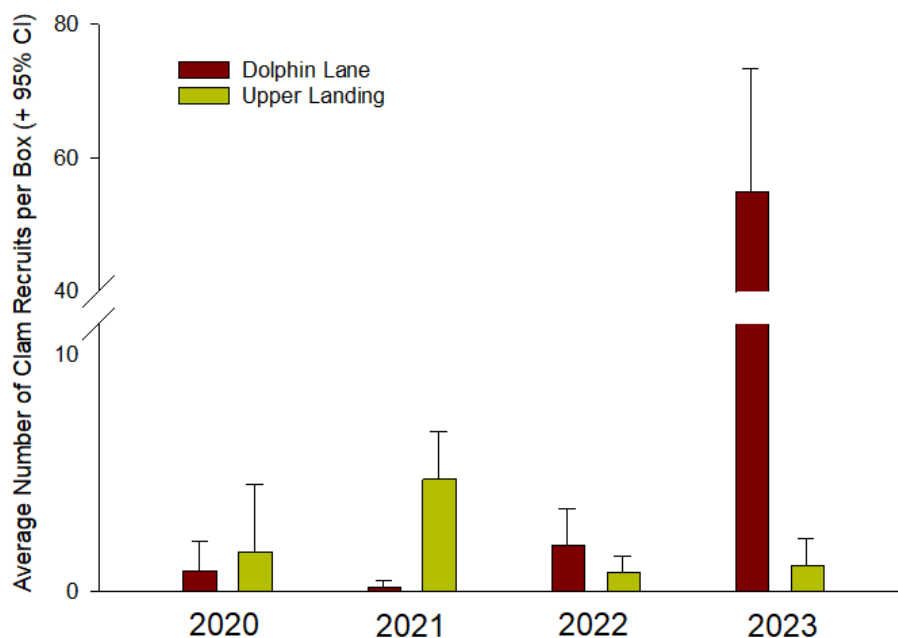
Clam densities are presented as the average number of clams per square foot (ft²) and accompanied by its 95% confidence interval (CI) in parentheses.

Site*	Avg. # per ft ²	Conclusion
Dolphin Lane	54.99 (±18.31)	Approximately 57x more clam recruits were found at Dolphin Lane than Upper Landing. This difference was statistically significant ($p < 0.0001$). The average density for both flats was 27.98 ± 9.64 clams/ft ² .
Upper Landing	0.97 (±1.03)	

*A detailed graphical analysis of fall clam recruitment by flat can be found in [Appendix F](#).

At Upper Landing, clam recruit density increased from 2022 (0.73 clams/ft²) to 2023 (0.97 clams/ft²), but is still a slightly lower density than both 2020 (1.6 clams/ft²) and 2021 (4.2 clams/ft²). Clam recruit density at Dolphin Lane increased in 2023 with an average of 54.99 clams/ft². Comparing this average to previous years, recruit density at Dolphin Lane decreased from an average of 4.3 clams/ft² in 2020 to 0.2 clams/ft² in 2021 and then increased to an average of 1.72 clams/ft² in 2022. Additional data on the density of soft-shell clam recruits across all years and sites can be found in [Appendix C](#).

The graph below shows the average number of young-of-the-year soft-shell clams in recruitment boxes from the two study sites in the town of Wells (Spring to Fall 2020-2023). All boxes had a mesh top (PetScreen®; 1.7mm x 0.9mm aperture) across all years. In 2020 (n = 8) and 2023 (n = 12), boxes had a ground cover (fabric) bottom. In 2021 (n = 16), all boxes at Dolphin Lane had fabric bottoms, and all boxes at Upper Landing had PetScreen® bottoms. In 2022 (n = 16), all bottoms were comprised of PetScreening®.



Summary of Clam Recruit Size

Size summary of recruits is presented in both mm and inches. Average size is accompanied by the 95% confidence interval (CI):

Site	# Recruits Measured (N)	Min. Size of Recruit	Max. Size of Recruit	Average Recruit Size
Dolphin Lane	240	13.68 mm [0.54 in]	42.79 mm [1.68 in]	26.44 (± 0.86) mm [1.04 in]
Upper Landing	19	15.9 mm [0.63 in]	38.01 mm [1.50 in]	26.71 (± 3.24) mm [1.05 in]

In 2023, the size of recruits across both Dolphin Lane and Upper Landing were generally very similar. This differed from previous years where recruits tended to be larger at Dolphin Lane than Upper Landing. Additional data on the size of soft-shell clam recruits can be found in [Appendices C and G](#).

Summary of Green Crab Density and Size

Total number of green crabs in $n = 12$ recruitment boxes per site, along with average number of crabs per square foot \pm 95% CI and size information.*

Site	Total # of Green Crabs	Density**	Min. Size	Max. Size	Average Size
Dolphin Lane	246	12.61 (± 3.36) crabs/ft ²	5.58 mm [0.22 in]	26.9 mm [1.06 in]	10.84 mm (± 0.49) [0.43 in]
Upper Landing	47	2.41 (± 0.75) crabs/ft ²	7.3 mm [0.29 in]	32.11 mm [1.26 in]	15.68 mm (± 1.99) [0.62 in]

*An analysis of green crab size-frequency distribution by flat can be found in [Appendix H](#).

**Data on the average size and density of green crabs found in recruitment boxes can be found in [Appendix D](#).

In 2023, the average density of green crabs at Dolphin Lane was significantly higher than at Upper Landing ($p < 0.0001$) which was also observed in 2022. Unlike in previous years, green crabs found at Dolphin Lane were on average slightly smaller than those found at Upper Landing. Graphs showing the relationship between the largest green crab in each recruitment box and the number of clam recruits recovered can be found in [Appendix I](#).

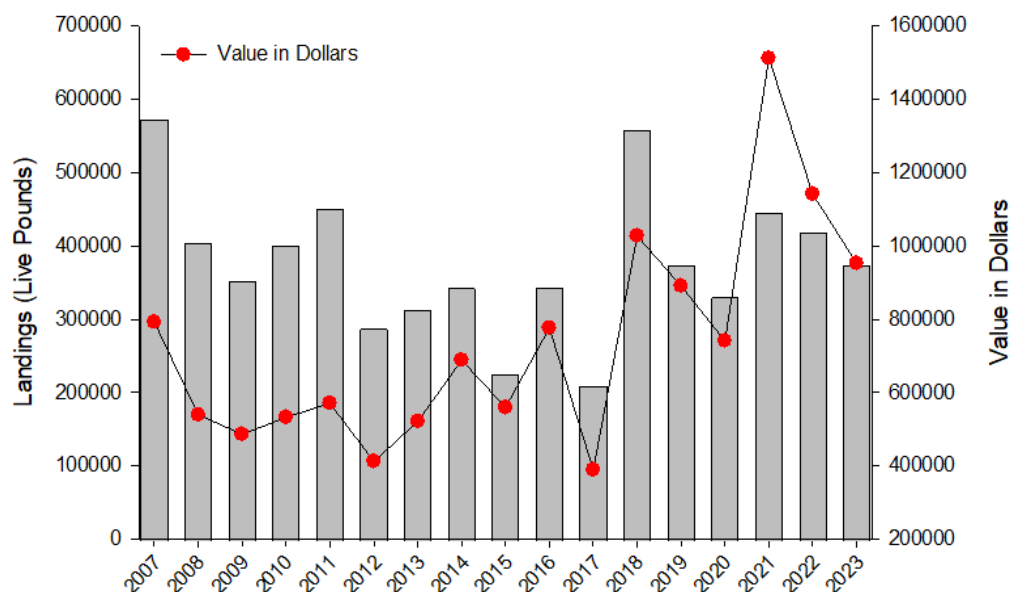
SCARBOROUGH



Site locations: Winnock Neck and Jones Creek

CLAMMING PROFILE:

- 1,008.7 intertidal acres (DMR Acreage by Town, 2016).
- 46 commercial clammers and 374 recreational licenses were allocated in 2021 (DMR General Town Shellfish Information, 2021).
- In 2023, 374,631 live pounds of soft-shell clams were landed in Scarborough (ex-vessel value of \$952,884) (DMR Landings, 2023). A graph of the live pounds and value of landings since 2007 is below.



Beginning (Deployment) Date: April 9, 2023

Ending (Fall Sampling) Date: October 29, 2023 (203 days total duration)

SEAWATER TEMPERATURE

Site	2020 Seawater Temperatures*	2021 Seawater Temperatures	2022 Seawater Temperatures
Jones Creek	Max: 20.8°C (August 25) Min: 5.7°C (May 10)	Max: 23.4°C (August 14) Min: 7.6°C (May 1)	Max: 21.9°C (August 25) Min: 6.1°C (April 23/29)
Winnock Neck	Max: 23.9°C (July 12) Min: 6.0°C (May 10)	Max: 24.3°C (August 14) Min: 7.4°C (May 1/2)	Max: 22.4°C (August 21) Min: 5.9°C (April 23)

*Seawater temperature was calculated from five temperature recordings around both high tides each day: 60 minutes and 30 minutes prior to and after high tide, as well as at high tide.

No temperature recorders were recovered in Scarborough for 2023.

2023 SITE CORE SURVEY RESULTS - Fall and Spring

Below is a summary of the spring vs. fall site core survey results for Scarborough (n=12 for each flat and season). Clam densities are provided in the average number of clams per square foot (ft²) and accompanied by its 95% confidence interval (CI) in parentheses.

Site	Density of clams found in surveys		Difference between Spring and Fall densities		Average size of clams sampled	
	Spring	Fall			Spring	Fall
Jones Creek	25.9 (±16.07) clams/ft ²	1.7 (±2.87) clams/ft ²	Loss of 24.2 clams/ft ²		5.34 mm [0.21 in]	4.73 mm [0.19 in]
Winnock Neck	3.82 (±3.42) clams/ft ²	0 clams/ft ²	Loss of 3.82 clams/ft ²		5.68 mm [0.22 in]	N/A

In 2023, the average clam density was higher at Jones Creek than Winnock Neck in the fall and spring, which was the opposite of what was found in the previous 3 years. Additional data on the densities of surveyed clams across all years and sites can be found in [Appendix A](#).

Both sites experienced a decrease in clam density from spring to fall, with Jones Creek having a loss of 24.2 clams/ft² and Winnock Neck having a loss of 3.82 clams/ft². In 2022, no clams were found in surveys at Jones Creek in both the fall and spring and Winnock Neck experienced a gain of 0.32 clams/ft² from spring to fall. In both 2020 and 2021, both sites experienced overall losses. Additional data on the size distribution of surveyed clams across all years and sites can be found in [Appendix B](#).

2023 RECRUITMENT BOX RESULTS

Summary of Average Soft-shell Clam Recruit Density

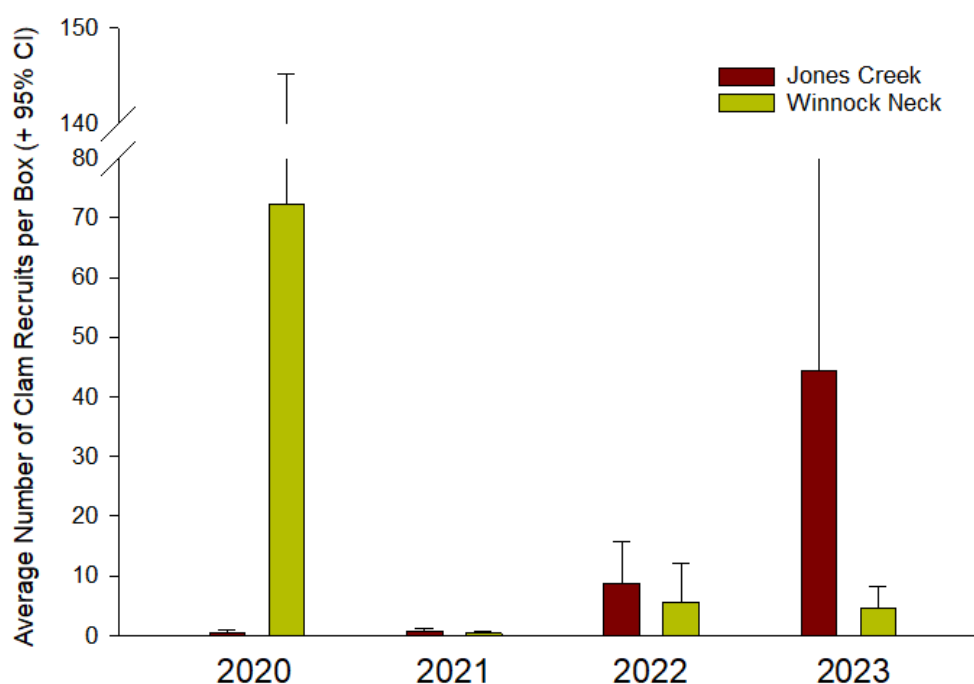
Clam densities are presented as the average number of clams per square foot (ft²) and are accompanied by their 95% confidence intervals (CI) in parentheses.

Site*	Avg. # per ft ²	Conclusion
Jones Creek	44.44 (±36.7)	In 2023, there were ~10x more clam recruits at Jones Creek than Winnock Neck. This was a statistically significant difference (p = 0.0389). The average density for both flats combined was 24.55 ±20.12 clams/ft ² .
Winnock Neck	4.66 (±3.54)	

*A detailed analysis of fall clam recruitment by flat can be found in [Appendix F](#).

Clam recruit density increased from 2021 to 2022 at Jones Creek (average of 0.8 clams/ft² and 8.8 clams/ft², respectively) and has increased again in 2023 (44.44 clams/ft²). At Winnock Neck, recruit density dropped from 2022 (5.61 clams/ft²) to 2023 (4.66 clams/ft²). Additional data on the density of soft-shell clam recruits across all years and sites can be found in a table in [Appendix C](#).

The graph below shows the average number of young-of-the-year soft-shell clams in recruitment boxes from two study sites in the town of Scarborough (Spring to Fall 2020-2023). All boxes had a mesh top (PetScreen®; 1.7mm x 0.9mm aperture) across all years. In 2020 (n = 8) and 2023 (n = 12), boxes had a ground cover (fabric) bottom. In 2021 and 2022 (n = 16), all bottoms were comprised of PetScreening®.



Summary of Clam Recruit Size

Summary of the size of recruits given in both mm and inches. Average size is accompanied by its 95% confidence interval (CI).

Site	# Recruits Measured (N)	Min. Size of Recruit	Max. Size of Recruit	Average Recruit Size
Jones Creek	234	2.0 mm [0.08 in]	31.21 mm [1.23 in]	16.88 (± 0.83) mm [0.66 in]
Winnock Neck	81	2.23 mm [0.09 in]	26.34 mm [1.04 in]	10.32 (± 1.31) mm [0.41 in]

In 2023, the average size of clam recruits was larger at Jones Creek compared to Winnock Neck. This trend was also seen in 2021, but is the opposite of what was observed in 2022 and 2020. Additional data on the size of soft-shell clam recruits across all years and sites can be found in [Appendix C and G](#).

Summary of Green Crab Density and Size

Total number of green crabs in $n = 12$ recruitment boxes per site, along with average number of green crabs per square foot \pm 95% CI and size information.*

Site	Total # of Green Crabs	Density**	Min. Size	Max. Size	Average Size
Jones Creek	259	13.27 (± 6.75) crabs/ft ²	1.92 mm [0.08 in]	31.52 mm [1.24 in]	9.56 mm (± 0.7) [0.38 in]
Winnock Neck	7	0.36 (± 0.31) crabs/ft ²	1.98 mm [0.08 in]	9.30 mm [0.37 in]	6.99 mm (± 2.46) [0.28 in]

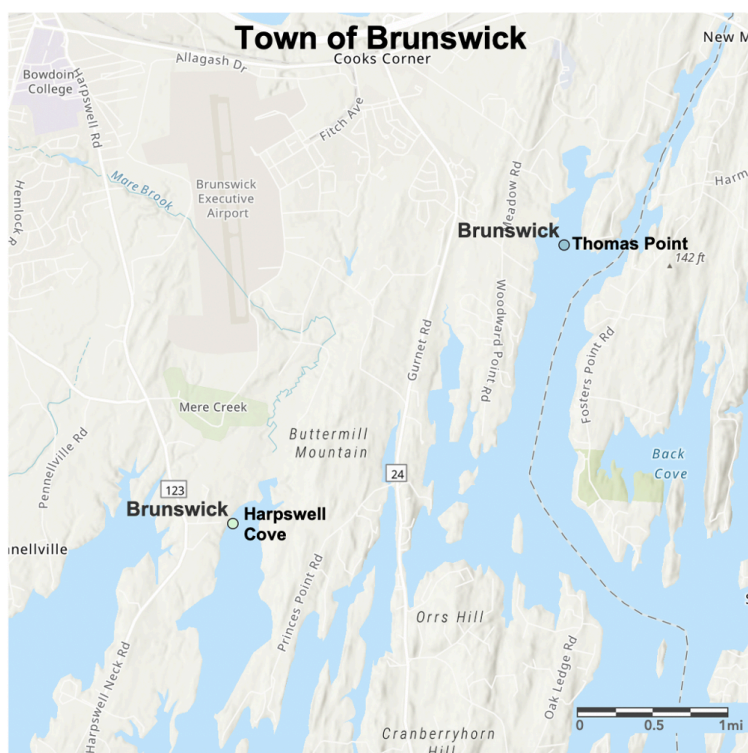
*An analysis of green crab size-frequency distribution by flat can be found in [Appendix H](#).

**Data on the average size and density of green crabs found in recruitment boxes can be found in [Appendix D](#).

Unlike in 2022, in 2023 the average density of green crabs found in boxes at Jones Creek was significantly more than the average density at Winnock Neck ($p = 0.0004$). In 2022, the average green crab density at Jones Creek was 1.11 crabs/ft², while it increased to 13.27 crabs/ft² in 2023. At Winnock Neck, the average density was 9.38 crabs/ft² in 2022 and decreased to 0.36 crabs/ft² in 2023. Also unlike in both 2022 and 2021, the green crabs sampled were generally larger at Jones Creek than Winnock Neck.

Graphs showing the relationship between the largest green crab in each recruitment box and the number of clam recruits recovered can be found in [Appendix I](#).

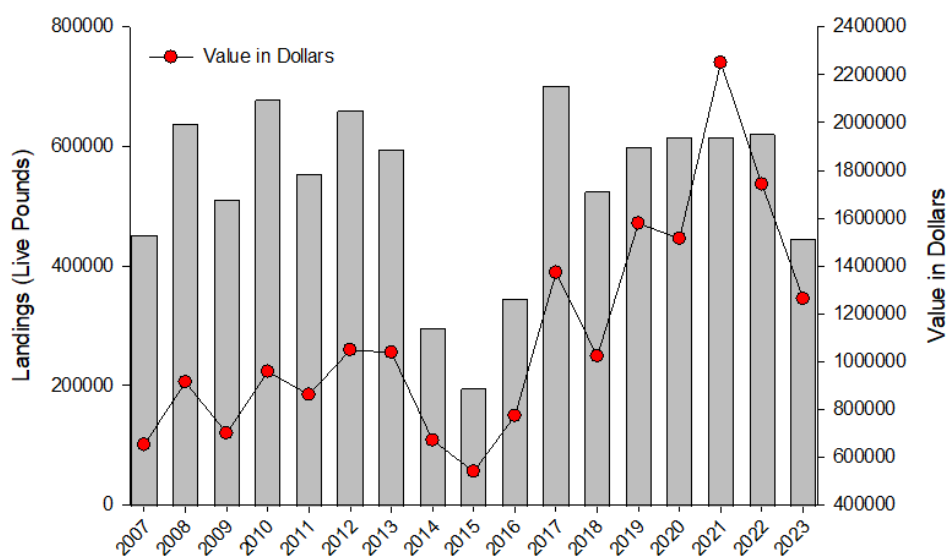
BRUNSWICK



Site locations: Thomas Point and Harpswell Cove

CLAMMING PROFILE:

- 2,254.53 intertidal acres (DMR Acreage by Town, 2016).
- 82 commercial clammers in 2023. No limit on the amount of recreational licenses sold to residents, and a 10% limit on recreational licenses sold to nonresidents.
- In 2023, 446,925 live pounds of soft-shell clams were landed in Brunswick (ex-vessel value of \$1,263,050) (DMR Landings, 2023). A graph of the live pounds and value of landings since 2007 is below.



Beginning (Deployment) Date: April 7, 2023

Ending (Fall Sampling) Date: October 27, 2023 (203 days total duration)

SEAWATER TEMPERATURE

Site	2020 Seawater Temperatures*	2021 Seawater Temperatures	2022 Seawater Temperatures	2023 Seawater Temperatures
Harpswell Cove	Max: 23.5°C (August 13) Min: 7.3°C (November 5)	Max: 22.8°C (August 14) Min: 8.5°C (April 30)	Max: 23.6°C (August 8) Min: 7.0°C (October 9)	Max: 24.0°C (July 26) Min: 6.4°C (April 9)
Thomas Point	Max: 25.0°C (August 13) Min: 6.7°C (November 5)	Max: 23.6°C (August 14) Min: 9.1°C (April 30)	Lost Recorder	Lost Recorder

*Seawater temperature was calculated from five temperature recordings around both high tides each day: 60 minutes and 30 minutes prior to and after high tide, as well as at high tide.

Temperature data was only recovered from Harpswell Cove in 2023. Analysis of how seawater temperatures changed through the season can be found in [Appendix E](#).

2023 SITE CORE SURVEY RESULTS - Fall and Spring

Below is a summary of the spring vs. fall core survey results for Brunswick (n=12 for each flat and season). Clam densities are provided in the average number of clams per square foot (ft²) and accompanied by the 95% confidence interval (CI) number in the parenthesis.

Site	Density of clams found in surveys		Difference between Spring and Fall densities		Average size of clams sampled	
	Spring	Fall			Spring	Fall
Harpswell Cove	5.09 (±3.38) clams/ft ²	0 clams/ft ²	Loss of 5.09 clams/ft ²		11.34 mm [0.45 in]	N/A
Thomas Point	4.67 (±4.01) clams/ft ²	0 clams/ft ²	Loss of 4.67 clams/ft ²		8.92 mm [0.35 in]	N/A

In 2023, average clam density was slightly higher at Harpswell Cove compared to Thomas Point, which was the same as in 2020 and 2021. No clams were found in surveys at either site in the fall. Additional data on the densities of surveyed clams across all years and sites can be found in [Appendix A](#).

No clams were found in surveys at both Harpswell Cove and Thomas Point in the fall, so both sites experienced a decrease in density from spring to fall. Comparing this to previous years, in 2022, Harpswell Cove experienced a small increase in density while no clams were found in surveys at Thomas Point. In 2021, both flats experienced no change in density and in 2020 there was an average gain of 0.3 clams/ft².

In previous years, the average size of surveyed soft-shell clams was larger at Harpswell Cove than Thomas Point. Additional data on the size-frequency distribution of surveyed clams can be found in [Appendix B](#).

2023 RECRUITMENT BOX RESULTS

Summary of Average Soft-shell Clam Recruit Density

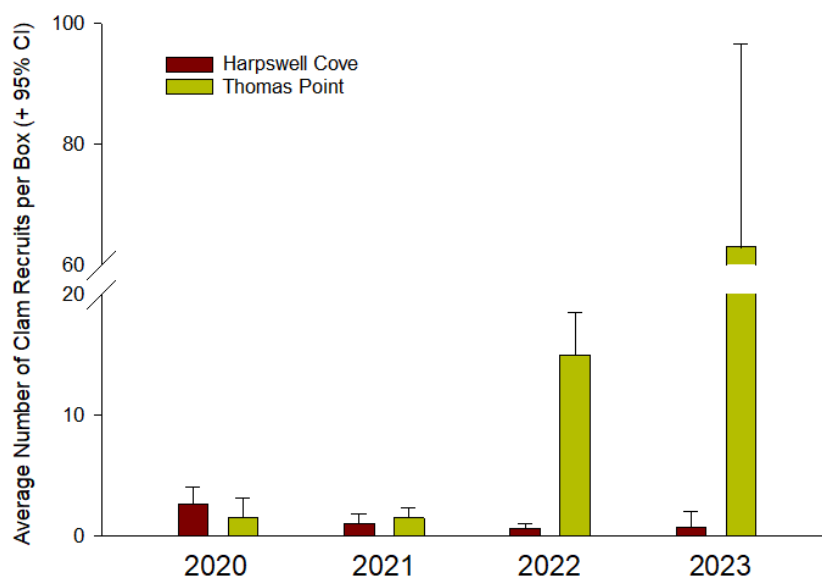
Clam density is presented as the average number of clams per square foot (ft²) and is accompanied by its 95% confidence interval (CI) in parentheses.

Site*	Avg. # per ft ²	Conclusion
Harpswell Cove	0.67 (±1.35)	In 2023, there were 94x more clam recruits at Thomas Point than Harpswell Cove. This was a statistically significant difference (p = 0.0005).
Thomas Point	62.94 (±33.69)	

*A detailed analysis of fall clam recruitment by flat can be found in [Appendix F](#).

At Thomas Point, clam recruit density increased from 2021 (1.5 clams/ft² average) and 2022 (14.95 clams/ft²) to 2023 (62.94 clams/ft²). At Harpswell Cove, recruit density remained similar to numbers seen in 2022 (0.67 and 0.65 clams/ft², respectively) but is still lower than what was seen in 2020 (3.85 clams/ft² average) and 2021 (1.0 clams/ft²). Additional data on the density of soft-shell clam recruits can be found in [Appendix C](#).

The graph below shows the average number of young-of-the-year soft-shell clams in recruitment boxes from two study sites in the town of Brunswick (Spring to Fall 2020-2023). All boxes had a mesh top (PetScreen®; 1.7mm x 0.9mm aperture) across all years. In 2020 (n = 8) and 2023 (n = 12), boxes had a ground cover (fabric) bottom. In 2021 and 2022 (n = 16), all bottoms were comprised of PetScreening®.



Summary of Clam Recruit Size

Summary of the size of recruits given in both mm and inches. Average size is accompanied by its 95% confidence interval (CI).

Site	# Recruits Measured (N)	Min. Size of Recruit	Max. Size of Recruit	Average Recruit Size
Harpswell Cove	13	1.46 mm [0.06 in]	19.45 mm [0.77 in]	12.04 (± 4.12) mm [0.47 in]
Thomas Point	205	1.53 mm [0.06 in]	27.59 mm [1.09 in]	7.79 (± 0.84) mm [0.31 in]

Unlike the last two years, recruits were generally larger at Harpswell Cove than Thomas Point. Additional data on the size of soft-shell clam recruits can be found in [Appendix C and G](#).

Summary of Green Crab Density and Size

Total number of green crabs in n = 12 recruitment boxes per site, along with average number of green crabs per square foot \pm 95% CI and size information.*

Site	Total # of Green Crabs	Density**	Min. Size	Max. Size	Average Size
Harpswell Cove	26	1.33 (± 0.33) crabs/ft ²	5.27 mm [0.21 in]	40.14 mm [1.58 in]	22.54 (± 3.84) mm [0.89 in]
Thomas Point	11	0.56 (± 0.39) crabs/ft ²	3.29 mm [0.13 in]	28.77 mm [1.13 in]	13.3 (± 4.99) mm [0.52 in]

*An analysis of green crab size-frequency distribution by flat can be found in [Appendix H](#).

**Data on the average size and density of green crabs found in recruitment boxes can be found in [Appendix D](#).

In 2023, green crab density was significantly greater at Harpswell Cove than Thomas Point ($p = 0.0003$). The average carapace size was also larger at Harpswell Cove, which is the opposite of what was seen in 2022.

Graphs showing the relationship between the largest green crab in each recruitment box and the number of clam recruits recovered can be found in [Appendix I](#).

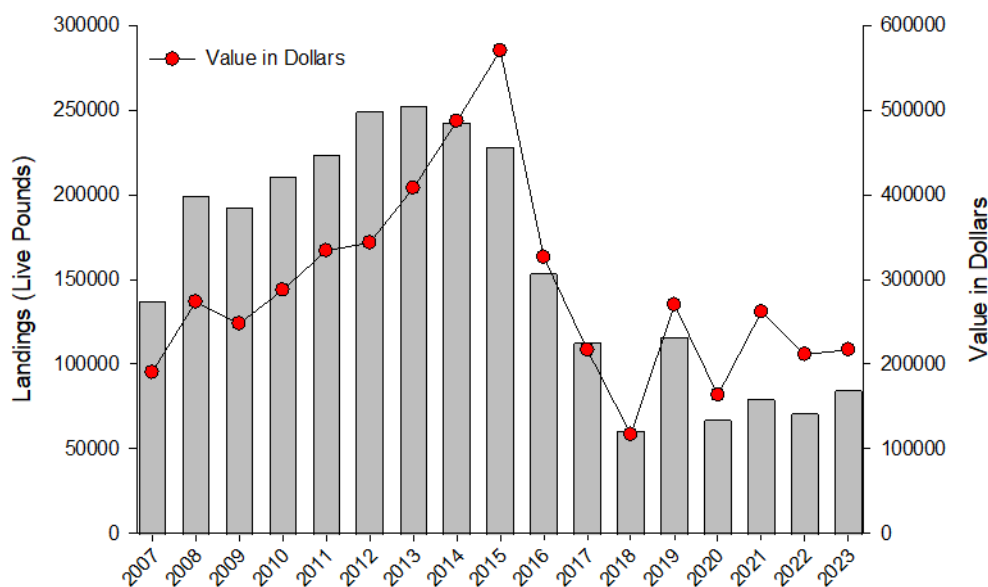
PHIPPSBURG



Site locations: Atkins Flat and Branch Flat

CLAMMING PROFILE:

- 2,224.12 intertidal acres (DMR Acreage by Town, 2016).
- In 2023, Phippsburg had 28 commercial and 660 recreational clamming licenses allocated for residents and nonresidents.
- In 2023, 85,120 live pounds of soft-shell clams were landed in Phippsburg (ex-vessel value of \$216,978) (DMR Landings, 2023). A graph of the live pounds and value of landings since 2007 is below.



Beginning (Deployment) Date: April 6, 2023

Ending (Fall Sampling) Date: October 28, 2023 (205 days total duration)

SEAWATER TEMPERATURE

Site	2023 Seawater Temperatures*
Atkins Flat	Lost Recorder
Branch Flat	Max: 23.6°C (July 29) Min: 5.5°C (April 8)

*Seawater temperature was calculated from five temperature recordings around both high tides each day: 60 minutes and 30 minutes prior to and after high tide, as well as at high tide.

Temperature data was only recovered from Branch Flat in 2023. No temperature recorders were recovered in 2022. Analysis of how seawater temperatures changed at Branch Flat through the season can be found in [Appendix E](#).

2023 SITE CORE SURVEY RESULTS - Fall and Spring

Below is a summary of the spring vs. fall site core survey results for Phippsburg (n=12 at each flat and season). Clam densities are presented as the average number of clams per square foot (ft²) and is accompanied by its 95% confidence interval (CI) in parentheses.

Site	Density of clams found in surveys		Difference between Spring and Fall densities	Average size of clams sampled	
	Spring	Fall		Spring	Fall
Atkins Flat	6.79 (±5.04) clams/ft ²	6.37 (±9.38) clams/ft ²	Loss of 0.42 clams/ft ²	6.73 mm [0.26 in]	3.03 mm [0.02 in]
Branch Flat	6.79 (±3.18) clams/ft ²	1.27 (±1.46) clams/ft ²	Loss of 5.52 clams/ft ²	6.14 mm [0.24 in]	3.96 mm [0.16 in]

In 2023, average clam density was higher at Atkins Flat than Branch Flat in the fall which was also observed in 2022. Additional data on the densities of surveyed clams across all sites and years can be found in [Appendix A](#).

In contrast to the results of the 2022 surveys, both Atkins Flat and Branch Flat experienced declines in clam densities from spring to fall (0.42 and 5.52 clams/ft² respectively). In 2022, both sites experienced gains from spring to fall that averaged 0.64 clams/ft².

The average size of surveyed clams was slightly larger at Atkins Flat in the spring and slightly larger at Branch Flat in the fall. Additional data on the size-frequency distribution of surveyed clams across all years and sites can be found in [Appendix B](#).

2023 RECRUITMENT BOX RESULTS

Summary of Average Soft-shell Clam Recruit Density

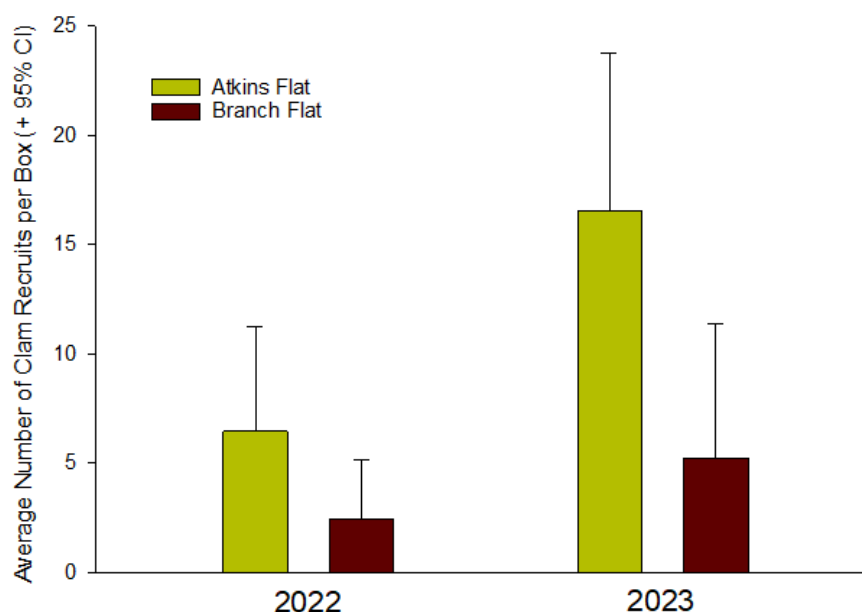
Clam densities are presented as the average number of clams per square foot (ft²) and is accompanied by its 95% confidence interval (CI) in parentheses.

Site*	Avg. # per ft ²	Conclusion
Atkins Flat	16.56 (±7.16)	On average, 3x more clam recruits occurred at Atkins Flat than Branch Flat. This difference was statistically significant (p = 0.0148). The average density across both flats and bottom types was 10.89 ±6.65 clams/ft ² .
Branch Flat	5.23 (±6.13)	

*A detailed analysis of fall clam recruitment by flat can be found in [Appendix F](#).

Clam recruit density at Atkins Flat increased from 2022 (6.46 clams/ft² in fabric-bottomed boxes) to 2023 (16.56 clams/ft²). Recruit density also increased at Branch Flat from 2022 (2.46 clams/ft² in fabric-bottomed boxes) to 2023 (5.23 clams/ft²). Additional data on the density of soft-shell clam recruits across all years and sites can be found in [Appendix C](#).

The graph below shows the average number of young-of-the-year soft-shell clams in recruitment boxes from two study sites in the town of Phippsburg (Spring to Fall 2022-2023). All boxes had a mesh top (PetScreen®; 1.7mm x 0.9mm aperture) across all years. In 2022 (n = 8) and 2023 (n = 12), boxes had a ground cover (fabric) bottom.



Summary of Clam Recruit Size

Summary of the size of recruits given in both mm and inches. Average size is accompanied by its 95% confidence interval (CI).

Site	# Recruits Measured (N)	Min. Size of Recruit	Max. Size of Recruit	Average Recruit Size
Atkins Flat	190	14.45 mm [0.57 in]	38.14 mm [1.50 in]	25.25 (± 0.79) mm [0.99 in]
Branch Flat	67	1.02 mm [0.04 in]	28.05 mm [1.10 in]	13.09 (± 1.58) mm [0.52 in]

In 2023, clam recruits were generally larger at Atkins Flat than Branch Flat, while in 2022, clam size was relatively similar across both flats. Additional data on the size of clam recruits across all years and sites can be found in [Appendix C and G](#).

Summary of Green Crab Density and Size

Total number of green crabs in $n = 12$ recruitment boxes, along with average number of green crabs per square foot \pm 95% CI and size information.*

Site	Total # of Green Crabs	Density**	Min. Size	Max. Size	Average Size
Atkins Flat	103	5.28 (± 1.79) crabs/ft ²	3.58 mm [0.14 in]	34.46 mm [1.36 in]	13.06 (± 0.88) mm [0.51 in]
Branch Flat	106	5.43 (± 2.70) crabs/ft ²	3.02 mm [0.12 in]	25.92 mm [1.02 in]	11.01 (± 0.84) mm [0.43 in]

*An analysis of green crab size-frequency distribution by flat can be found in [Appendix H](#).

**Data on the average size and density of green crabs found in recruitment boxes can be found in [Appendix D](#).

In 2023, the average density of green crabs did not differ significantly between Atkins Flat and Branch Flat ($p = 0.9177$), while in 2022 the average density was greater at Atkins than Branch. The average size of green crabs was larger at Atkins Flat than Branch Flat.

Graphs showing the relationship between the largest green crab in each recruitment box and the number of clam recruits recovered can be found in [Appendix I](#).

MIDCOAST

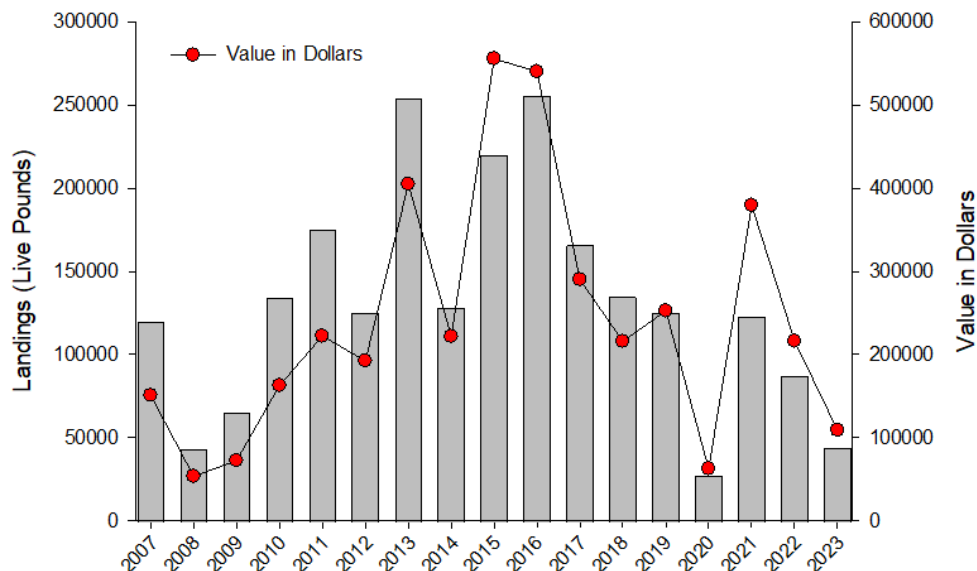
BREMEN



Site locations: Broad Cove and Sam's Cove

CLAMMING PROFILE:

- 1,078.76 intertidal acres (DMR Acreage by Town, 2016).
- 47 commercial clammers and 55 recreational licenses were allocated for in 2023.
- In 2023, 44,497 live pounds of soft-shell clams were landed in Bremen (ex-vessel value of \$108,931) (DMR Landings, 2023). A graph of the live pounds and value of landings since 2007 is below.



Beginning (Deployment) Date: April 16, 2023

Ending (Fall Sampling) Date: October 26, 2023 (193 days total duration)

SEAWATER TEMPERATURE

Site	2020 Seawater Temperatures*	2021 Seawater Temperatures
Sam's Cove	Max: 23.7°C (August 11) Min: 4.7°C (November 19)	Lost recorder
Broad Cove	Max: 22.8°C (August 11) Min: 3.6°C (November 19)	Max: 21.8°C (August 27) Min: 8.4°C (November 5)

*Seawater temperature was calculated from five temperature recordings around both high tides each day: 60 minutes and 30 minutes prior to and after high tide, as well as at high tide.

Temperature recorders were lost and not recovered from either study site in 2022 and 2023.

2023 SITE CORE SURVEY RESULTS - Fall and Spring

Below is a summary of the spring vs. fall site core survey results for Bremen (n=12 for each flat and season). Clam densities are presented as the average number of clams per square foot (ft²) and is accompanied by its 95% confidence interval (CI) in parentheses.

Site	Density of clams found in surveys		Difference between Spring and Fall densities		Average size of clams sampled	
	Spring	Fall			Spring	Fall
Sam's Cove	0 clams/ft ²	0 clams/ft ²	No change in clams/ft ²		N/A	N/A
Broad Cove	2.12 (±2.16) clams/ft ²	0 clams/ft ²	Loss of 2.12 clams/ft ²		6.14 mm [0.24 in]	N/A

In 2023, only 7 clams were found across both the spring and fall surveys at Broad Cove. In previous years, the average clam density was higher at Broad Cove than Sam's Cove in both the spring and fall. Additional data on the densities of surveyed clams across all years and sites can be found in [Appendix A](#).

Broad Cove experienced a loss of 2.12 clams/ft² from spring to fall while there was no change at Sam's Cove with 0 clams being found in surveys in both the spring and fall. Interestingly, 2022 seems to be an outlier with clams being found in surveys at both sites during both the spring and fall. In 2020 and 2021, no clams were found at Sam's Cove in the fall and spring. Additional data on the size-frequency distribution of surveyed clams can be found in [Appendix B](#).

2023 RECRUITMENT BOX RESULTS

Summary of Average Soft-shell Clam Recruit Density

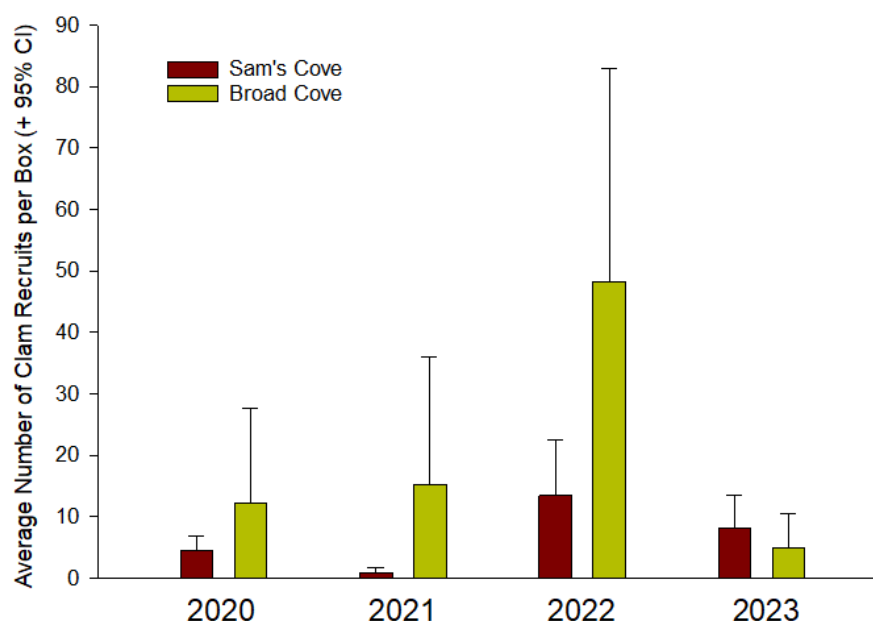
Clam densities are presented as the average number of clams per square foot (ft²) and is accompanied by its 95% confidence interval (CI) in parentheses.

Site*	Avg. # per ft ²	Conclusion
Sam's Cove	8.20 (±5.31)	1.6x more clam recruits occurred at Sam's Cove than Broad Cove, but this difference in average number per ft ² was not statistically significant (p = 0.3613). The average density for both flats was 6.59 ±5.39 clams/ft ² .
Broad Cove	4.97 (±5.47)	

*A detailed analysis of fall clam recruitment by flat can be found in [Appendix F](#).

In 2023, clam recruit density at Broad Cove decreased from 2020 (12.95 clams/ft²), 2021 (15.3 clams/ft²), and 2022 (48.24 clams/ft²) to 2023 (4.97 clams/ft²). At Sam's Cove, recruit density decreased from 2020 (5.6 clams/ft² average) to 2021 (0.9 clams/ft²), increased in 2022 (13.45 clams/ft²) and decreased again in 2023 (8.2 clams/ft²). Additional data on the density of soft-shell clam recruits across all years and sites can be found in [Appendix C](#).

The graph below shows the average number of young-of-the-year soft-shell clams in recruitment boxes from two study sites in the town of Bremen (Spring to Fall 2020-2023). All boxes had a mesh top (PetScreen®; 1.7mm x 0.9mm aperture) across all years. In 2020 (n = 8) and 2023 (n = 12), boxes had a ground cover (fabric) bottom. In 2021 and 2022 (n = 16), all bottoms were comprised of PetScreening®.



Summary of Clam Recruit Size

Summary of the size of recruits in both mm and inches. Average size is accompanied by its 95% confidence interval (CI).

Site	# Recruits Measured (N)	Min. Size of Recruit	Max. Size of Recruit	Average Recruit Size
Sam's Cove	119	1.81 mm [0.07 in]	42.43 mm [1.67 in]	15.48 (± 1.57) mm [0.61 in]
Broad Cove	66	1.54 mm [0.06 in]	30.07 mm [1.18 in]	11.85 (± 2.14) mm [0.47 in]

Similar to the last three years, clams were generally able to achieve a larger size at Sam's Cove than Broad Cove in 2023. Additional data on the size of soft-shell clam recruits across all years and sites can be found in a table in [Appendix C and G](#).

Summary of Green Crab Density and Size

Total number of green crabs in n = 12 recruitment boxes per site, along with average number of crabs per square foot \pm 95% CI and size information.*

Site	Total # of Green Crabs	Density**	Min. Size	Max. Size	Average Size
Sam's Cove	27	1.38 (± 0.63) crabs/ft ²	3.27 mm [0.13 in]	48.26 mm [1.9 in]	15.75 (± 4.12) mm [0.62 in]
Broad Cove	15	0.77 (± 0.58) crabs/ft ²	4.09 mm [0.16 in]	35.0 mm [1.38 in]	21.01 (± 5.42) mm [0.83 in]

*An analysis of green crab size-frequency distribution by flat can be found in [Appendix H](#).

**Data on the average size and density of green crabs found in recruitment boxes can be found in [Appendix D](#).

Unlike in 2022, the density of green crabs was greater at Sam's Cove than Broad Cove and the average size was slightly larger at Broad Cove in 2023. The average density of crabs was ~1.8x greater at Sam's Cove than Broad Cove, but this difference was not significant ($p = 0.1271$). The density of green crabs at Broad Cove was less than in 2022 and 2021 (1.69 and 1.2 crabs/ft² respectively). At Sam's Cove, the 2023 green crab density was less than in 2021 (3.8 crabs/ft²), but greater than in 2022 (0.78 crabs/ft²).

Graphs showing the relationship between the largest green crab in each recruitment box and the number of clam recruits recovered can be found in [Appendix I](#).

ISLESBORO



Site locations: Ryder Cove and Little Broad Cove

CLAMMING PROFILE:

- 4,380.15 intertidal acres (DMR Acreage by Town, 2016).
- In 2023, Islesboro had an unlimited number of commercial and recreational clamming licenses allocated for residents.
- In 2015 (the most recent available data), 5,350 live pounds of soft-shell clams, valued at \$13,586, were landed in Islesboro (DMR Landings, 2020).

Beginning (Deployment) Date: April 14, 2023

Ending (Fall Sampling) Date: November 24, 2023 (224 days total duration)

SEAWATER TEMPERATURE

Site	2020 Seawater Temperatures*	2021 Seawater Temperatures	2022 Seawater Temperatures
Little Broad Cove	Max: 21.2°C (August 13) Min: 6.1°C (May 17)	Max: 19.8°C (August 27) Min: 6.4°C (May 9)	Max: 20.5°C (August 8) Min: 5.8°C (May 3)
Ryder Cove	Max: 21.8°C (August 11) Min: 6.3°C (May 17)	Max: 20.4°C (August 14) Min: 6.4°C (May 8)	Max: 21.4°C (August 6) Min: 6.0°C (May 3)

*Seawater temperature was calculated from five temperature recordings around both high tides each day: 60 minutes and 30 minutes prior to and after high tide, as well as at high tide.

Temperature recorders were lost and not recovered from either study site in 2023.

2023 SITE CORE SURVEY RESULTS - Fall and Spring

Below is a summary of the spring vs. fall site core survey results for Islesboro (n=12 for each flat and season). Clam densities are presented as the average number of clams per square foot (ft²) and is accompanied by its 95% confidence interval (CI) in parentheses.

Site	Density of clams found in surveys		Difference between Spring and Fall densities	Average size of clams sampled	
	Spring	Fall		Spring	Fall
Ryder Cove	0.43 (±0.94) clams/ft ²	2.12 (±2.16) clams/ft ²	Gain of 1.69 clams/ft ²	4.11 mm* [0.16 in]	3.27 mm [0.13 in]
Little Broad Cove	1.27 (±1.46) clams/ft ²	0.43 (±0.93) clams/ft ²	Loss of 0.84 clams/ft ²	5.93 mm [0.23 in]	3.6 mm* [0.14 in]

*Only 1 clam found in survey

In 2023, clam density was almost 5 times higher at Ryder Cove than Little Broad Cove in the fall which was similar to results seen in 2022. In the spring however, the average clam density was higher at Little Broad Cove. No live clams were present in cores from 2021. Additional data on the densities of surveyed clams across all years and sites can be found in [Appendix A](#).

Ryder Cove experienced a gain of 1.69 clams/ft² from spring to fall, which is similar to the gain that occurred at this site in 2022 (1.91 clams/ft²). Little Broad Cove experienced a decrease of 0.84 clams/ft² from spring to fall. Additional data on the size-frequency distribution of surveyed clams across all years and sites can be found in [Appendix B](#).

2023 RECRUITMENT BOX RESULTS

Summary of Average Soft-shell Clam Recruit Density

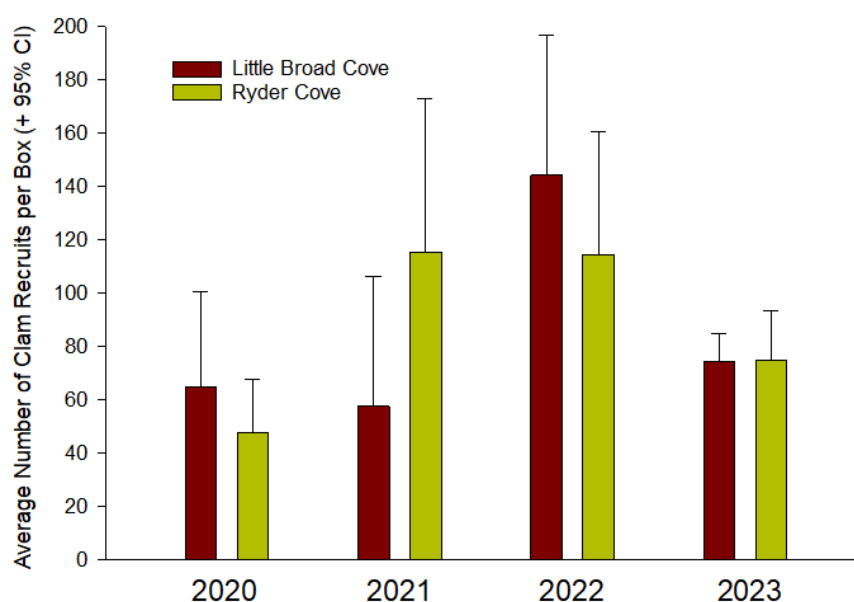
Clam densities are presented as the average number of clams per square foot (ft²) and is accompanied by its 95% confidence interval (CI) in parentheses.

Site*	Avg. # per ft ² (live recruits)	Conclusion
Little Broad Cove	74.06 (±10.61)	Ryder Cove had a slightly higher average number of recruits than Little Broad Cove, but this difference was not statistically significant (P = 0.9633). The average density for both flats was 74.29 ±14.84 clams/ft ² .
Ryder Cove	74.52 (±19.07)	

*A detailed analysis of fall clam recruitment by flat can be found in [Appendix F](#).

The average number of recruits decreased at both Little Broad Cove and Ryder Cove from 2022 to 2023. At Ryder Cove, clam recruit density increased from 2020 (26.2 clams/ft² average) to 2021 (115.3 clams/ft²) and stayed about the same in 2022 (114.36 clams/ft²). At Little Broad Cove, recruit density increased from 2020 and 2021 (32.6 and 57.5 clams/ft²) to 2022 (144.34 clams/ft²). Additional data on the density of soft-shell clam recruits across all years and sites can be found in [Appendix C](#).

The graph below shows the average number of young-of-the-year soft-shell clams in recruitment boxes from two study sites in the town of Islesboro (Spring to Fall 2020-2023). All boxes had a mesh top (PetScreen®; 1.7mm x 0.9mm aperture) across all years. In 2020 (n = 8), 2021 (n = 16), 2022 (n = 16), and 2023 (n = 12), boxes had a ground cover (fabric) bottom.



Summary of Clam Recruit Size

Summary of the size of recruits. Average size is accompanied by its 95% confidence interval (CI).

Site	# Recruits Measured (N)	Min. Size of Recruit	Max. Size of Recruit	Average Recruit Size
Little Broad Cove	240	7.74 mm [0.3 in]	31.47 mm [1.24 in]	20.11 (± 0.45) mm [0.79 in]
Ryder Cove	240	4.93 mm [0.19 in]	35.21 mm [1.39 in]	21.99 (± 0.85) mm [0.87 in]

Similar to the last three years, clam recruits were larger at Ryder Cove than Little Broad Cove in 2023. Additional data on the size of soft-shell clam recruits can be found in [Appendix C and G](#).

Summary of Green Crab Density and Size

Total number of green crabs in n = 12 recruitment boxes per site with the average number of crabs per square foot \pm 95% CI and size information.*

Site	Total # of Green Crabs	Density**	Min. Size	Max. Size	Average Size
Little Broad Cove	216	11.07 (± 3.59) crabs/ft ²	4.57 mm [0.18 in]	41.26 mm [1.62 in]	9.17 (± 0.68) mm [0.36 in]
Ryder Cove	169	8.66 (± 4.21) crabs/ft ²	3.17 mm [0.12 in]	22.47 mm [0.88 in]	7.95 (± 2.49) mm [0.31 in]

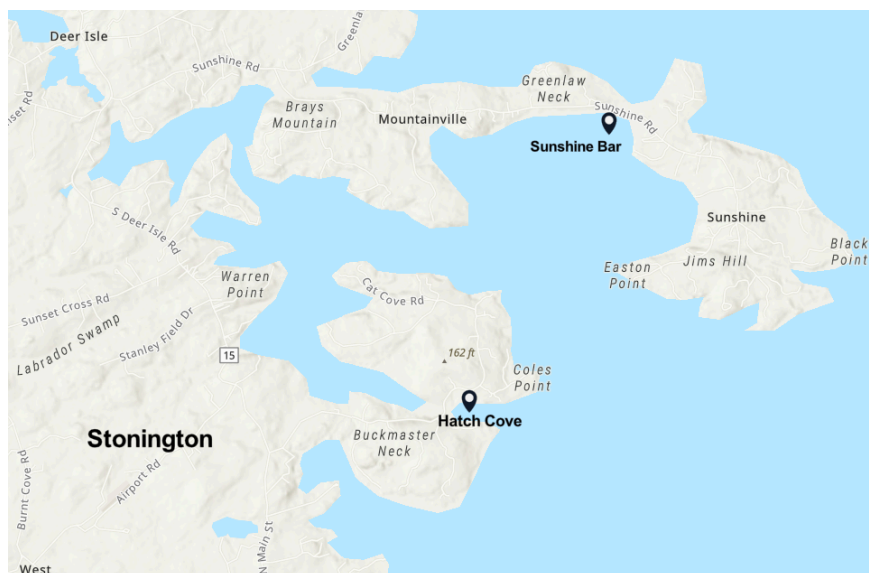
*An analysis of green crab size-frequency distribution by flat can be found in [Appendix H](#).

**Data on the average size and density of green crabs found in recruitment boxes can be found in [Appendix D](#).

As in previous years, the average density of green crabs was greater at Little Broad Cove than Ryder Cove, but this difference was not significant in 2023 ($p = 0.3479$). The density and average size of green crabs did decrease slightly at both sites from 2022.

Graphs showing the relationship between the largest green crab in each recruitment box and the number of clam recruits recovered can be found in [Appendix I](#).

Stonington/Deer Isle

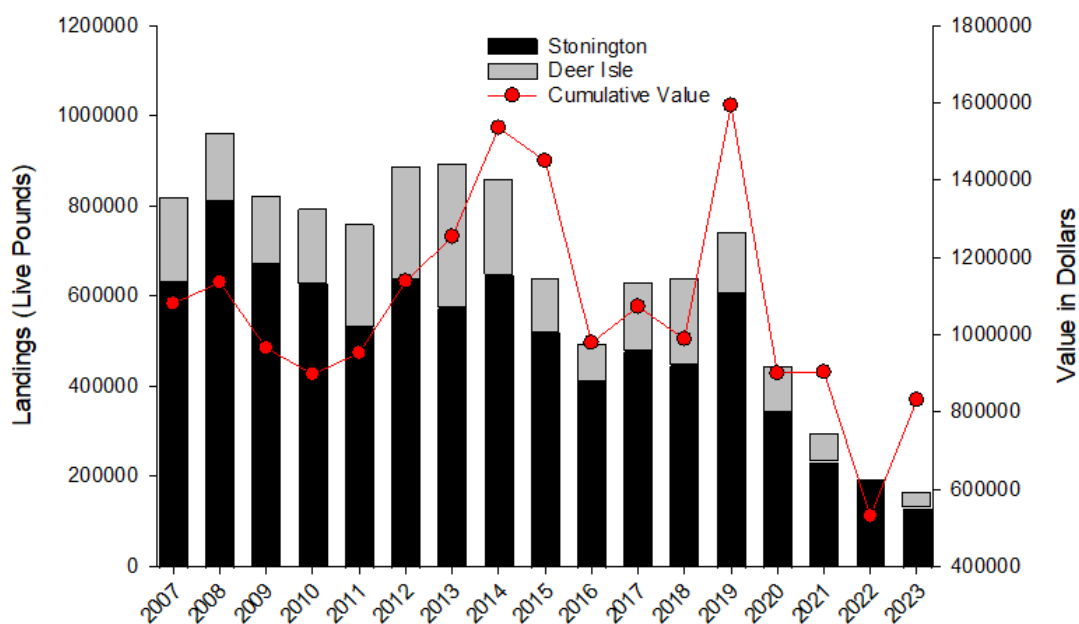


Site Locations: Hatch Cove (Stonington) and Sunshine Bar (Deer Isle)

CLAMMING PROFILE:

Stonington and Deer Isle have a combined shellfish program.

- Stonington has 1624.39 intertidal acres and Deer Isle has 4597.21 intertidal acres (DMR Acreage by Town, 2016).
- In 2023, Stonington and Deer Isle had an unlimited number of commercial and recreational clamming licenses allocated for residents and non-residents.
- In 2023, 32,936 live pounds of soft-shell clams, valued at \$221,412, were landed in Stonington (DMR Landings, 2023) and 131,001 live pounds of clams, valued at \$609,358, were landed in Deer Isle (DMR Landings, 2023). A graph of the live pounds and value of landings since 2007 is below.



Beginning (Deployment) Date: April 15, 2023

Ending (Fall Sampling) Date: November 25, 2023 (224 days total duration)

SEAWATER TEMPERATURE

Site	2023 Seawater Temperatures
Hatch Cove	Lost Recorder
Sunshine Bar	Max: 22.0°C (July 28) Min: 4.8°C (November 25)

*Seawater temperature was calculated from five temperature recordings around both high tides each day: 60 minutes and 30 minutes prior to and after high tide, as well as at high tide.

The temperature recorder was only recovered from Sunshine Bar in 2023 and were not recovered from either site in 2022.

2023 SITE CORE SURVEY RESULTS - Fall and Spring

Below is a summary of the spring vs. fall site survey results for Stonington (n=12 at each survey). Clam densities are presented as the average number of clams per square foot (ft²) and is accompanied by its 95% confidence interval (CI) in parentheses.

Site	Density of clams found in surveys		Difference between Spring and Fall densities		Average size of clams sampled	
	Spring	Fall			Spring	Fall
Hatch Cove	2.55 (±1.69) clams/ft ²	1.69 (±1.59) clams/ft ²	Loss of 0.86 clams/ft ²		6.05 mm [0.24 in]	4.55 mm [0.18 in]
Sunshine Bar	1.27 (±1.46) clams/ft ²	0 clams/ft ²	Loss of 1.27 clams/ft ²		8.87 mm [0.35 in]	N/A

In 2023, average clam density was higher at Hatch Cove than Sunshine Bar in both the spring and fall. Additional data on the densities of surveyed clams across all sites and years can be found in [Appendix A](#).

The number of clams found in clam surveys in 2023 at Hatch Cove decreased by 0.86 clams/ft² from spring to fall. Sunshine Bar also experienced a loss of 1.27 clams/ft² from spring to fall. Additional data on sizes of surveyed clams across all sites and years can be found in [Appendix B](#).

2023 RECRUITMENT BOX RESULTS

Summary of Average Soft-shell Clam Recruit Density

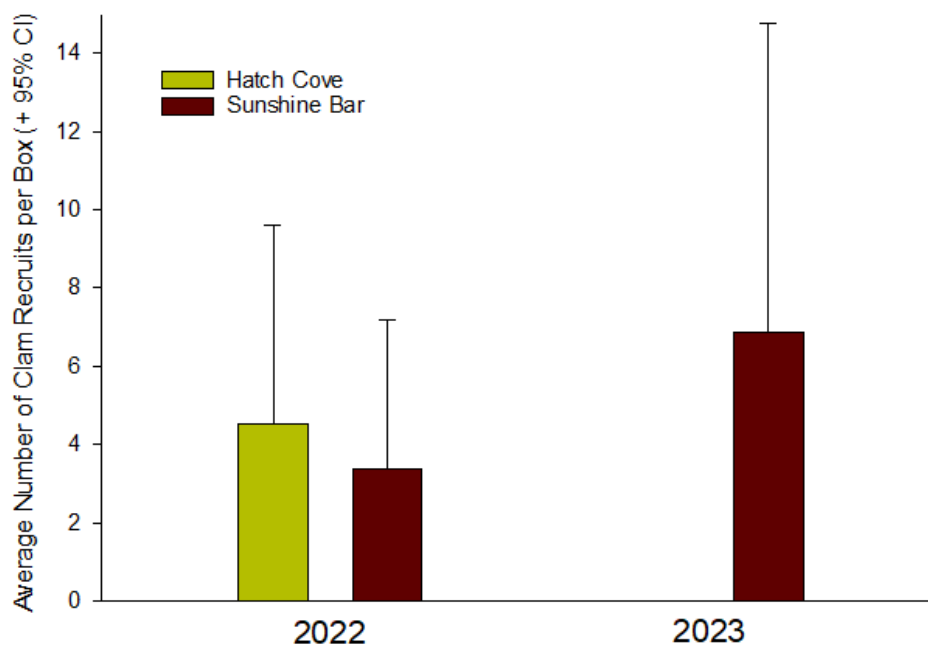
Clam densities are provided as the average number of clams per square foot (ft²) accompanied by the 95% confidence interval (CI) number in the parenthesis.

Site*	Avg. # per ft ²	Conclusion
Hatch Cove	0	The average clam recruit densities were not significantly different between Hatch Cove and Sunshine Bar ($p = 0.068$). The average density for both flats combined was 3.44 ± 3.94 clams/ft ² .
Sunshine Bar	6.87 (± 7.88)	

*A detailed analysis of fall clam recruitment by flat can be found in [Appendix F](#).

Unlike in 2022, no recruits were found in boxes at Hatch Cove in 2023. At Sunshine Bar, the average recruit density in 2023 was 2 times greater than in 2022 (6.87 vs 3.38 clams/ft²) if we only consider the boxes with fabric bottoms. Additional data on the density of soft-shell clam recruits across all years and sites can be found in [Appendix C](#).

The graph below shows the average number of young-of-the-year soft-shell clams in recruitment boxes from two study sites in the town of Stonington (Spring to Fall 2022-2023). All boxes had a mesh top (PetScreen®; 1.7mm x 0.9mm aperture) across all years. In 2022 ($n = 8$) and 2023 ($n = 12$), boxes had a ground cover (fabric) bottom.



Summary of Clam Recruit Size

Summary of the size of recruits. Average size is accompanied by its 95% confidence interval (CI).

Site	# Recruits Measured (N)	Min. Size of Recruit	Max. Size of Recruit	Average Recruit Size
Hatch Cove	0	N/A	N/A	N/A
Sunshine Bar	82	4.83 mm [0.19 in]	29.78 mm [1.17 in]	19.79 (± 1.06) mm [0.78 in]

In 2023, the average size of recruits at Sunshine Bar was slightly less than in 2022 (19.79 vs 21.72 mm, respectively). Additional data on the size of soft-shell clam recruits from all years and sites can be found in [Appendix C and G](#).

Summary of Green Crab Density and Size

Total number of green crabs in n = 12 recruitment boxes per site with average number of crabs per square foot \pm 95% CI and size information.*

Site	Total # of Green Crabs	Density**	Min. Size	Max. Size	Average Size
Hatch Cove	42	2.15 (± 0.66) crabs/ft ²	5.55 mm [0.22 in]	32.17 mm [1.27 in]	17.17 (± 1.73) mm [0.68 in]
Sunshine Bar	67	3.89 (± 1.51) crabs/ft ²	4.73 mm [0.19 in]	34.94 mm [1.38 in]	16.19 (± 1.86) mm [0.64 in]

*An analysis of green crab size-frequency distribution by flat can be found in [Appendix H](#).

**Data on the average size and density of green crabs found in recruitment boxes can be found in [Appendix D](#).

In 2023, the average density of green crabs in boxes decreased at both Sunshine Bar and Hatch Cove from 2022. The average crab size was similar between sites in 2023, unlike in 2022 when crabs at Sunshine Bar were larger. In 2023, the density of green crabs at Sunshine Bar was significantly higher than at Hatch Cove ($p = 0.0296$).

Graphs showing the relationship between the largest green crab in each recruitment box and the number of clam recruits recovered can be found in [Appendix I](#).

DOWNEAST FRENCHMAN BAY

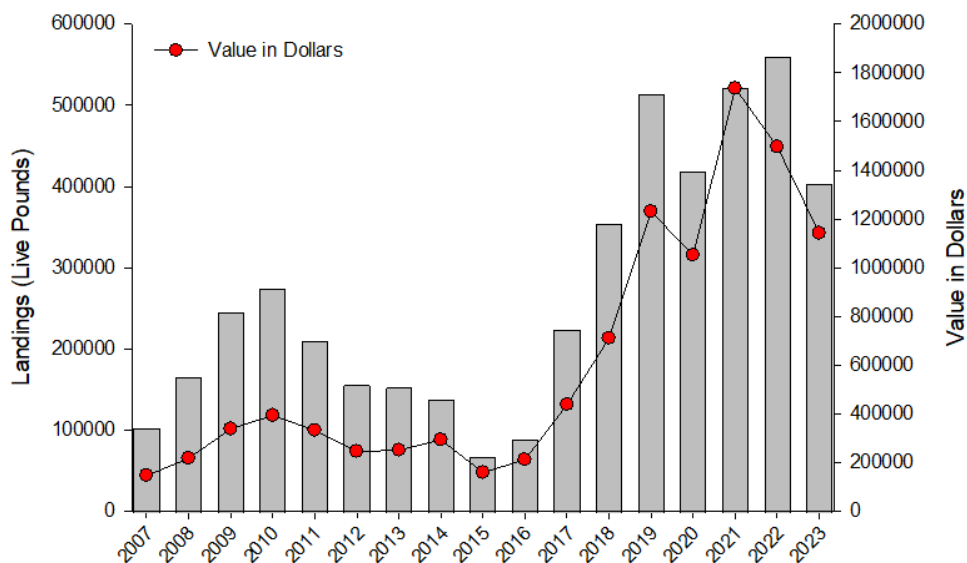


Site Locations: Hog Bay and Raccoon Cove

CLAMMING PROFILE:

Frenchman Bay Regional Shellfish Program is governed by a regional ordinance, with agreements from seven towns in Hancock County: Ellsworth, Franklin, Hancock, Lamoine, Sorrento, Sullivan, and Trenton.

- Frenchman Bay Regional Shellfish Program is composed of 8,054.81 intertidal acres (IA) (DMR Acreage by Town, 2016). Franklin (the location of Hog Bay) has 1,725.09 intertidal acres and Lamoine (the location of Raccoon Cove) has 1,907.55 intertidal acres. Ellsworth has 280.72 IA, Hancock: 1,589.71 IA, Sorrento: 770.92 IA, Sullivan: 306.65 IA, and Trenton: 1,473.80 IA.
- There were no limits on the number of residential commercial or recreational licenses allocated for in 2023.
- In 2023, 227,016 live pounds of soft-shell clams (valued at \$539,214) were landed in Franklin. 31,195 pounds (valued at \$68,831) were landed in Lamoine. 34,737 pounds (valued at \$157,856) were landed in Hancock. 130,162 pounds (valued at \$418,252) were landed in Sullivan. And 12,051 pounds (valued at \$26,659) were landed in Trenton (DMR Landings, 2023). A graph of the live pounds and value of landings since 2007 is below.



Beginning (Deployment) Date: April 23, 2023

Ending (Fall Sampling) Date: November 1, 2023 (192 days total duration)

SEAWATER TEMPERATURE

Site	2020 Seawater Temperatures*	2021 Seawater Temperatures	2022 Seawater Temperatures	2023 Seawater Temperatures
Raccoon Cove	Max: 17.2°C (August 6) Min: 7.3°C (May 14)	Max: 18.4°C (August 15) Min: 7.4°C (April 29/May 2)	Lost Recorder	Max: 16.4°C (Sept. 15) Min: 6.9°C (April 25)
Hog Bay	Max: 25.1°C (June 19) Min: 8.4°C (October 9)	Max: 24.8°C (June 29/30) Min: 9.5°C (May 9)	Max: 26.6°C (July 24) Min: 6.6°C (April 20)	Max: 23.5°C (Aug. 2) Min: 8.5°C (April 27)

*Seawater temperature was calculated from five temperature recordings around both high tides each day: 60 minutes and 30 minutes prior to and after high tide, as well as at high tide.

The battery of the Hog Bay recorder failed after 137 days on August 18, 2023. Analysis of how seawater temperatures changed through the season can be found in [Appendix E](#).

2023 SITE CORE SURVEY RESULTS - Fall and Spring

Below is a summary of the spring vs. fall site survey results for Frenchman's Bay (n=12 at each survey). Clam densities are presented as the average number of clams per square foot (ft²) and is accompanied by its 95% confidence interval (CI) in parentheses.

Site	Density of clams found in surveys		Difference between Spring and Fall densities		Average size of clams sampled	
	Spring	Fall			Spring	Fall
Raccoon Cove	0 clams/ft ²	0.85 (±1.26) clams/ft ²	Gain of 0.85 clams/ft ²		N/A	3.57 mm [0.14 in]
Hog Bay	0.43 (±2.84) clams/ft ²	0.43 (±0.93) clams/ft ²	No change in clams/ft ²		5.41 mm* [0.21 in]	36.64 mm* [1.44 in]

*only 1 clam found in survey

In 2023, average clam density in the surveys was higher at Hog Bay than Raccoon Cove in the spring, but lower in the fall. In both 2022 and 2021, average clam density was higher at Hog Bay. Additional data on the densities of surveyed clams across all sites and years can be found in [Appendix A](#).

Clams increased by 0.85 clams/ft² from spring to fall at Raccoon Cove. Hog Bay experienced no change from spring to fall. Averaging both sites, there was a net gain of 0.42 clams/ft², in contrast to the previous three years which all experienced net losses from spring to fall.

The average size of surveyed soft-shell clams was larger at Hog Bay than Raccoon Cove, which was the same as seen in previous years. Additional data on sizes of surveyed clams across all years and sites can be found in the table in [Appendix B](#).

2023 RECRUITMENT BOX RESULTS

Summary of Average Soft-shell Clam Recruit Density

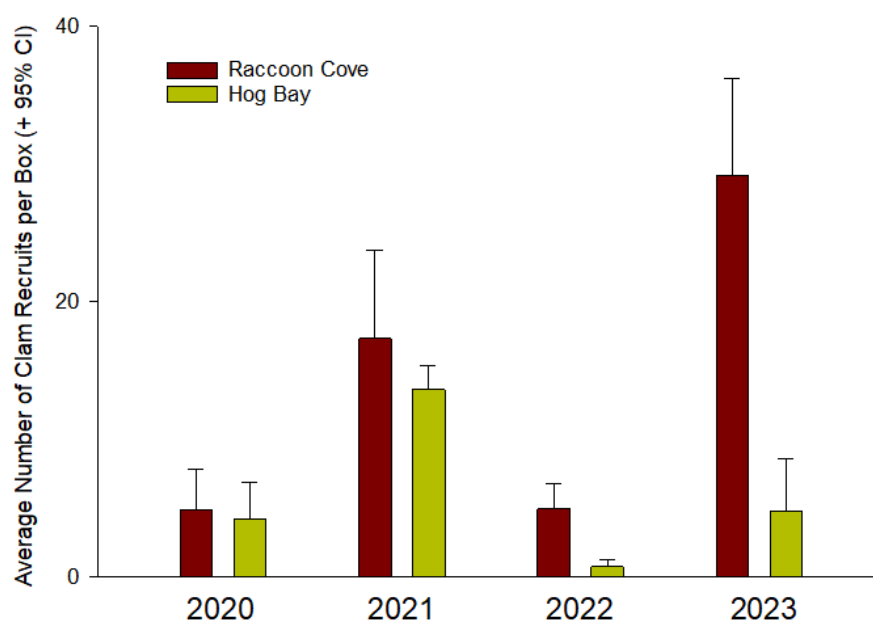
Clam densities are provided as the average number of clams per square foot (ft²) and accompanied by the 95% confidence interval (CI) number in the parenthesis.

Site*	Avg. # per ft ²	Conclusion
Raccoon Cove	29.11 (±7.11)	The average number of recruits at Raccoon Cove was almost 6x greater than at Hog Bay. This difference in average number of recruits between the two sites was statistically significant ($P < 0.0001$). The average density for both flats was 16.92 ± 5.49 clams/ft ² .
Hog Bay	4.72 (±3.86)	

*A detailed analysis of fall clam recruitment by flat can be found in [Appendix F](#).

In 2023, clam recruit density increased at both sites compared to 2022. The clam density this year was almost 6 times greater at Raccoon Cove and was 6.5 times greater at Hog Bay compared to what was found in 2022. Data on the density of soft-shell clam recruits can be found in [Appendix C](#).

The graph below shows the average number of young-of-the-year soft-shell clams in recruitment boxes from two study sites in Frenchman's Bay (Spring to Fall 2020-2023). All boxes had a mesh top (PetScreen®; 1.7mm x 0.9mm aperture) across all years. In 2020 (n = 8) and 2023 (n = 12), boxes had a ground cover (fabric) bottom. In 2021 and 2022 (n = 16), boxes at Raccoon Cove had mesh bottoms while boxes at Hog Bay had fabric bottoms.



Summary of Clam Recruit Size

Summary of the size of clam recruits given in both mm and inches. Average size is accompanied by its 95% confidence interval (CI).

Site	# Recruits Measured (N)	Min. Size of Recruit	Max. Size of Recruit	Average Recruit Size
Raccoon Cove	240	1.64 mm [0.06 in]	18.46 mm [0.73 in]	8.78 (± 0.45) mm [0.35 in]
Hog Bay	78	1.80 mm [0.07 in]	16.90 mm [0.67 in]	8.89 (± 1.01) mm [0.35 in]

Similar to the last two years, clam recruits were generally able to achieve a larger size at Hog Bay than Raccoon Cove, but this difference was not as significant as in previous years. Additional data on the size of soft-shell clam recruits can be found in [Appendix C and G](#).

Summary of Green Crab Density and Size

Total number of green crabs in n = 12 recruitment boxes per site, along with average number of crabs per square foot \pm 95% CI and size information.*

Site	Total # of Green Crabs	Density**	Min. Size	Max. Size	Average Size
Raccoon Cove	6	0.31 (± 0.26) crabs/ft ²	8.26 mm [0.33 in]	17.50 mm [0.69 in]	11.21 (± 3.73) mm [0.44 in]
Hog Bay	5	0.26 (± 0.2) crabs/ft ²	14.84 mm [0.58 in]	32.53 mm [1.28 in]	24.75 (± 11.04) mm [0.97 in]

*An analysis of green crab size-frequency distribution by flat can be found in [Appendix H](#).

**Data on the size and density of green crabs found in recruitment boxes can be found in a table in [Appendix D](#).

Unlike in 2022 and 2021, green crabs were found at Hog Bay as well as Raccoon Cove. In 2020, green crabs were only found at Hog Bay. This year, the average size of the green crabs found was greater at Hog Bay than Raccoon Cove. There was no significant difference in average crab density between the two sites in 2023 ($p = 0.7369$).

Graphs showing the relationship between the largest green crab in each recruitment box and the number of clam recruits recovered can be found in [Appendix I](#).

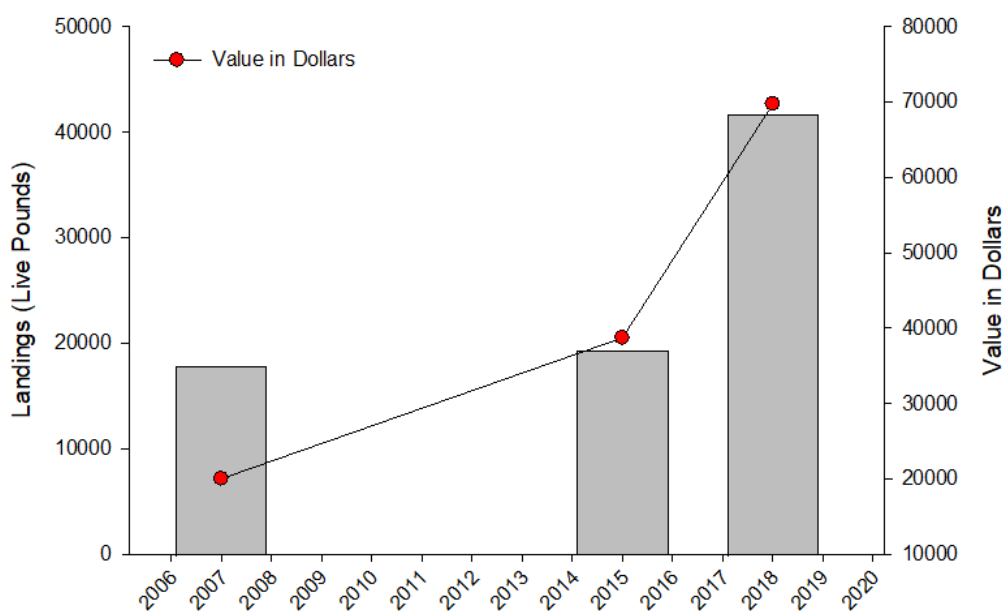
BEALS



Site Locations: Perio Point and Dobbins' Island

CLAMMING PROFILE:

- Beals has 1,741.22 intertidal acres (DMR Acreage by Town, 2016).
- Beals had no limit on the sale of commercial and recreational licenses for residents in 2023.
- In 2018 (the most recent available data), 41,711 live pounds of soft-shell clams, valued at \$69,767, were landed in Beals (DMR Landings, 2020). A graph of the live pounds and value of landings in 2007, 2015, and 2018 is below.



Beginning (Deployment) Date: April 6, 2023*

Ending (Fall Sampling) Date: November 13, 2023 (221 days total duration)

SEAWATER TEMPERATURE

Site	2020 Seawater Temperatures*	2021 Seawater Temperatures	2022 Seawater Temperatures	2023 Seawater Temperatures
Dobbins' Island	Max: 20.2°C (August 12) Min: 7.0°C (May 16)	Max: 20.2°C (August 14) Min: 6.4°C (May 1)	Max: 20.0°C (August 7) Min: 5.3°C (April 19)	Lost Recorder
Perio Point	Max: 15.6°C (Aug. 6/14/15) Min: 6.5°C (May 13)	Max: 16.2°C (August 27) Min: 7.1°C (May 1)	Max: 16.3°C (August 22) Min: 7.1°C (May 5)	Max: 15.9°C (Sept. 6) Min: 4.5°C (April 6)

*Seawater temperature was calculated from five temperature recordings around both high tides each day: 60 minutes and 30 minutes prior to and after high tide, as well as at high tide.

The recorder at Dobbins' Island was not recovered. Analysis of how seawater temperatures changed through the season can be found in [Appendix E](#).

2023 SITE CORE SURVEY RESULTS - Fall and Spring

Below is a summary of the spring vs. fall site survey results for Beals (n=12 at each survey).

Clam densities are presented as the average number of clams per square foot (ft²) and is accompanied by its 95% confidence interval (CI) in parentheses.

Site	Density of clams found in surveys		Difference between Spring and Fall densities	Average size of clams sampled	
	Spring	Fall		Spring	Fall
Dobbins' Island	1.27 (±2.01) clams/ft ²	0 clams/ft ²	Loss of 1.27 clams/ft ²	4.43 mm [0.17 in]	N/A
Perio Point	6.37 (±6.49) clams/ft ²	0.43 (±0.93) clams/ft ²	Loss of 5.94 clams/ft ²	3.91 mm [0.15 in]	4.82 mm* [0.19 in]

*only 1 clam found in survey

In 2023, average clam density in the surveys was higher at Perio Point than Dobbins' Island, which was a return to the trends observed in 2021 and 2020. Additional data on the densities of surveyed clams across all years and sites can be found in [Appendix A](#).

Dobbins' Island experienced a loss of 1.27 clams/ft² from spring to fall. Perio Point experienced a loss of 5.97 clams/ft² from spring to fall. In 2022, both sites also experienced decreases in clam density from spring to fall.

The average size of soft-shell clams from core samples was larger at Dobbins' Island than Perio Point in the spring. The opposite trend was seen in 2022. Only one clam was found in surveys in the fall. Additional data on the size-frequency distribution of clams from spring core samples can be found in [Appendix B](#).

2023 RECRUITMENT BOX RESULTS

Summary of Average Soft-shell Clam Recruit Density

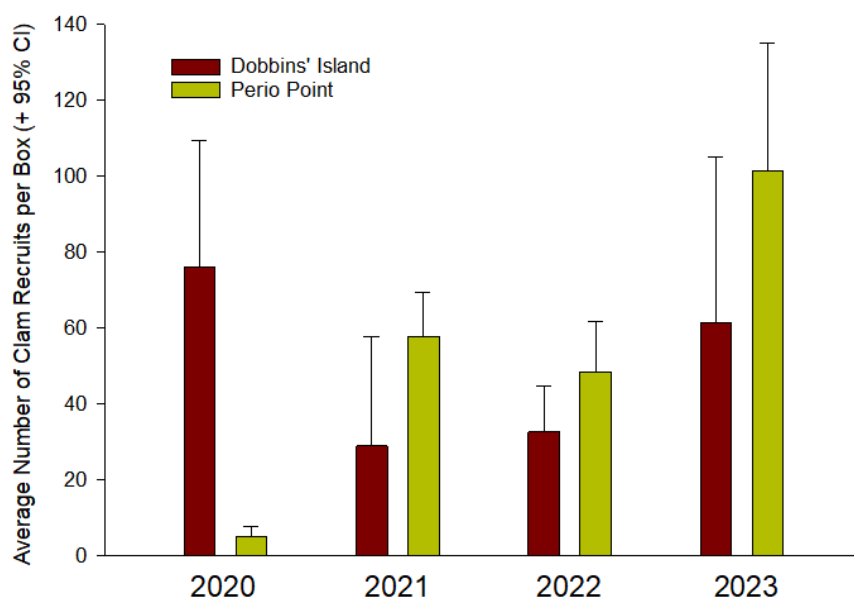
Clam densities are presented as the average number of clams per square foot (ft²) and is accompanied by its 95% confidence interval (CI) in parentheses.

Site*	Avg. # per ft ²	Conclusion
Dobbins' Island	61.25 (±43.67)	Approximately 1.6x as many clam recruits occurred at Perio Point than Dobbins' Island; however, this was not significantly different (p = 0.1254). The average density for both flats combined was 81.24 ±38.75 clams/ft ² .
Perio Point	101.23 (±33.82)	

*A detailed analysis of fall clam recruitment by flat can be found in [Appendix F](#).

In 2023, the average number of recruits almost doubled from 2022 at both Dobbins' Island and Perio Point. Additional data on the density of soft-shell clam recruits can be found in [Appendix C](#).

The graph below shows the average number of young-of-the-year soft-shell clams in recruitment boxes from two study sites in the town of Beals (Spring to Fall 2020-2023). All boxes had a mesh top (PetScreen®; 1.7mm x 0.9mm aperture) across all years. In 2020 (n = 8) and 2023 (n = 12), boxes had a ground cover (fabric) bottom. In 2022 (n = 16), all bottoms were comprised of PetScreening® while in 2021, the flats were split. Boxes at Dobbins' Island had PetScreen® bottoms and boxes at Perio Point had fabric bottoms.



Summary of Clam Recruit Size

Summary of the size of recruits given in both mm and inches. Average size is accompanied by its 95% confidence interval (CI).

Site	# Recruits Measured (N)	Min. Size of Recruit	Max. Size of Recruit	Average Recruit Size
Dobbins' Island	193	1.37 mm [0.05 in]	31.78 mm [1.25 in]	11.62 (± 1.0)mm [0.46 in]
Perio Point	240	1.52 mm [0.06 in]	22.61 mm [0.89 in]	6.53 (± 0.66) mm [0.26 in]

As in the last three years, the average recruit size was larger at Dobbins' Island than Perio Point in 2023. Additional data on the size of soft-shell clam recruits can be found in [Appendix C and G](#).

Summary of Green Crab Density and Size

Total number of green crabs in n = 12 recruitment boxes per site, along with average number of green crabs per square foot \pm 95% CI and size information.*

Site	Total # of Green Crabs	Density**	Min. Size	Max. Size	Average Size
Dobbins' Island	194	9.94 (± 5.56) crabs/ft ²	1.47 mm [0.06 in]	21.83 mm [0.86 in]	7.45 (± 0.34) mm [0.29 in]
Perio Point	66	3.38 (± 3.48) crabs/ft ²	2.65 mm [0.1 in]	8.73 mm [0.34 in]	4.94 (± 0.32) mm [0.19 in]

*An analysis of green crab size-frequency distribution by flat can be found in [Appendix H](#).

**Data on the size and density of green crabs found in recruitment boxes can be found in a table in [Appendix D](#).

From 2022 to 2023, the density and average size of green crabs decreased at Dobbins' Island. And green crab density increased slightly at Perio Point, while the average size decreased. In 2023, the average density of green crabs was significantly different between Dobbins' Island and Perio Point ($p = 0.0385$).

Graphs showing the relationship between the largest green crab in each recruitment box and the number of clam recruits recovered can be found in [Appendix I](#).

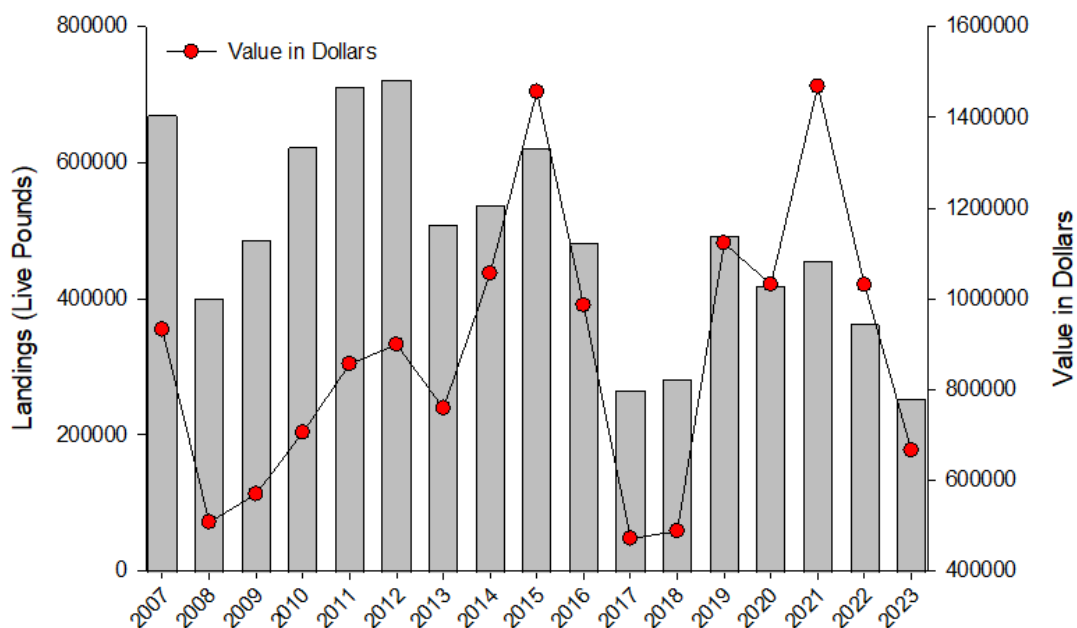
MACHIASPORT



Site Locations: Sanborn Cove and Randall Point Flat

CLAMMING PROFILE:

- 3,696.06 intertidal acres (DMR Acreage by Town, 2016).
- In 2023, Machiasport had an unlimited number of commercial and recreational clamming licenses allocated for residents.
- In 2023, 254,655 live pounds of soft-shell clams, valued at \$665,666, were landed in Machiasport (DMR Landings, 2023). A graph of the live pounds and value of landings since 2007 is below.



Beginning (Deployment) Date: April 18, 2023

Ending (Fall Sampling) Date: November 12, 2023 (208 days total duration)

SEAWATER TEMPERATURE

Site	2022 Seawater Temperatures*
Sanborn Cove	Max: 16.5°C (August 23) Min: 5.6°C (April 30)
Randall Point Flat	Lost Recorder

*Seawater temperature was calculated from five temperature recordings around both high tides each day: 60 minutes and 30 minutes prior to and after high tide, as well as at high tide.

Both temperature loggers were lost in Machiasport in 2023.

2023 SITE CORE SURVEY RESULTS - Fall and Spring

Below is a summary of the spring vs. fall site survey results for Machiasport (n=12 at each survey). Clam densities are presented as the average number of clams per square foot (ft²) and is accompanied by its 95% confidence interval (CI) in parentheses.

Site	Density of clams found in surveys		Difference between Spring and Fall densities	Average size of clams sampled	
	Spring	Fall		Spring	Fall
Sanborn Cove	0.43 (±0.94) clams/ft ²	0.43 (±0.93) clams/ft ²	No change in clams/ft ²	4.67 mm* [0.18 in]	3.59 mm* [0.14 in]
Randall Point Flat	8.49 (±4.44) clams/ft ²	0.85 (±1.26) clams/ft ²	Loss of 7.64 clams/ft ²	7.65 mm [0.3 in]	6.73 mm [0.26 in]

*only 1 clam found in survey

In 2023, average clam density in the surveys was higher at Randall Point Flat than at Sanborn Cove and the average size of clams sampled was also higher at Randall Point Flat. This is very similar to trends that were seen in 2022. Additional data on the densities of surveyed clams across all sites and years can be found in [Appendix A](#).

Sanborn Cove experienced no change in clam density from spring to fall while the clam density at Randall Point Flat decreased by 7.64 clams/ft² from spring to fall in 2023. In 2022, both sites experienced gains from spring to fall with Randall Point Flat in particular gaining 19.42 clams/ft².

The average size of soft-shell clams from core samples was larger at Randall Point Flat than at Sanborn Cove in both the spring and fall. Additional data on the clam size-frequency distribution from core samples can be found in [Appendix B](#).

2023 RECRUITMENT BOX RESULTS

Summary of Average Soft-shell Clam Recruit Density

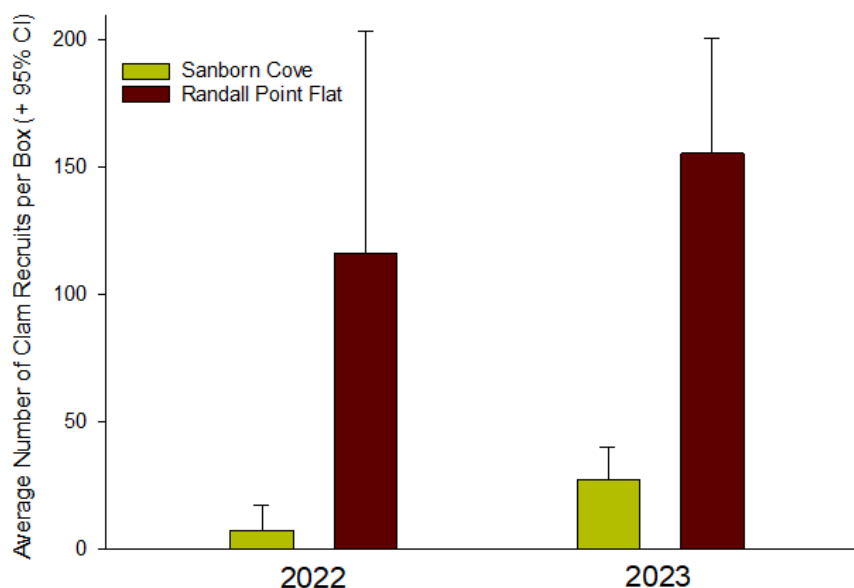
Clam densities are presented as the average number of clams per square foot (ft²) and is accompanied by its 95% confidence interval (CI) in parentheses.

Site*	Avg. # per ft ²	Conclusion
Sanborn Cove	27.42 (±12.81)	There were approximately 5x as many recruits at Randall Point as Sanborn Cove, and this difference was statistically significant ($p < 0.0001$). The average density for both flats combined was 91.46 ± 28.08 clams/ft ² .
Randall Point	155.5 (±45.35)	

*A detailed analysis of fall clam recruitment by flat can be found in [Appendix F](#).

In 2023, the density of soft-shell clams was higher at both Sanborn Cove and Randall Point compared to in 2022 (7.3 and 116.17 clams/ft², respectively). Additional data on the density of soft-shell clam recruits can be found in [Appendix C](#).

The graph below shows the average number of young-of-the-year soft-shell clams in recruitment boxes from two study sites in the town of Machiasport (Spring to Fall 2022-2023). All boxes had a mesh top (PetScreen®; 1.7mm x 0.9mm aperture) across all years. In 2022 (n = 8) and 2023 (n = 12), boxes had a ground cover (fabric) bottom.



Summary of Clam Recruit Size

Summary of the size of recruits. Average size is accompanied by its 95% confidence interval (CI).

Site	# Recruits Measured (N)	Min. Size of Recruit	Max. Size of Recruit	Average Recruit Size
Sanborn Cove	199	1.59 mm [0.06 in]	20.72 mm [0.82 in]	5.86 (± 0.51) mm [0.23 in]
Randall Point	240	1.17 mm [0.05 in]	9.97 mm [0.39 in]	2.97 (± 0.19) mm [0.12 in]

In 2023, clams were generally larger at Sanborn Cove than Randall Point which was similar to trends seen in 2022. Compared to 2022, the average recruit size was smaller at both sampling sites.

Additional data on recruit size is in [Appendix C and G](#).

Summary of Green Crab Density and Size

Total number of green crabs in n = 12 recruitment boxes per site, along with the average number of crabs per square foot \pm 95% CI and size information.*

Site	Total # of Green Crabs	Density**	Min. Size	Max. Size	Average Size
Sanborn Cove	27	1.38 (± 1.59) crabs/ft ²	3.87 mm [0.15 in]	12.23 mm [0.48 in]	7.21 (± 0.9) mm [0.28 in]
Randall Point	13	0.67 (± 0.42) crabs/ft ²	2.98 mm [0.12 in]	4.43 mm [0.17 in]	3.58 (± 0.27) mm [0.14 in]

*An analysis of green crab size-frequency distribution by flat can be found in [Appendix H](#).

**Data on the size and density of green crabs found in recruitment boxes can be found in a table in [Appendix D](#).

In 2023, the density of green crabs found in recruitment boxes was less at both sites compared to densities in 2022. The average crab size at Sanborn Cove was slightly larger than in 2022, but was smaller at Randall Point. There was no significant difference in average densities between Sanborn Cove and Randall Point in 2023 ($p = 0.3477$).

Graphs showing the relationship between the largest crab in each recruitment box and the number of clam recruits in each box is in [Appendix I](#).

EDMUNDS/TRESCOTT



Site Locations: Williams/Hallowell Island, Marion Cove, and Burnt Cove

Edmunds (Hallowell Island and Burnt Cove) and Trescott (Marion Cove) are unorganized territories in Washington County, and have been part of the recruitment monitoring network since 2021. Twelve boxes were deployed at each site in 2023 ($n = 36$).

CLAMMING PROFILE:

- 1103.35 intertidal acres in Edmunds Township and 1632.96 intertidal acres in Trescott Township (DMR Acreage by Town, 2016).

Beginning (Deployment) Dates: Hallowell Island & Burnt Cove: April 19, 2023
Marion Cove: April 20, 2023

Ending (Fall Sampling) Dates: Hallowell Island & Burnt Cove: October 30, 2023 (194 days total duration)
Marion Cove: October 30, 2023 (193 days total duration)

SEAWATER TEMPERATURE

Site	2021 Seawater Temperatures*	2022 Seawater Temperatures	2023 Seawater Temperatures
Williams/Hallowell Island	Max: 22.5°C (May 27) Min: 3.6°C (May 30)	Max: 17.2°C (August 7) Min: 7.7°C (May 17/18/19)	Lost Recorder
Marion Cove	Max: 16.5°C (August 27) Min: 8.4°C (June 1)	Max: 16.1°C (August 8/22/30) Min: 8.1°C (May 22)	Max: 16.1°C (September 9) Min: 6.4°C (April 21)
Burnt Cove	N/A	Lost Recorder	Max: 18.4°C (July 28) Min: 7.0°C (April 21)

*Seawater temperature was calculated from five temperature recordings around both high tides each day: 60 minutes and 30 minutes prior to and after high tide, as well as at high tide.

Analysis of how seawater temperatures changed through the season can be found in [Appendix E](#).

2023 SITE CORE SURVEY RESULTS - Fall and Spring

Below is a summary of the spring vs. fall site survey results for Edmunds/Trescott (n=12 at each survey). Clam densities are presented as the average number of clams per square foot (ft²) and is accompanied by its 95% confidence interval (CI) in parentheses.

Site	Density of clams found in surveys		Difference between Spring and Fall densities		Average size of clams sampled	
	Spring	Fall			Spring	Fall
Williams/Hallowell Island	0 clams/ft ²	0 clams/ft ²	No change in clams/ft ²		N/A	N/A
Marion Cove	0 clams/ft ²	0.85 (±1.26) clams/ft ²	Gain of 0.85 clam/ft ²		N/A	4.96 mm [0.2 in]
Burnt Cove	0 clams/ft ²	0 clams/ft ²	No change in clams/ft ²		N/A	N/A

In 2023, very few clams were found in surveys in both the spring and fall at all three sites. Something very similar occurred in 2021, but in 2022 clams were found at all sites in both the spring and fall. Additional data on the densities of surveyed clams across all sites and years can be found in [Appendix A](#).

Williams/Hallowell Island and Burnt Cove experienced no change in clam density from spring to fall in 2023 as 0 clams were found at both sites. Marion Cove experienced a gain of 0.9 clams/ft² in clam density from spring to fall. Additional data on the size-frequency distribution of clams from core samples can be found in [Appendix B](#).

2023 RECRUITMENT BOX RESULTS

Summary of Average Soft-shell Clam Recruit Density

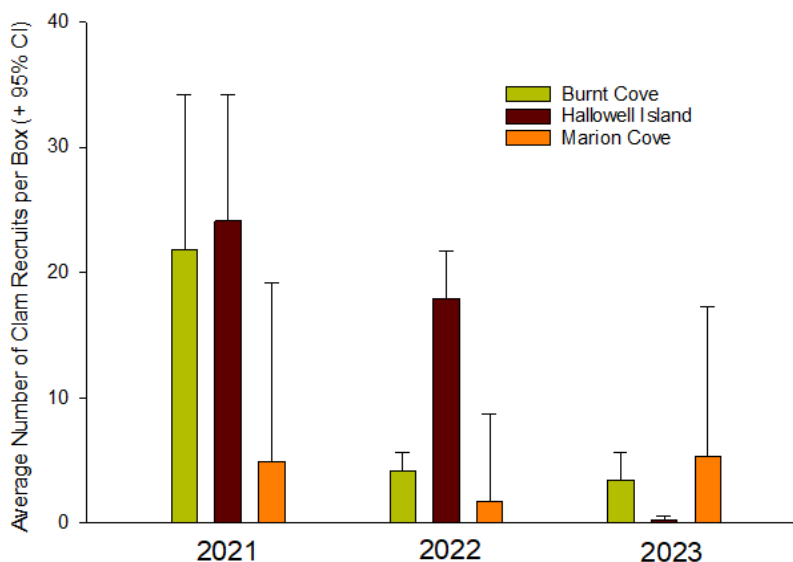
Clam densities are presented as the average number of clams per square foot (ft²) and is accompanied by its 95% confidence interval (CI)* in parentheses.

Site*	Avg. # per ft ²	Conclusion
Burnt Cove	3.43 (±2.16)	The average density at Marion Cove was significantly higher than the densities at both Hallowell Island and Burnt Cove (p<0.0001).
Hallowell Island	0.26 (±0.26)	
Marion Cove	11.94 (±5.3)	The combined average density for all three sites was 5.21 ±2.57 clams/ft ² .

*A detailed analysis of fall clam recruitment by flat can be found in [Appendix F](#).

In 2023, the density of clam recruits decreased at Burnt Cove from 4.07 clams/ft² in 2022 to 3.43 clams/ft². At Hallowell Island, the density also decreased from 17.91 clams/ft² in 2022 to 0.26 clams/ft². The recruit density increased at Marion Cove from 7.03 clams/ft² in 2022 to 11.94 clams/ft² in 2023. Additional data on the density of soft-shell clam recruits can be found in [Appendix C](#).

The graph below shows the average number of young-of-the-year soft-shell clams in recruitment boxes from two study sites in the township of Edmunds and one site in the township of Trescott (Marion Cove) (Spring to Fall 2021-2023). All boxes had a mesh top (PetScreen®; 1.7mm x 0.9mm aperture) across all years. In 2021 (n = 8) and 2023 (n = 12), boxes had a ground cover (fabric) bottom. In 2022 (n = 16), all bottoms were comprised of PetScreening®.



Summary of Clam Recruit Size

Summary of the size of recruits given in both mm and inches. Average size is accompanied by its 95% confidence interval (CI).

Site	# Recruits Measured (N)	Min. Size of Recruit	Max. Size of Recruit	Average Recruit Size
Burnt Cove	67	1.83 mm [0.07 in]	11.59 mm [0.46 in]	4.11 (± 0.44) mm [0.16 in]
Hallowell Island	5	3.55 mm [0.14 in]	5.9 mm [0.23 in]	4.66 (± 1.11) mm [0.18 in]
Marion Cove	172	1.61 mm [0.06 in]	22.16 mm [0.87 in]	4.04 (± 0.41) mm [0.16 in]

The average recruit size was similar across all three sites with Hallowell Island having the largest average recruit size by just 0.5mm. Compared to previous years, the average recruit size was also smaller across all sites. Additional data on the size of soft-shell clam recruits can be found in [Appendix C and G](#).

Summary of Green Crab Density and Size

Total number of green crabs in n = 12 recruitment boxes per site, along with average number of crabs per square foot \pm 95% CI and size information.*

Site	Total # of Green Crabs	Density**	Min. Size	Max. Size	Overall Avg. Size
Burnt Cove	0	0 crabs/ft ²	N/A	N/A	N/A
Hallowell Island	0	0 crabs/ft ²	N/A	N/A	N/A
Marion Cove	16	0.82 (± 0.65) crabs/ft ²	2.74 mm [0.11 in]	13.44 mm [0.53 in]	6.65 (± 1.79) mm [0.26 in]

*An analysis of green crab size-frequency distribution by flat and box type can be found in [Appendix H](#).

**Data on the size and density of green crabs found in recruitment boxes can be found in a table in [Appendix D](#).

In 2023, green crabs were only found in recruitment boxes at Marion Cove while in both 2021 and 2022, green crabs were found at all sites in low densities. The average size of green crabs collected at Marion Cove was similar to previous years.

Graphs showing the relationship between the largest green crab in each recruitment box and the number of clam recruits recovered can be found in [Appendix I](#).

SIPAYIK



Site Locations: Gleason Cove and Half Moon Cove

CLAMMING PROFILE:

- 1.02 intertidal acres (DMR Acreage by Town, 2016).

Beginning (Deployment) Date: April 20, 2023

Ending (Fall Sampling) Date: November 11, 2023 (205 days total duration)

SEAWATER TEMPERATURE

Site	2020 Seawater Temperatures*	2021 Seawater Temperatures	2022 Seawater Temperatures
Gleason Cove	Max: 16.7°C (August 14) Min: 6.5°C (May 16/17)	Max: 17.3°C (August 28) Min: 6.6°C (May 6)	Max: 16.9°C (August 28) Min: 5.1°C (April 16/17)
Half Moon Cove	Max: 15.6°C (August 15) Min: 6.8°C (May 16)	Max: 16.1°C (September 1) Min: 6.9°C (May 6/8)	Max: 16.1°C (August 21/25) Min: 5.6°C (April 17/19/20)

*Seawater temperature was calculated from five temperature recordings around both high tides each day: 60 minutes and 30 minutes prior to and after high tide, as well as at high tide.

Both temperature recorders were lost in Sipayik in 2023.

2023 SITE CORE SURVEY RESULTS - Fall and Spring

Below is a summary of the spring vs. fall site survey results for Sipayik (n=12 at each survey). Clam densities are presented as the average number of clams per square foot (ft²) and is accompanied by its 95% confidence interval (CI) in parentheses.

Site	Density of clams found in surveys		Difference between Spring and Fall densities	Average size of clams sampled	
	Spring	Fall		Spring	Fall
Gleason Cove	7.64 (±5.25) clams/ft ²	1.7 (±2.87) clams/ft ²	Loss of 5.94 clams/ft ²	4.73 mm [0.19 in]	2.87 mm [0.11 in]
Half Moon Cove	0 clams/ft ²	0.43 (±0.93) clams/ft ²	Gain of 0.43 clams/ft ²	N/A	7.28 mm* [0.29 in]

*only 1 clam found in survey

In 2023, average clam density was approximately 4 times higher at Gleason Cove than Half Moon Cove in the fall. In 2020 and 2021, densities were higher at Half Moon Cove, but data from 2022 shows a similar relationship between sites to this year. Additional data on the densities of surveyed clams across all sites and years can be found in [Appendix A](#).

Gleason Cove experienced a loss of 5.94 clams/ft² from spring to fall, while Half Moon Cove experienced a small gain of 0.43 clams/ft² in clam density from spring to fall. Combining both sites, this was a greater loss than was found in 2022, when we recorded an average loss of 0.3 clams/ft².

The average size of soft-shell clams from core samples was larger at Half Moon Cove than Gleason Cove in the fall, but this average was based on the size of one clam at Half Moon Cove. Additional data on the clam size-frequency distribution from core samples can be found in [Appendix B](#).

2023 RECRUITMENT BOX RESULTS

Summary of Average Soft-shell Clam Recruit Density

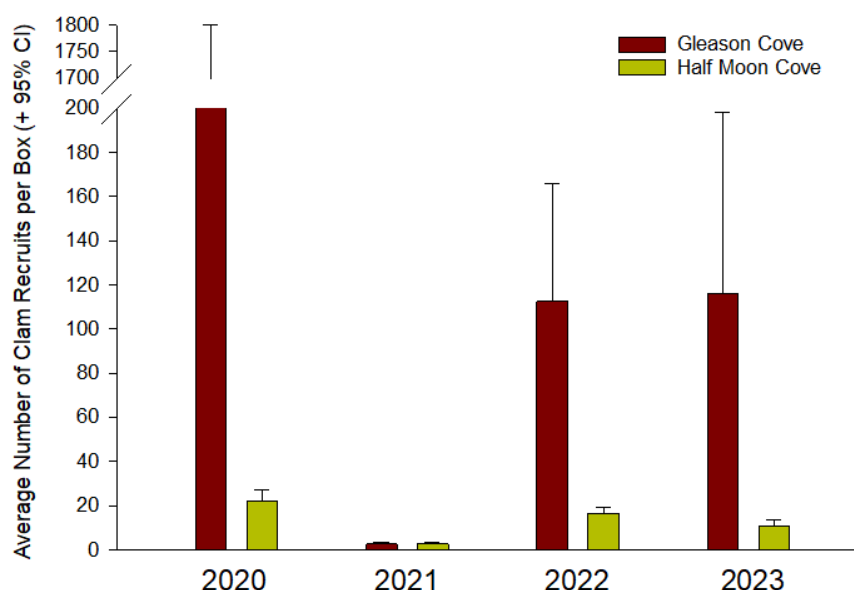
Clam densities are provided in the average number of clams per square foot (ft²) and accompanied by the 95% confidence interval (CI)* number in the parenthesis.

Site*	Avg. # per ft ²	Conclusion
Gleason Cove	115.91 (±82.42)	Approximately 10x more clam recruits occurred at Gleason Cove than Half Moon Cove, and this difference was statistically significant (P = 0.0073). The average density for both flats combined was 63.36 ± 42.70 clams/ft ² .
Half Moon Cove	10.81 (±2.97)	

*A detailed analysis of fall clam recruitment by flat can be found in [Appendix F](#).

The average density of clam recruits stayed about the same between 2022 and 2023 at Gleason Cove and decreased slightly at Half Moon Cove. Additional data on the density of soft-shell clam recruits can be found in a table in [Appendix C](#).

The graph below shows the average number of young-of-the-year soft-shell clams in recruitment boxes from two study sites in the town of Sipayik (Spring to Fall 2020-2023). All boxes had a mesh top (PetScreen®; 1.7mm x 0.9mm aperture) across all years. In 2020 (n = 8) and 2023 (n = 12), boxes had a ground cover (fabric) bottom. In 2021 and 2022 (n = 16), all bottoms were comprised of PetScreening®.



Summary of Clam Recruit Size

Summary of the size of recruits given in both mm and inches. Average size is accompanied by its 95% confidence interval (CI).

Site	# Recruits Measured (N)	Min. Size of Recruit	Max. Size of Recruit	Average Recruit Size
Gleason Cove	198	1.57 mm [0.06 in]	22.19 mm [0.87 in]	7.62 (± 0.49) mm [0.3 in]
Half Moon Cove	190	1.66 mm [0.07 in]	11.06 mm [0.44 in]	3.74 (± 0.28) mm [0.15 in]

In 2023, the average recruit size was larger at Gleason Cove than Half Moon Cove which was the same trend that was seen in 2022. Additional data on the size of soft-shell clam recruits can be found in [Appendix C and G](#).

Summary of Green Crab Density and Size

Total number of green crabs in n = 12 recruitment boxes per site, along with average number of crabs per square foot \pm 95% CI and size information.*

Site	Total # of Green Crabs	Density**	Min. Size	Max. Size	Average Size
Gleason Cove	109	6.09 (± 3.69) crabs/ft ²	2.63 mm [0.1 in]	12.82 mm [0.5 in]	7.21 (± 0.47) mm [0.28 in]
Half Moon Cove	2	0.1 (± 0.15) crabs/ft ²	3.98 mm [0.16 in]	7.99 mm [0.31 in]	5.99 (± 25.48) mm [0.24 in]

*An analysis of green crab size-frequency distribution by flat can be found in [Appendix H](#).

**Data on the size and density of green crabs found in recruitment boxes can be found in [Appendix D](#).

The density of green crabs in recruitment boxes at both Gleason Cove and Half Moon Cove decreased from 2022 to 2023, but the average size of crabs at both sites was greater in 2023 than 2022. Between Gleason Cove and Half Moon Cove, in 2023 the density of green crabs was significantly different ($p = 0.0011$).

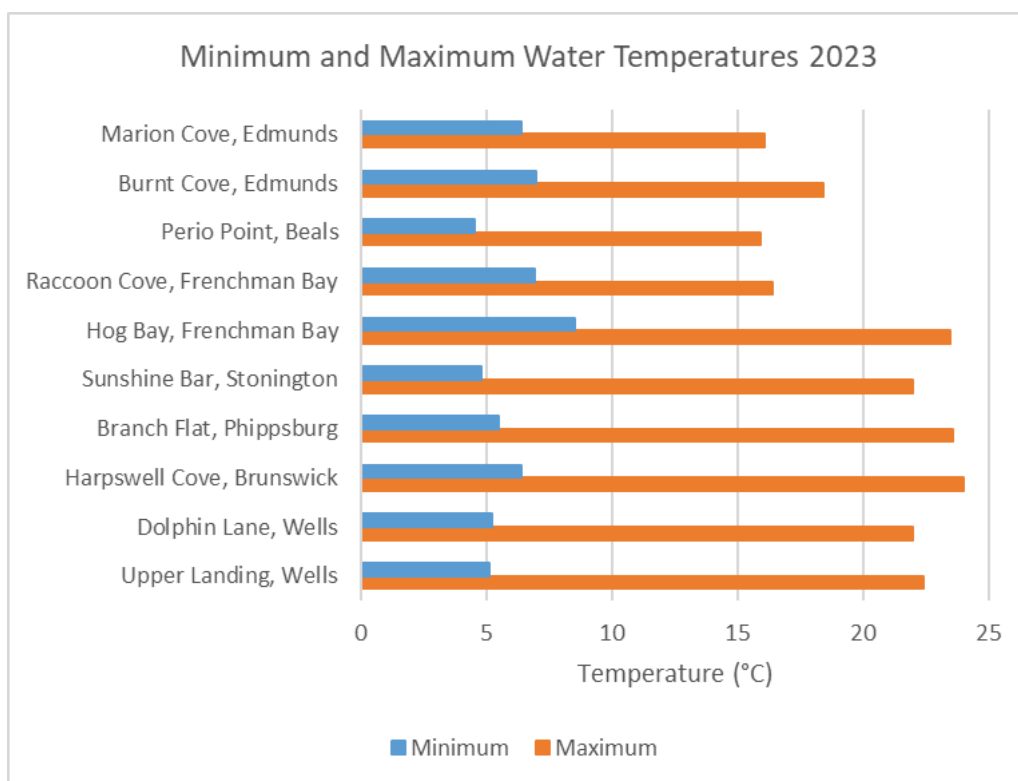
Graphs showing the relationship between the largest green crab in each recruitment box and the number of clam recruits recovered can be found in [Appendix I](#).

OVERALL RESULTS

Temperature

Seawater temperature is the most important driver influencing the biological and ecological processes that govern the health of the clam fishery. Temperature is the key prompt for clams to begin spawning, and may drive the duration of the spawning season (see: [How Many Eggs Does a Clam Produce?](#)). Temperature also affects how fast clams grow as well as the rates of predation by green crabs and other clam consumers. Warm temperatures allow certain predators, such as invasive green crabs, to proliferate, and increase predation intensity (rates) by speeding up their metabolism. In addition, warm seawater temperatures extend the period that predators feed at high intensity.

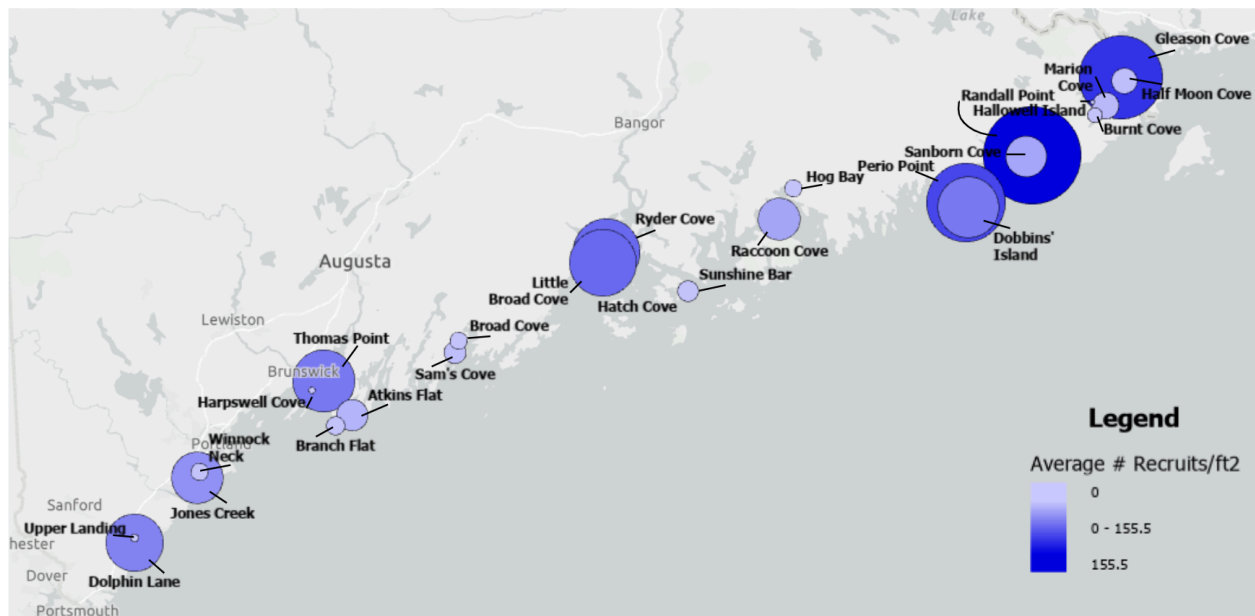
The graph below shows the maximum and minimum water temperatures at each site that the temperature recorders were recovered over the 2023 Clam Recruitment Monitoring season. For information about seawater temperatures, see [Appendix E](#).



Site-Specific Clam Recruitment Densities

In 2023, 11 of the 25 sites (44%) had average soft-shell clam recruit densities less than 10 recruits/ft². Sixteen of the 25 sites (64%) had densities less than 50 recruits/ft². Three sites – Randall Point in Machiasport, Gleason Cove in Sipayik, and Perio Point on Beals – averaged more than 100 recruits/ft². And these top three sites were all located in the Downeast region. Unlike last year where seven of the top ten locations were in the Downeast region, in 2023, only five of the top ten sites were located Downeast and three of the top ten locations were in Southern Maine. Compared with the average recruit densities in 2022, there was an increase in the number of sites that had an average recruit density over 50 recruits/ft² with 32% in 2023 vs only 16% in 2022.

	Location	Average # Recruits/ft ²
1	Randall Point, Machiasport	155.5 (±45.35)
2	Gleason Cove, Sipayik	115.91 (±82.42)
3	Perio Point, Beals	101.23 (±33.82)
4	Ryder Cove, Islesboro	74.52 (±19.07)
5	Little Broad Cove, Islesboro	74.06 (±10.61)
6	Thomas Point, Brunswick	62.94 (±33.69)
7	Dobbins' Island, Beals	61.25 (±43.67)
8	Dolphin Lane, Wells	54.99 (±18.31)
9	Jones Creek, Scarborough	44.44 (±36.7)
10	Raccoon Cove, Frenchman Bay	29.11 (±7.11)
11	Sanborn Cove, Machiasport	27.42 (±12.81)
12	Atkins Flat, Phippsburg	16.56 (±7.16)
13	Marion Cove, Edmunds	11.94 (±5.3)
14	Half Moon Cove, Sipayik	10.81 (±2.97)
15	Sam's Cove, Bremen	8.2 (±5.31)
16	Sunshine Bar, Stonington	6.87 (±7.88)
17	Branch Flat, Phippsburg	5.23 (±6.13)
18	Broad Cove, Bremen	4.97 (±5.47)
19	Hog Bay, Frenchman Bay	4.72 (±3.86)
20	Winnock Neck, Scarborough	4.66 (±3.54)
21	Burnt Cove, Edmunds	3.43 (±2.16)
22	Upper Landing, Wells	0.97 (±1.03)
23	Harpwell Cove, Brunswick	0.67 (±1.35)
24	Hallowell Island, Edmunds	0.26 (±0.26)
25	Hatch Cove, Stonington	0.0 (-)



The map above shows the average clam recruit density across all sites for the 2023 season. Larger and darker circles indicate higher densities (with a maximum of 155.5 recruits/ft²). Hatch Cove in Stonington was the only site with no recruits.

Regional Trends

Overall, densities of clam recruits were highest in the downeast region (colored red in the table above), with an average density of 47.42 (± 30.23) recruits/ft², and were lowest in the southern region (colored blue above), with an average density of 23.81 (± 16.89) recruits/ft². Clam recruit densities in the midcoast region (colored green above) averaged 28.1 (± 26.21) recruits/ft².

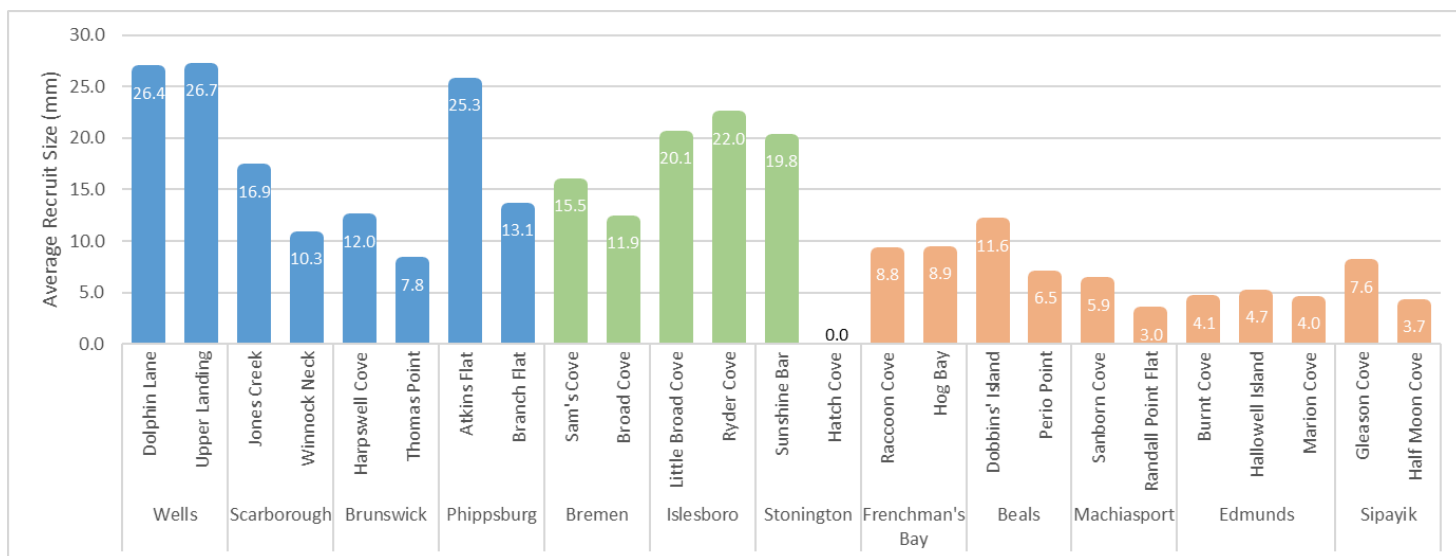
In comparison, in 2022 and 2021, clam recruit densities were highest in the midcoast region (41.1 and 31.7 recruits/ft², respectively), and in 2020 were highest downeast (227 recruits/ft² average). As in previous years, clam recruit densities were lowest in southern Maine (4.24, 1.35, and 21 recruits/ft², respectively). More information about clam recruitment levels can be found in [Appendix F](#).

Size of Clam Recruits

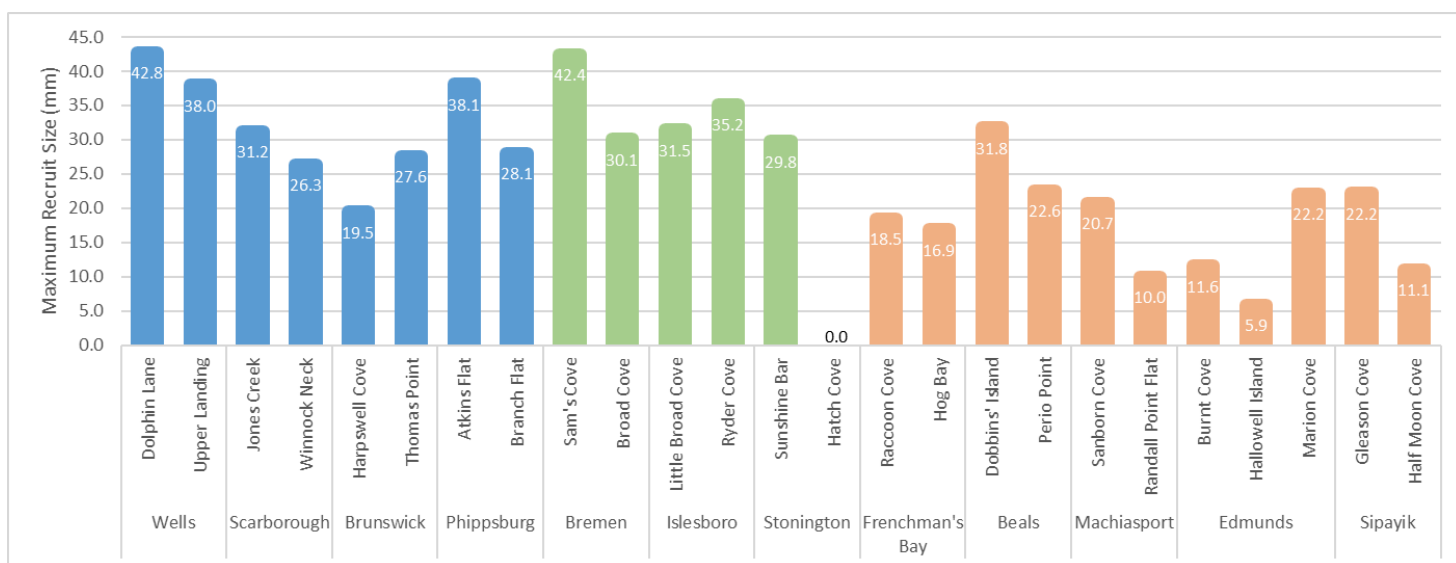
Approximately three to four weeks after adults spawn by releasing their gametes into the water column, clam larvae settle to the benthos (bottom) at about $\frac{1}{4}$ - $\frac{1}{5}$ of a mm. This process does not occur on a single day or even over a week or two. Rather, we found that clams have a major settlement event (during the first weeks of June in the Freeport area) followed by a protracted (2-3 month) period when small numbers of settlers reach the flats. Size of recruits is driven by seawater temperatures, food availability, genetics, and how early in the season settlement occurs. Because Beal boxes are on the mudflats during the entirety of the clam settling and growing season, a variety of recruit sizes are found in the boxes.

Knowing how fast clams grow is crucial to understand when a clam will reach harvestable size. In places where clams are not protected from predators, it is the clams that recruit later in the year, when summer predation rates are beginning to decline, that have the best chance of surviving their first year of life and making it to harvestable size in the following years (Beal et al. 2018). That means the bulk of clams that settle to flats during June and July become food for predators ranging from green crabs and hermit crabs to killifish, milky ribbon worms, and moon snails.

The chart below shows the average size of recruits found in the recruitment boxes in each town in the fall of 2023. Southern sites are colored blue, midcoast sites are in green, and downeast sites are in orange/red.



The chart below shows the size of the LARGEST recruit found in each town. This chart is helpful to understand what size clam is possible to grow in each town in this timeframe.

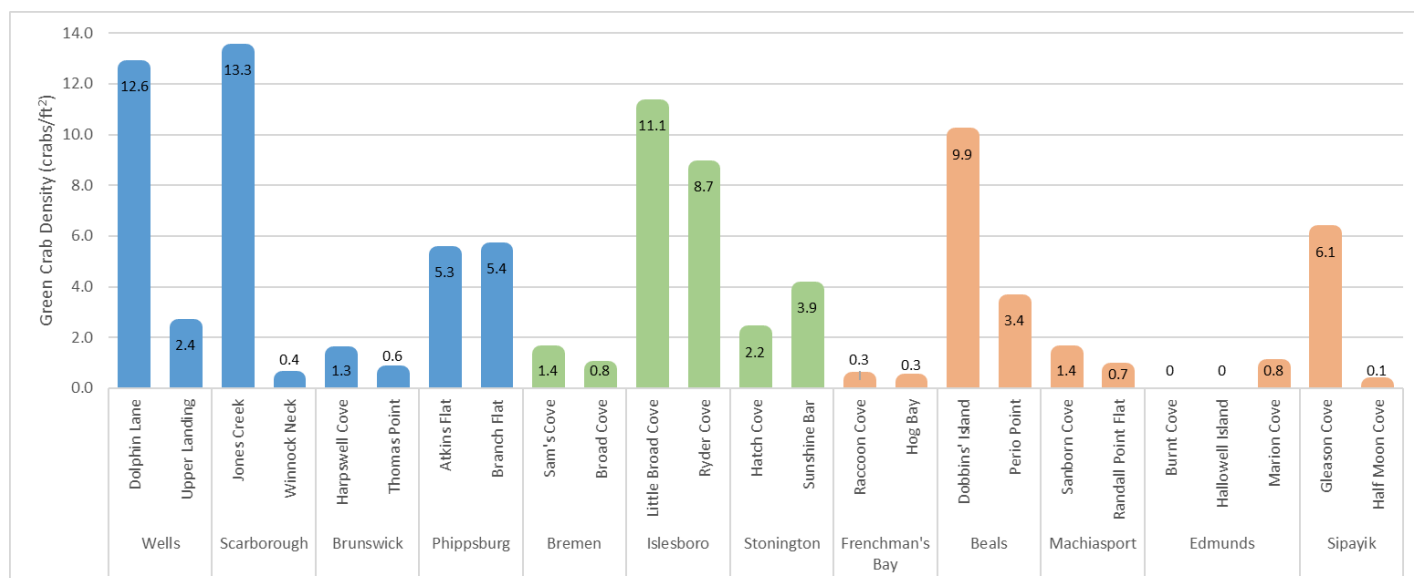


For more information about the sizes of recruits see [Appendix C](#).

Density and Size of Green Crabs

There are at least two ways, and times, for crabs to enter the boxes. Crabs may settle into a recruitment box from the plankton (as do clams and other species with planktotrophic larvae). The other way is for them to crawl into the boxes after settlement. Crabs with carapace widths as large as 2.02 mm that settled either during the monitoring period or that settled the previous fall and overwintered at small sizes could presumably have crawled into the box through the aperture of the screening.

The chart below shows the density of green crabs found in the recruitment boxes in each town in 2023. Southern sites are in blue, midcoast sites are in green, and downeast sites are in orange/red.



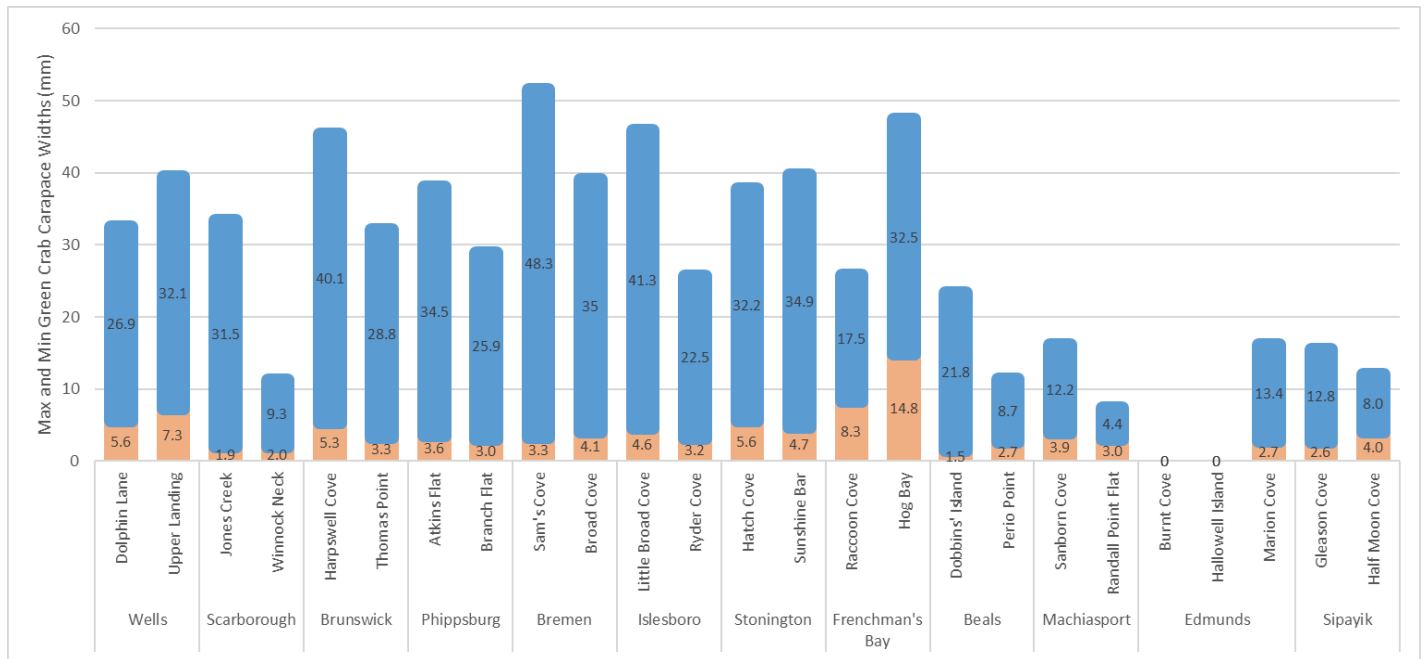
The number and size of green crabs in the boxes is important to understanding their biomass level. For more information about green crab sizes and densities, see [Appendix D](#).

Green crabs settle out of the water column at ~1 mm, giving them a distinct size advantage over their prey of soft-shell clams (at 1 mm, green crabs are about 5x larger than settling soft-shell clams). Crab settlement occurs during the summer (Berrill 1982) typically after the bulk of soft-shell clams settle out of the water column. How fast green crabs grow is controlled by the same factors that control clam growth.

It is not possible to discern the length of time a particular crab was in a box, but based on its size, one may assume that a crab with a carapace width greater than 15 mm resided in boxes longer and consumed more clam recruits than those with a carapace width less than 10 mm.

The smallest green crab found in 2023 was 1.47 mm or 0.06 inches at Dobbins' Island, Beals, and the largest was 48.26 mm or 1.9 inches at Sam's Cove, Bremen.

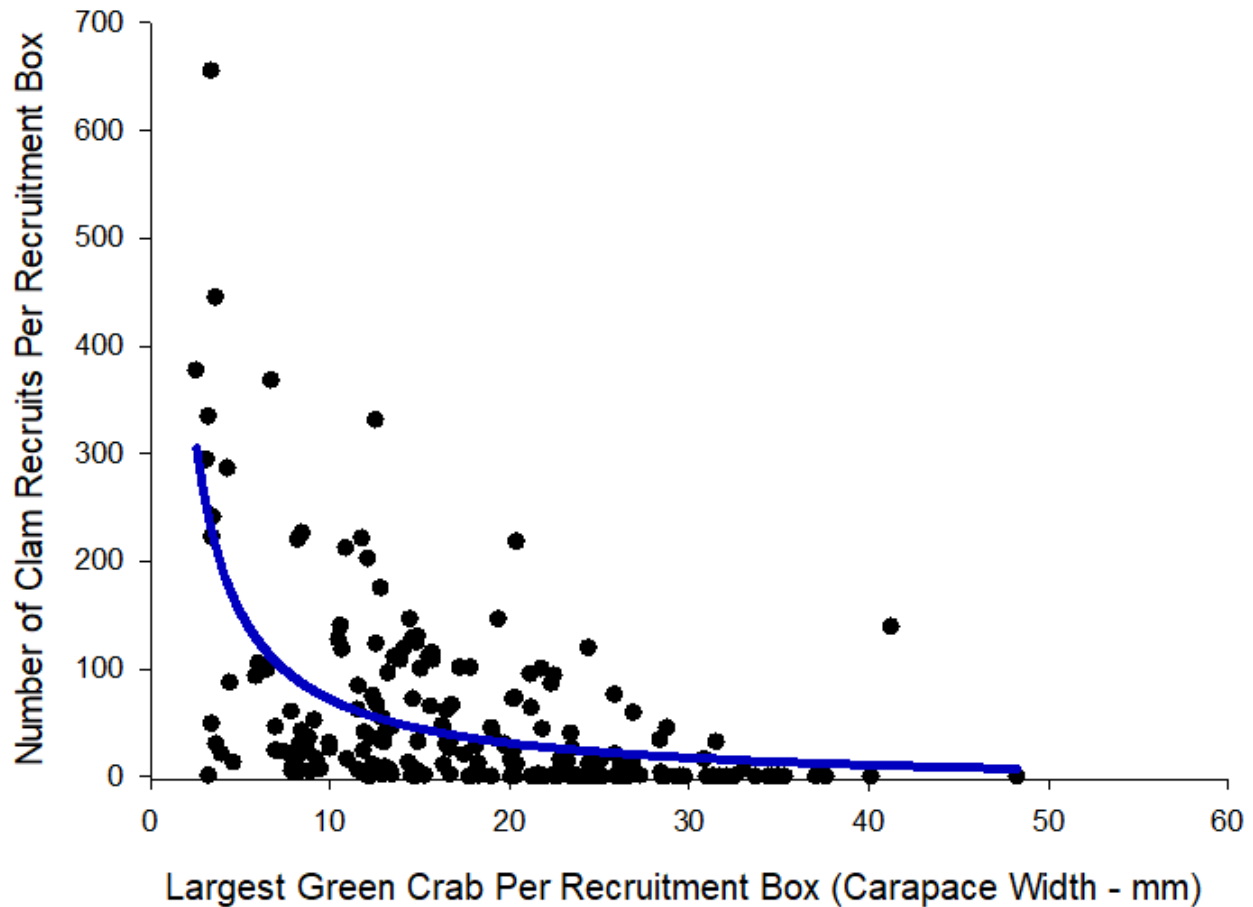
The graph below shows the size of the smallest (in orange) and largest (in blue) green crabs found in recruitment boxes at each site. There were no green crabs found in recruitment boxes at both Burnt Cove and Hallowell Island in Edmunds. For more information about the size distribution of green crabs found at the study sites, see [Appendix H](#).



Relationship Between Crab Size and Clams Per Box

Our analysis of results from all 25 monitoring sites determined an inverse relationship between the number of clam recruits per box and size of the largest green crab per box. This was similar to the same relationship that was found in both 2020 & 2021 (i.e., when crabs exceed 10 mm (~ ½-inch) in carapace width, few soft-shell clam juveniles occur in recruitment boxes). The graph shows that there is an impressive decrease in clam recruits with increasing green crab size.

The figure below shows the relationship between the number of live 0-year class soft-shell clam recruits (data from each of the 12 communities and 25 flats for 2023, N= 202) and the size of the largest green crab per recruitment box. An inverse, polynomial function ($y = a + b/x$), where y = the number of clam recruits per box and x = size of the largest green crab per box. The regression equation (line of best fit) is $y = -9.29 + 811.31/x$; $r^2 = 0.34$, which is statistically significant ($p < 0.001$).



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Stonington: George Powell.

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Appendix A: 2020-2023 Fall & Spring Soft-Shell Clam Density Survey Data.

Average density in number of clams/ft² and parentheses after the average refer to a 95% confidence interval.

Town	Flat	2020 Spring Avg. Density	2020 Fall Avg. Density	Density + or -?	2021 Spring Avg. Density	2021 Fall Avg. Density	Density + or -?	2022 Spring Avg. Density	2022 Fall Avg. Density	Density + or -?	2023 Spring Avg. Density	2023 Fall Avg. Density	Density + or -?
Wells	Dolphin Lane	3.2(2.2)	1.9(1.7)	-	2.7(1.7)	0.6(0.9)	-	5.41(2.88)	0.32(0.68)	-	4.67(3.77)	1.7(2.11)	-
	Upper Landing	3.5(2.2)	0.0(0)	-	6.4(3.9)	0.3(0.7)	-	9.23(4.67)	0.32(0.68)	-	4.67(2.57)	0.85(1.26)	-
Scarborough	Jones Creek	1.9(1.7)	0.0(0)	-	1.9(2.2)	0.0(0)	-	0.0(0)	0.0(0)	=	25.9(16.07)	1.7(2.87)	-
	Winnock Neck	29.6(9.4)	9.6(4.4)	-	6.4(6.3)	3.1(3.9)	-	0.0(0)	0.32(0.68)	+	3.82(3.42)	0.0(0)	-
Brunswick	Harpswell Cove	0.0(0)	0.3(0.7)	+	0.3(0.7)	0.0(0)	-	0.64(1.36)	1.59(1.63)	+	5.09(3.38)	0.0(0)	-
	Thomas Point	1.3(1.2)	0.0(0)	-	0.0(0)	0.3(0.7)	+	0.0(0)	0.0(0)	=	4.67(4.01)	0.0(0)	-
Phippsburg	Atkins Flat	N/A	N/A	N/A	N/A	N/A	N/A	0.59(1.63)	1.91(1.95)	+	6.79(5.04)	6.37(9.38)	-
	Branch Flat	N/A	N/A	N/A	N/A	N/A	N/A	0.0(0)	0.96(1.09)	+	6.79(3.18)	1.27(1.46)	-
Bremen	Sam's Cove	0.0(0)	0.0(0)	=	0.0(0)	0.0(0)	=	0.0(0)	0.32(0.68)	+	0.0(0)	0.0(0)	=
	Broad Cove	0.6(9.1)	0.6(0.9)	=	6.0(2.5)	2.5(2.4)	-	0.32(0.36)	0.64(0.93)	+	2.12(2.16)	0.0(0)	-
Islesboro	Little Broad Cove	0.9(1.1)	0.0(0)	-	0.0(0)	0.0(0)	=	0.0(0)	0.32(0.68)	+	1.27(1.46)	0.43(0.93)	-
	Ryder Cove	3.2(1.9)	0.0(0)	-	0.0(0)	0.0(0)	=	1.27(1.51)	3.18(2.19)	+	0.43(0.94)	2.12(2.16)	+
Stonington	Hatch Cove	N/A	N/A	N/A	N/A	N/A	N/A	0.0(0)	0.0(0)	=	2.55(1.69)	1.69(1.59)	-
	Sunshine Bar	N/A	N/A	N/A	N/A	N/A	N/A	0.0(0)	0.32(0.68)	+	1.27(1.46)	0.0(0)	-
Frenchman's Bay	Raccoon Cove	28.0(26.4)	1.6(1.3)	-	4.5(3.9)	0.9(1.5)	-	0.32(0.68)	0.0(0)	-	0(0)	0.85(1.26)	+
	Hog Bay	2.2(1.9)	0.0(0)	-	2.5(2.2)	3.2(2.8)	+	4.14(2.84)	1.59(1.63)	-	0.43(2.84)	0.43(0.93)	=
Beals	Dobbins' Island	2.2(1.7)	0.0(0)	-	0.0(0)	0.3(0.7)	+	1.91(1.68)	0.0(0)	-	1.27(2.01)	0.0(0)	-
	Perio Point	8.3(3.6)	0.0(0)	-	0.6(0.9)	0.6(0.9)	=	1.59(1.29)	0.0(0)	-	6.37(6.49)	0.43(0.93)	-
Machiasport	Sanborn Cove	N/A	N/A	N/A	N/A	N/A	N/A	0.0(0)	1.69(2.3)	+	0.43(0.94)	0.43(0.93)	=
	Randall Point Flat	N/A	N/A	N/A	N/A	N/A	N/A	2.87(2.42)	22.29(7.48)	+	8.49(4.44)	0.85(1.26)	-
Edmunds	Burnt Cove	N/A	N/A	N/A	0.0(0)	4.1(5.1)	+	0.32(0.68)	0.64(0.93)	+	0.0(0)	0.0(0)	=
	Hallowell Island	N/A	N/A	N/A	4.1(5.3)	3.1(5.7)	-	2.55(2.8)	1.59(2.15)	-	0.0(0)	0.0(0)	=
	Marion Cove	N/A	N/A	N/A	0.0(0)	1.0(2.8)	+	1.27(1.21)	0.64(0.93)	-	0.0(0)	0.85(1.26)	+
Sipayik	Gleason Cove	1.9(1.4)	1.3(1.2)	-	0.6(0.9)	0.0(0)	-	5.09(2.62)	6.05(5.08)	+	7.64(5.25)	1.7(2.87)	-
	Half Moon Cove	4.8(2.5)	1.6(1.6)	-	1.3(1.2)	1.3(1.6)	=	1.59(2.15)	0.0(0)	-	0.0(0)	0.43(0.93)	+

Key:

Blue shaded cells = southern region sites

Green shaded cells = midcoast region sites

Orange shaded cells = downeast region sites

Appendix B: 2020-2023 Fall & Spring Soft-Shell Clam Size Ranges from Spring and Fall Survey Data. The parentheses after the average size refer to the 95% confidence interval. A (-) indicates no confidence interval as n = 1. N = the number of clams sampled.

Town	Flat	2020 Spring Avg. Size (mm)	n	Size range (mm)	2020 Fall Avg. Size (mm)	n	Size range (mm)	2021 Spring Avg. Size (mm)	n	Size range (mm)	2021 Fall Avg. Size (mm)	n	Size range (mm)	2022 Spring Avg. Size (mm)	n	Size range (mm)	2022 Fall Avg. Size (mm)	n	Size range (mm)	2023 Spring Avg. Size (mm)	n	Size range (mm)	2023 Fall Avg. Size (mm)	n	Size range (mm)
Wells	Dolphin Lane	4.5(1.2)	10	2.7-7.5	3.6(0.9)	6	2.8-4.7	4.8(1.8)	9	2.7-8.8	2.1(1.8)	2	1.9-2.2	6.05(0.83)	17	2.93-8.69	4.29(-)	1	-	4.27(0.83)	11	3.13-6.96	2.46(0.47)	4	2.02-2.67
	Upper Landing	4.6(1.5)	11	2.7-8.9	-	0	-	9.5(6.4)	20	2.7-67.1	2.0(-)	1	-	8.12(4.62)	29	2.94-70.1	16.15(-)	1	-	5.35(0.86)	11	3.95-6.96	2.52(5.34)	2	2.1-2.94
Scarborough	Jones Creek	8.6(3.6)	6	6.0-13.7	-	0	-	8.6(3.6)	6	4.9-13.7	-	0	-	-	0	-	-	0	-	5.34(0.48)	60	2.2-10.3	4.73(2.14)	4	3.52-6.65
	Winnock Neck	40.8(2.9)	16	5.4-60.3	53.9(4.9)	30	4.9-68.7	40.8(2.9)	93	5.4-60.3	60.4(16.1)	8	20.8-76.3	-	0	-	29.63(-)	1	-	5.68(0.86)	9	4.0-7.23	-	0	-
Brunswick	Harpswell Cove	-	0	-	7.9(-)	1	-	19.4(-)	1	-	-	0	-	8.77(3.88)	2	8.46-9.07	6.44(2.63)	5	3.52-9.17	11.34(2.86)	12	4.9-20.7	-	0	-
	Thomas Point	5.8(2.2)	4	4.6-7.4	-	0	-	-	0	-	14.7(-)	1	-	-	0	-	-	0	-	8.92(2.47)	11	4.1-16.32	-	0	-
Phippsburg	Atkins Flat	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	7.22(3.35)	5	5.11-11.77	3.79(1.26)	6	2.59-5.78	6.73(0.72)	16	4.5-8.61	3.03(0.39)	15	2.3-4.98
	Branch Flat	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	-	0	-	4.85(1.27)	3	4.44-5.42	6.14(1.19)	16	3.2-10.53	3.96(1.27)	3	2.87-5.49
Bremen	Sam's Cove	-	0	-	-	0	-	-	0	-	-	0	-	-	0	-	6.15(-)	1	-	-	0	-	-	0	-
	Broad Cove	11.3(18.8)	2	9.8-12.7	8.1(11.4)	2	7.2-9.0	15.7(7.4)	19	4.0-50.4	48.8(17.0)	8	7.2-68.1	6.05(-)	1	-	4.37(14.74)	2	3.21-5.53	6.14(2.48)	7	3.15-10.9	-	0	-
Islesboro	Little Broad Cove	4.5(4.8)	3	3.1-6.7	-	0	-	-	0	-	-	0	-	-	0	-	2.47(-)	1	-	5.93(5.17)	3	3.64-7.63	3.6(-)	1	-
	Ryder Cove	7.2(2.1)	9	3.9-12.6	-	0	-	-	0	-	-	0	-	9.3(2.3)	4	7.78-11.11	2.78(0.53)	10	1.84-4.46	4.11(-)	1	-	3.27(0.63)	5	2.49-3.82
Stonington	Hatch Cove	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	-	0	-	-	0	-	6.05(1.73)	6	4.3-8.6	4.55(2.26)	4	3.05-6.12
	Sunshine Bar	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	-	0	-	40.81(-)	1	-	8.87(12.52)	3	3.56-13.58	-	0	-
Frenchman's Bay	Raccoon Cove	10.0(1.8)	47	3.2-37.2	11.5(9.2)	8	2.5-30.3	20.5(7.6)	14	7.1-44.0	22.7(41.8)	3	3.8-36.2	30.4(-)	1	-	-	0	-	-	0	-	3.57(9.59)	2	2.81-4.32
	Hog Bay	39.3(25.5)	7	4.3-74.3	-	0	-	41.5(11.9)	8	20-62.1	46.4(7.9)	10	21.2-62.4	44.89(6.01)	13	26.16-66.93	22.27(19.98)	5	6.95-52.5	5.41(-)	1	-	36.64(-)	1	-
Beals	Dobbins' Island	3.7(1.0)	7	2.5-5.8	-	0	-	-	0	-	9.9(-)	1	-	4.22(0.7)	6	3.44-5.43	-	0	-	4.43(2.49)	3	3.3-5.24	-	0	-
	Perio Point	7.5(0.9)	26	2.6-11.7	-	0	-	6.2(9.5)	2	5.4-6.9	6.2(36.5)	2	3.3-9.1	7.55(2.73)	5	4.09-9.86	-	0	-	3.91(0.72)	15	2.09-7.4	4.82(-)	1	-
Machiasport	Sanborn Cove	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	-	0	-	3.34(0.71)	5	2.88-4.31	4.67(-)	1	-	3.59(-)	1	-
	Randall Point Flat	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	47.92(12.02)	9	12.3-62.41	5.84(2.11)	70	2.04-71.32	7.65(2.74)	20	3.43-30.0	6.73(49.74)	2	2.81-10.64
Edmunds	Burnt Cove	N/A	N/A	N/A	N/A	N/A	N/A	-	0	-	3.5(1.5)	4	2.9-4.9	9.80(-)	1	-	3.54(1.14)	2	3.45-3.63	-	0	-	-	0	-
	Hallowell Island	N/A	N/A	N/A	N/A	N/A	N/A	5.6(2.3)	4	3.7-7.2	3.3(1.5)	3	2.6-3.8	6.78(2.01)	8	3.9-10.3	3.02(0.62)	5	2.48-3.74	-	0	-	-	0	-
	Marion Cove	N/A	N/A	N/A	N/A	N/A	N/A	-	0	-	3.5(-)	1	-	7.73(2.07)	4	6.6-8.9	4.8(11.94)	2	3.86-5.74	-	0	-	4.96(14.05)	2	3.85-6.06
Sipayik	Gleason Cove	14.5(25.9)	6	3.0-64.9	13.3(17.0)	4	3.5-24.6	6.2(10.2)	2	5.4-7.0	11.9(15.1)	3	4.89-15.9	11.02(10.03)	16	2.8-65.45	2.61(0.33)	19	1.72-4.21	4.73(0.63)	18	2.4-7.45	2.87(0.98)	4	2.16-3.62
	Half Moon Cove	5.1(1.0)	15	2.8-8.3	4.8(1.3)	5	3.1-5.8	8.4(1.9)	4	7.1-10.0	-	0	-	6.53(3.74)	5	4.08-10.85	-	0	-	-	0	-	7.28(-)	1	-

Appendix C: 2020-2023 Soft-Shell Clam Recruitment Density Data and Recruit Size. The parentheses after the average density refer to the 95% confidence interval. A (-) indicates no confidence interval as n = 1.

Town	Flat	Treatment	2020 Avg. Density	2020 Mean Shell Length (mm)	2020 Size Range (mm)	2021 Avg. Density	2021 Mean Shell Length (mm)	2021 Size Range (mm)	2022 Avg. Density	2022 Mean Shell Length (mm)	2022 Size Range (mm)	2023 Avg. Density	2023 Mean Shell Length (mm)	2023 Size Range (mm)
Wells	Dolphin Lane	Mesh	7.8(6.4)	26.3(0.6)	16.2-33.1	N/A	N/A	N/A	1.72(1.38)	25.79(1.37)	18.78-34.25	N/A	N/A	N/A
		Fabric	0.8(0.8)	31.6(2.3)	16.6-34.9	0.2(0.2)	22.7(7.8)	8.6-28.6	N/A	N/A	N/A	54.99(18.31)	26.44(0.86)	13.68-42.79
	Upper Landing	Mesh	1.7(1.9)	16.2(1.7)	5.9-21.8	4.2(1.8)	5.2(0.5)	1.8-23.9	0.73(0.61)	19.83(2.69)	1.64-26.36	N/A	N/A	N/A
		Fabric	1.5(2.0)	12.9(2.2)	7.6-29.2	N/A	N/A	N/A	N/A	N/A	N/A	0.97(1.03)	26.71(3.24)	15.9-38.01
Scarborough	Jones Creek	Mesh	1.3(2.2)	8.8(1.3)	2.1-14.3	0.8(0.4)	18.7(3.1)	3.6-29.3	8.80(6.89)	8.67(1.32)	1.94-33.32	N/A	N/A	N/A
		Fabric	0.4(0.6)	6.1(1.7)	4.5-9.1	N/A	N/A	N/A	N/A	N/A	N/A	44.44(36.7)	16.88(0.83)	2.0-31.21
	Winnock Neck	Mesh	105.5(102.9)	8.3(0.7)	1.5-16.2	0.4(0.4)	17.8(3.6)	6.1-25.4	5.61(6.39)	18.34(0.62)	11.01-24.83	N/A	N/A	N/A
		Fabric	72.3(72.9)	8.8(0.6)	2.5-20.9	N/A	N/A	N/A	N/A	N/A	N/A	4.66(3.54)	10.32(1.31)	2.23-26.34
Brunswick	Harpwell Cove	Mesh	5.1(4.1)	12.1(1.4)	2.7-28.4	1(0.8)	13.3(2.2)	5.5-24.4	0.65(0.37)	17.56(3.79)	2.21-26.82	N/A	N/A	N/A
		Fabric	2.6(1.4)	18.5(2.1)	3.7-28.1	N/A	N/A	N/A	N/A	N/A	N/A	0.67(1.35)	12.04(4.12)	1.46-19.45
	Thomas Point	Mesh	1.2(1.3)	15.7(4.4)	4.7-33.1	1.5(0.8)	17.3(3.0)	2.2-35.8	14.95(3.55)	15.49(0.98)	2.41-43.56	N/A	N/A	N/A
		Fabric	1.5(1.6)	23.2(3.7)	2.1-34.8	N/A	N/A	N/A	N/A	N/A	N/A	62.94(33.69)	7.79(0.84)	1.53-27.59
Phippsburg	Atkins Flat	Mesh	N/A	N/A	N/A	N/A	N/A	N/A	0.99(1.03)	13.87(4.8)	3.61-30.83	N/A	N/A	N/A
		Fabric	N/A	N/A	N/A	N/A	N/A	N/A	6.46(4.76)	22.59(0.84)	5.41-28.42	16.56(7.16)	25.25(0.79)	14.45-38.14
	Branch Flat	Mesh	N/A	N/A	N/A	N/A	N/A	N/A	0.0(-)	0.0(-)	-	N/A	N/A	N/A
		Fabric	N/A	N/A	N/A	N/A	N/A	N/A	2.46(2.71)	17.01(3.22)	2.75-33.59	5.23(6.13)	13.09(1.58)	1.02-28.05
Bremen	Sam's Cove	Mesh	6.8(1.5)	14.9(1.6)	1.9-39.9	0.9(0.8)	17(3.4)	5.3-29.5	13.45(9.1)	10.85(1.02)	1.68-34.36	N/A	N/A	N/A
		Fabric	4.4(2.4)	22.1(2.6)	2.3-41.5	N/A	N/A	N/A	N/A	N/A	N/A	8.2(5.31)	15.48(1.57)	1.81-42.43
	Broad Cove	Mesh	13.7(12.4)	11.7(0.9)	3.2-21.4	15.3(20.7)	9.9(1.4)	2.5-21.2	48.24(34.62)	7.6(0.79)	1.68-25.38	N/A	N/A	N/A
		Fabric	12.2(15.5)	15.6(2.1)	1.8-29.5	N/A	N/A	N/A	N/A	N/A	N/A	4.97(5.47)	11.85(2.14)	1.54-30.07
Islesboro	Little Broad Cove	Mesh	0.5(0.4)	9.6(2.9)	3.4-13.2	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
		Fabric	64.7(35.9)	16.2(0.7)	4.0-25.0	57.5(48.5)	14.2(0.4)	3.3-21.4	144.34(52.27)	16.64(0.31)	13.53-25.55	74.06(10.61)	20.11(0.45)	7.74-31.47
	Ryder Cove	Mesh	4.8(4.8)	15.9(1.2)	2.3-25.8	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
		Fabric	47.5(19.9)	21.5(0.8)	2.3-33.9	115.3(57.5)	17.6(0.5)	6.3-26.3	114.36(46.18)	16.64(0.31)	9.75-25.34	74.52(19.07)	21.99(0.85)	4.93-35.21
Stonington	Hatch Cove	Mesh	N/A	N/A	N/A	N/A	N/A	N/A	0.46(1.09)	17.99(2.09)	15.4-20.73	N/A	N/A	N/A
		Fabric	N/A	N/A	N/A	N/A	N/A	N/A	4.54(5.07)	17.83(1.84)	2.1-26.18	0.0(-)	0.0(-)	-
	Sunshine Bar	Mesh	N/A	N/A	N/A	N/A	N/A	N/A	0.0(-)	0.0(-)	-	N/A	N/A	N/A
		Fabric	N/A	N/A	N/A	N/A	N/A	N/A	3.38(3.81)	21.72(1.37)	2.44-28.87	6.87(7.88)	19.79(1.06)	4.83-29.78
Frenchman's Bay	Raccoon Cove	Mesh	32.2(15.2)	5.3(0.3)	2.2-10.3	17.3(6.4)	7.8(0.3)	2.8-18.4	4.92(1.84)	7.61(0.75)	1.51-17.53	N/A	N/A	N/A
		Fabric	4.9(2.9)	6.7(0.8)	2.8-11)	N/A	N/A	N/A	N/A	N/A	N/A	29.11(7.11)	8.78(0.45)	1.64-18.46
	Hog Bay	Mesh	0.0(-)	0.0(-)	-	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
		Fabric	4.2(2.7)	9.1(0.7)	2.6-15.9	13.6(1.7)	8.9(0.3)	3.2-19.1	0.73(0.47)	9.91(1.69)	3.14-16.99	4.72(3.86)	8.89(1.01)	1.8-16.9
Beals	Dobbins' Island	Mesh	137(86.9)	10.5(0.6)	3.5-21.5	28.9(28.7)	14.6(0.8)	2.1-25.9	32.59(12.03)	12.65(0.29)	12.45-30.39	N/A	N/A	N/A
		Fabric	75.9(33.6)	13.3(0.6)	2.9-20.5	N/A	N/A	N/A	N/A	N/A	N/A	61.25(43.67)	11.62(1.0)	1.37-31.78
	Perio Point	Mesh	4.4(15.2)	5.5(0.6)	1.8-10.6	N/A	N/A	N/A	48.47(13.18)	7.67(0.62)	1.62-22.99	N/A	N/A	N/A
		Fabric	4.9(2.6)	6.9(0.5)	1.3-16.9	57.7(11.8)	7.1(0.3)	1.7-22.9	N/A	N/A	N/A	101.23(33.82)	6.53(0.66)	1.52-22.61
Machiasport	Sanborn Cove	Mesh	N/A	N/A	N/A	N/A	N/A	N/A	3.92(2.19)	9.9(1.47)	2.08-20.68	N/A	N/A	N/A
		Fabric	N/A	N/A	N/A	N/A	N/A	N/A	7.3(9.84)	13.45(1.48)	2.4-21.33	27.42(12.81)	5.86(0.51)	1.59-20.72
	Randall Point Flat	Mesh	N/A	N/A	N/A	N/A	N/A	N/A	28.52(15.79)	5.79(0.55)	1.79-14.97	N/A	N/A	N/A
		Fabric	N/A	N/A	N/A	N/A	N/A	N/A	116.17(87.36)	6.12(0.69)	1.78-16.32	155.5(45.35)	2.97(0.19)	1.17-9.97
Edmunds	Burnt Cove	Mesh	N/A	N/A	N/A	58.4(21.1)	7.7(0.6)	1.8-18.2	4.07(1.58)	8.32(0.74)	2.32-20.59	N/A	N/A	N/A
		Fabric	N/A	N/A	N/A	21.8(12.4)	7.4(0.8)	1.5-20.9	N/A	N/A	N/A	3.43(2.16)	4.11(0.44)	1.83-11.59
	Hallowell Island	Mesh	N/A	N/A	N/A	15.1(5.7)	7.3(0.7)	1.1-17.6	17.91(3.81)	7.29(0.49)	2.01-19.4	N/A	N/A	N/A
		Fabric	N/A	N/A	N/A	24.1(10.1)	8.9(0.7)	1.6-19.8	N/A	N/A	N/A	0.26(0.26)	4.66(1.11)	3.55-5.9
Sipayik	Marion Cove	Mesh	N/A	N/A	N/A	10.1(4.3)	6.2(0.6)	1.5-15.4	7.03(1.65)	5.89(0.48)	1.82-14.74	N/A	N/A	N/A
		Fabric	N/A	N/A	N/A	14.3(4.9)	5.8(0.5)	1.7-15.1	N/A	N/A	N/A	11.94(5.3)	4.04(0.41)	1.61-22.16
	Gleason Cove	Mesh	1187.5(212.1)	5.8(0.3)	1.8-15.4	2.6(0.7)	7.4(0.8)	2.1-17.7	112.48(53.62)	7.42(0.49)	1.58-21.11	N/A	N/A	N/A
		Fabric	1109.6(690.3)	5.3(0.4)	1.5-13.3	N/A	N/A	N/A	N/A	N/A	N/A	115.91(82.42)	7.62(0.49)	1.57-22.19
	Half Moon Cove	Mesh	34.9(10.2)	7.7(0.4)	2.5-14.6	2.6(0.7)	7.4(0.8)	2.1-17.7	16.49(2.63)	5.72(0.44)	1.35-23.75	N/A	N/A	N/A
		Fabric	22.1(4.9)	8.9(0.4)	2.9-15.7	N/A	N/A	N/A	N/A	N/A	N/A	10.81(2.97)	3.74(0.28)	1.66-11.06

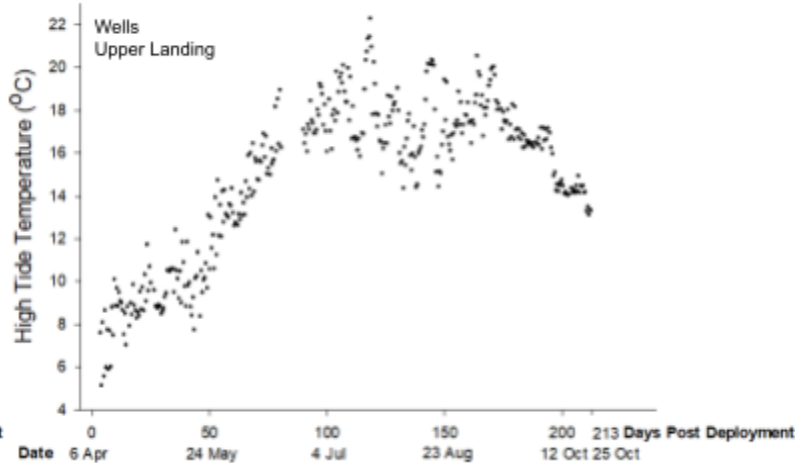
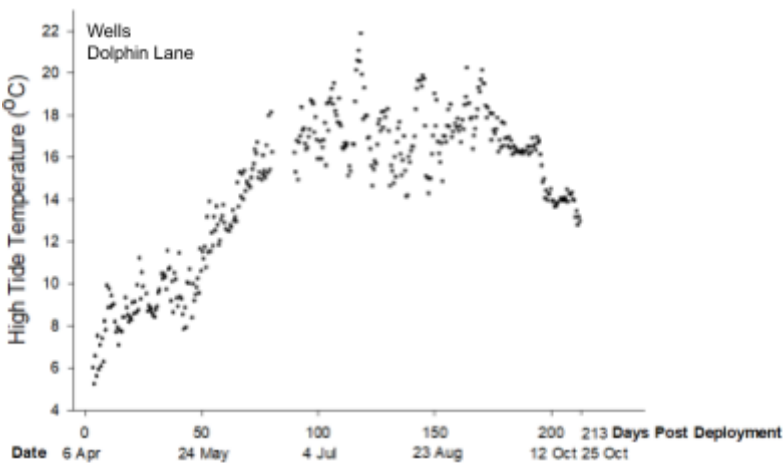
Appendix D: 2020-2023 Green Crab Size and Density Data. The parentheses after the average density refer to the 95% confidence interval. A (-) indicates no confidence interval as n = 1.

Town	Flat	Treatment	2020 Green Crab Avg. Density	2020 Mean Carapace Width (mm)	2020 Size Range (mm)	2021 Green Crab Avg. Density	2021 Mean Carapace Width (mm)	2021 Size Range (mm)	2022 Green Crab Avg. Density	2022 Mean Carapace Width (mm)	2022 Size Range (mm)	2023 Green Crab Avg. Density	2023 Mean Carapace Width (mm)	2023 Size Range (mm)
Wells	Dolphin Lane	Mesh	7.7(1.7)	14.7(1.0)	2.1-31.1	N/A	N/A	N/A	6.77(1.95)	13.9(0.65)	1.97-31.98	N/A	N/A	N/A
		Fabric	3.9(2.7)	14.1(1.7)	3.9-32.9	4.4(0.6)	15.1(0.8)	4.4-31.7	N/A	N/A	N/A	12.61(3.36)	10.84(0.49)	5.58-26.9
	Upper Landing	Mesh	1.7(1.9)	16.2(1.7)	5.9-21.8	4.2(1.8)	5.2(0.5)	1.8-23.9	3.42(0.99)	11.57(0.74)	5.73-27.88	N/A	N/A	N/A
		Fabric	1.5(2.0)	12.9(2.2)	7.6-29.2	N/A	N/A	N/A	N/A	N/A	N/A	2.41(0.75)	15.68(1.99)	7.3-32.11
Scarborough	Jones Creek	Mesh	0.0(-)	0.0(-)	-	8.8(1.8)	10.3(0.7)	2.6-39.3	1.11(1.33)	8.06(0.96)	2.03-16.04	N/A	N/A	N/A
		Fabric	0.4(0.6)	6.1(1.7)	4.5-9.1	N/A	N/A	N/A	N/A	N/A	N/A	13.27(6.75)	9.56(0.7)	1.92-31.52
	Winnock Neck	Mesh	7.2(4.4)	8.3(0.7)	1.5-16.2	4.3(0.9)	13.6(1.1)	3.3-33.5	9.38(6.21)	11.58(0.9)	2.6-33.92	N/A	N/A	N/A
		Fabric	1.6(0.9)	8.8(0.6)	2.5-20.9	N/A	N/A	N/A	N/A	N/A	N/A	0.36(0.31)	6.99(2.46)	1.98-9.3
Brunswick	Harpswell Cove	Mesh	1.7(0.7)	15.1(3.1)	6.5-40.8	3.4(1.0)	13.8(1.7)	3.5-35.8	2.23(0.53)	19.16(2.21)	5.68-41.64	N/A	N/A	N/A
		Fabric	1.2(1.1)	12.8(3.1)	6.5-30.7	N/A	N/A	N/A	N/A	N/A	N/A	1.33(0.33)	22.54(3.84)	5.27-40.14
	Thomas Point	Mesh	0.0(-)	0.0(-)	-	1.2(0.8)	8.3(1.5)	4.4-22.2	0.12(0.18)	26.98(10.58)	22.59-31.09	N/A	N/A	N/A
		Fabric	0.0(-)	0.0(-)	-	N/A	N/A	N/A	N/A	N/A	N/A	0.56(0.39)	13.3(4.99)	3.29-28.77
Phippsburg	Atkins Flat	Mesh	N/A	N/A	N/A	N/A	N/A	N/A	17.38(14.49)	10.71(0.59)	2.79-23.47	N/A	N/A	N/A
		Fabric	N/A	N/A	N/A	N/A	N/A	N/A	11.76(2.61)	12.01(0.63)	5.24-25.78	5.28(1.79)	13.06(0.88)	3.58-34.46
	Branch Flat	Mesh	N/A	N/A	N/A	N/A	N/A	N/A	6.99(3.12)	20.8(1.48)	3.24-36.12	N/A	N/A	N/A
		Fabric	N/A	N/A	N/A	N/A	N/A	N/A	5.92(2.93)	10.67(1.57)	2.7-34.79	5.43(2.7)	11.01(0.84)	3.02-25.92
Bremen	Sam's Cove	Mesh	0.8(0.7)	11.9(3.8)	3.7-27.1	3.8(1.0)	18.0(2.2)	5.2-44.6	0.78(0.44)	16.24(4.0)	6.56-33.08	N/A	N/A	N/A
		Fabric	0.4(0.4)	21.4(9.0)	10.2-31.5	N/A	N/A	N/A	N/A	N/A	N/A	1.38(0.63)	15.75(4.12)	3.27-48.26
	Broad Cove	Mesh	0.5(0.2)	23.9(9.2)	6.0-34.9	1.2(0.3)	20.8(4.2)	4.4-36.1	1.69(0.58)	10.3(2.02)	1.76-31.02	N/A	N/A	N/A
		Fabric	0.5(0.3)	28.2(10.1)	6.4-41.0	N/A	N/A	N/A	N/A	N/A	N/A	0.77(0.58)	21.01(5.42)	4.09-35
Islesboro	Little Broad	Mesh	0.0(-)	0.0(-)	-	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
		Fabric	2.5(3.2)	10.0(1.3)	5.1-20.0	20.1(3.8)	10.9(0.4)	2.9-29.9	11.69(2.58)	10.94(0.61)	1.94-32.49	11.07(3.59)	9.17(0.68)	4.57-41.26
	Ryder Cove	Mesh	0.2(0.2)	12.5(28.1)	8.0-16.9	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
		Fabric	2.2(0.9)	11.2(1.7)	4.8-28.7	11.3(3.6)	13.9(0.8)	1.8-29.6	9.73(1.49)	14.53(0.79)	2.79-38.64	8.66(4.21)	7.95(2.49)	3.17-22.47
Stonington	Hatch Cove	Mesh	N/A	N/A	N/A	N/A	N/A	N/A	3.23(2.02)	16.36(1.43)	7.75-25.77	N/A	N/A	N/A
		Fabric	N/A	N/A	N/A	N/A	N/A	N/A	5.61(2.22)	10.72(1.32)	2.44-23.75	2.15(0.66)	17.17(1.73)	5.55-32.17
	Sunshine Bar	Mesh	N/A	N/A	N/A	N/A	N/A	N/A	5.23(1.55)	21.89(1.54)	8.41-34.52	N/A	N/A	N/A
		Fabric	N/A	N/A	N/A	N/A	N/A	N/A	6.91(0.89)	17.83(1.73)	3.97-39.84	3.89(1.51)	16.19(1.86)	4.73-34.94
Frenchman's Bay	Raccoon Cove	Mesh	0.0(-)	0.0(-)	-	0.4(0.3)	8.9(2.4)	5.1-16.6	0.31(0.21)	12.05(3.15)	5.65-17.73	N/A	N/A	N/A
		Fabric	0.0(-)	0.0(-)	-	N/A	N/A	N/A	N/A	N/A	N/A	0.31(0.26)	11.21(3.73)	8.26-17.5
	Hog Bay	Mesh	0.2(0.2)	29.9(4.1)	29.3-30.6	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
		Fabric	4.2(2.7)	9.1(0.7)	2.6-15.9	0.0(-)	0.0(-)	-	0.0(-)	0.0(-)	-	0.26(0.2)	24.75(11.04)	14.84-32.53
Beals	Dobbins' Island	Mesh	5.9(2.2)	6.4(0.7)	2.3-20.5	14.5(4.1)	9.4(0.2)	1.4-22.4	15.76(1.4)	10.44(0.39)	2.87-66.22	N/A	N/A	N/A
		Fabric	2.2(1.4)	8.8(1.9)	2.5-27.5	N/A	N/A	N/A	N/A	N/A	N/A	9.94(5.56)	7.45(0.34)	1.47-21.83
	Perio Point	Mesh	0.0(-)	0.0(-)	-	N/A	N/A	N/A	2.34(1.57)	6.95(0.59)	2.86-12.41	N/A	N/A	N/A
		Fabric	0.0(-)	0.0(-)	-	0.1(0.1)	6.9(-)	-	N/A	N/A	N/A	3.38(3.48)	4.94(0.32)	2.65-8.73
Machiasport	Sanborn Cove	Mesh	N/A	N/A	N/A	N/A	N/A	N/A	6.15(3.39)	6.32(0.46)	3.5-14.53	N/A	N/A	N/A
		Fabric	N/A	N/A	N/A	N/A	N/A	N/A	9.84(2.56)	8.38(0.45)	2.94-15.04	1.38(1.59)	7.21(0.9)	3.87-12.23
	Randall Point Flat	Mesh	N/A	N/A	N/A	N/A	N/A	N/A	4.68(2.78)	6.04(0.41)	3.66-9.76	N/A	N/A	N/A
		Fabric	N/A	N/A	N/A	N/A	N/A	N/A	6.76(4.29)	7.14(0.54)	2.29-14.35	0.67(0.42)	3.58(0.27)	2.98-4.43
Edmunds	Burnt Cove	Mesh	N/A	N/A	N/A	0.8(0.6)	6.2(0.9)	3.8-8.6	0.64(0.93)	13.1(-)	9.36-16.84	N/A	N/A	N/A
		Fabric	N/A	N/A	N/A	1.2(0.8)	6.5(1.1)	2.8-10.9	N/A	N/A	N/A	0.0(-)	0.0(-)	-
	Hallowell Island	Mesh	N/A	N/A	N/A	0.6(0.4)	5.9(1.6)	2.9-10.5	0.23(0.16)	5.87(1.59)	3.71-7.66	N/A	N/A	N/A
		Fabric	N/A	N/A	N/A	0.3(0.3)	7.2(2.1)	4.8-8.7	N/A	N/A	N/A	0.0(-)	0.0(-)	-
	Marion Cove	Mesh	N/A	N/A	N/A	0.2(0.2)	7.7(7.0)	4.1-12.3	0.04(0.08)	5.21(-)	-	N/A	N/A	-
		Fabric	N/A	N/A	N/A	0.8(0.5)	7.1(1.6)	2.6-12.1	N/A	N/A	N/A	0.82(0.65)	6.65(1.79)	2.74-13.44
Sipayik	Gleason Cove	Mesh	2.5(1.7)	4.2(0.5)	2.2-9.8	11.2(2.6)	5.1(0.2)	1.6-13.0	8.34(3.37)	4.15(0.32)	1.07-17.85	N/A	N/A	N/A
		Fabric	1.7(1.5)	8.5(2.9)	2.8-24.6	N/A	N/A	N/A	N/A	N/A	N/A	6.09(3.69)	7.21(0.47)	2.63-12.82
	Half Moon Cove	Mesh	0.0(-)	0.0(-)	-	0.8(0.2)	4.9(0.8)	1.9-11.6	1.23(0.57)	5.15(1.46)	2.04-25.16	N/A	N/A	N/A
		Fabric	0.2(0.2)	5.5(16.9)	2.8-8.2	N/A	N/A	N/A	N/A	N/A	N/A	0.1(0.15)	5.99(25.48)	3.98-7.99

Appendix E: Seawater Temperatures

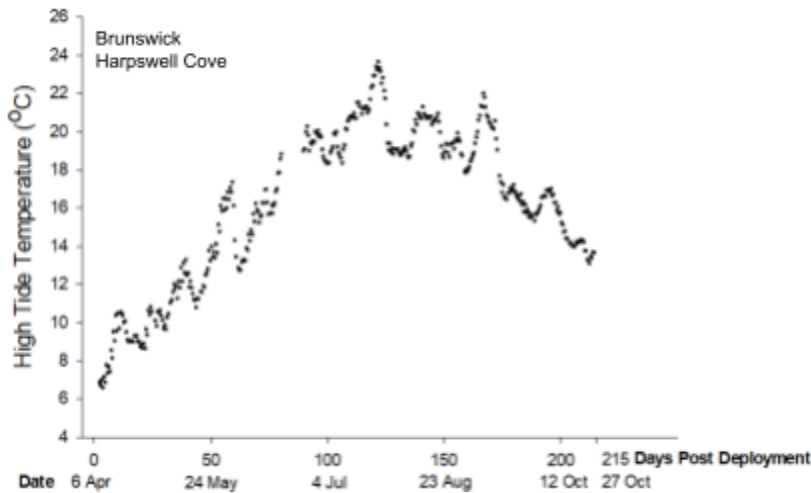
Southwest Region

Wells:



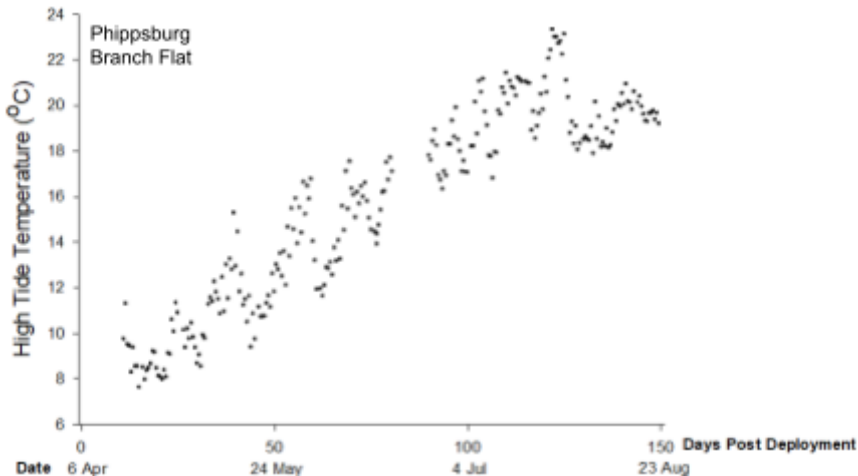
Temperature recorders were not recovered from either of the **Scarborough** sites.

Brunswick:



The temperature recorder at Thomas Point Beach was not recovered.

Phippsburg:

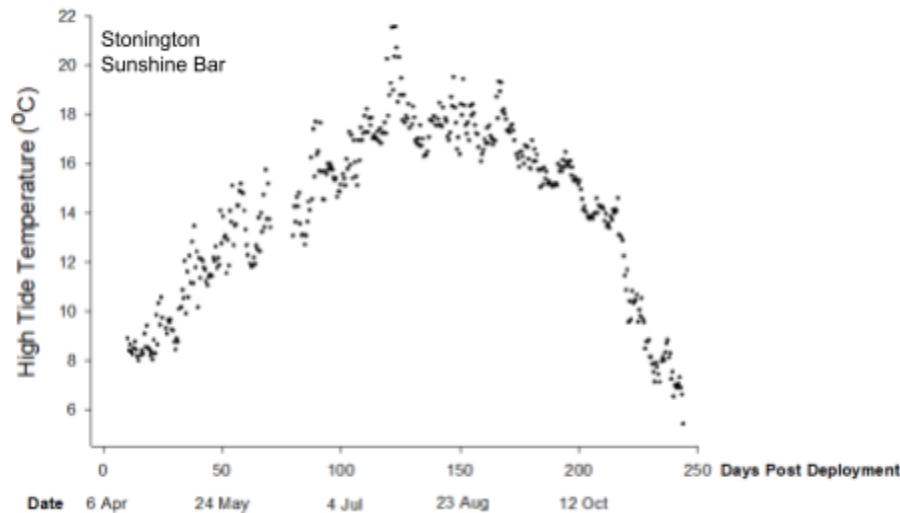


The temperature recorder at Atkins Flat was not recovered. The recorder at Branch Flat stopped recording in mid-August.

Appendix E: Seawater Temperatures
Midcoast Region

Temperature recorders were not recovered from any of the **Bremen** or **Islesboro** sites.

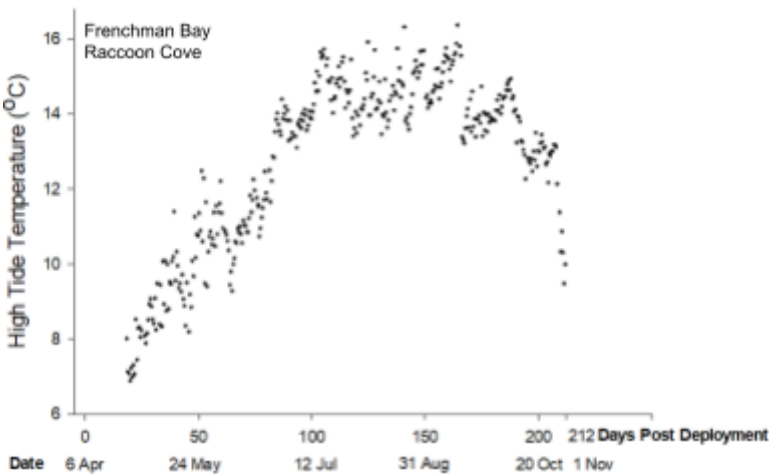
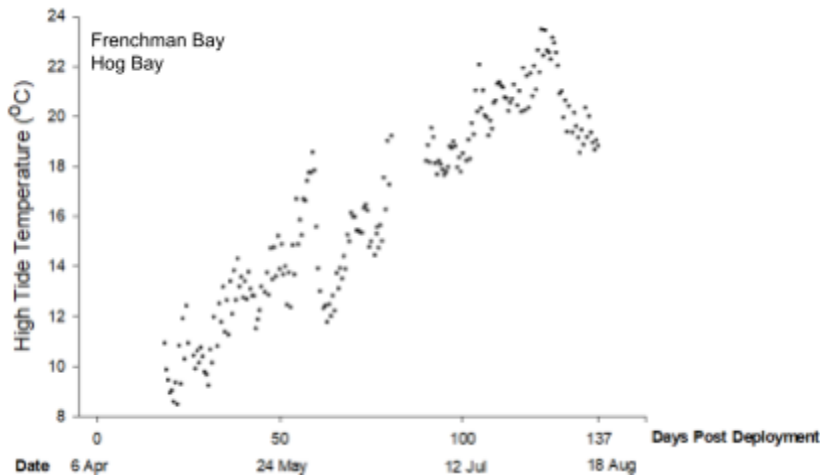
Stonington:



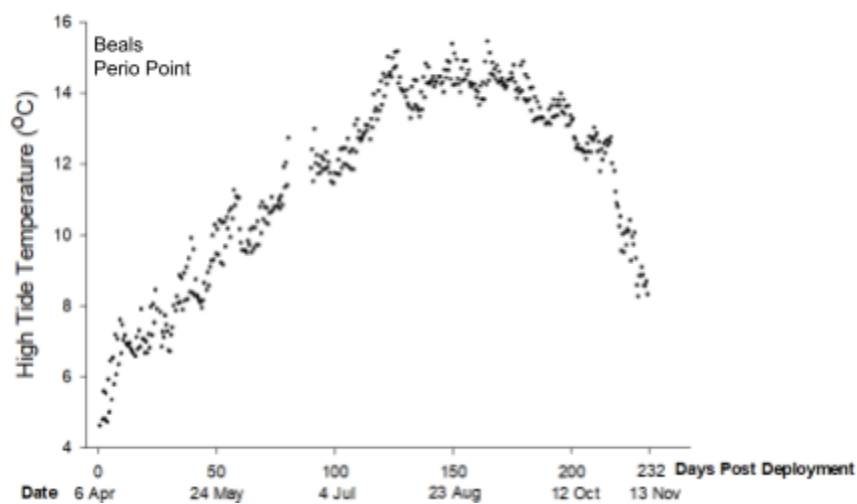
The temperature recorder at Hatch Cove was not recovered.

Appendix E: Seawater Temperatures
Downeast Region

Frenchman Bay:



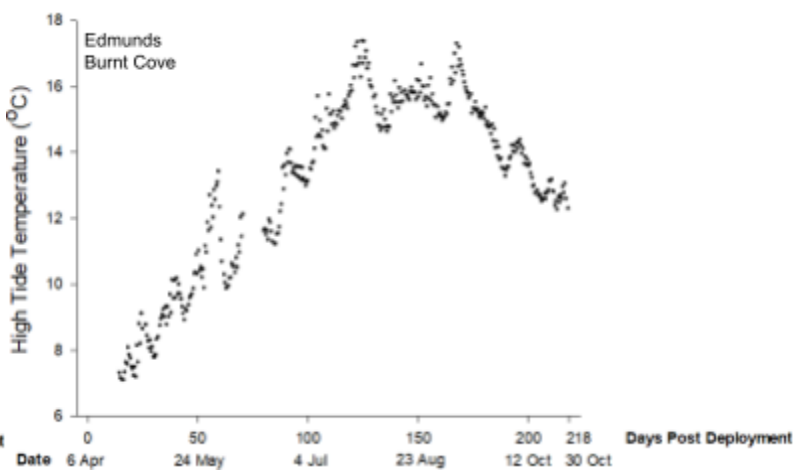
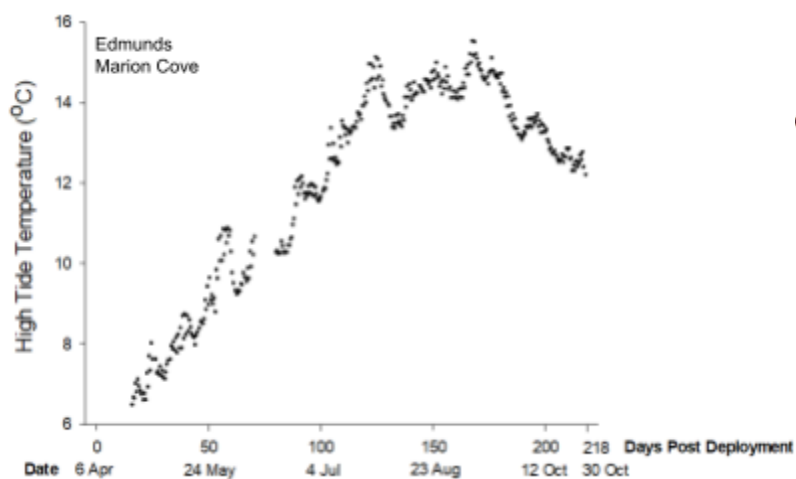
Beals:



The temperature recorder at Dobbins' Island was not recovered.

Temperature recorders were not recovered from either of the **Machiasport** sites.

Edmunds: The temperature recorder at Hallowell Island was lost.

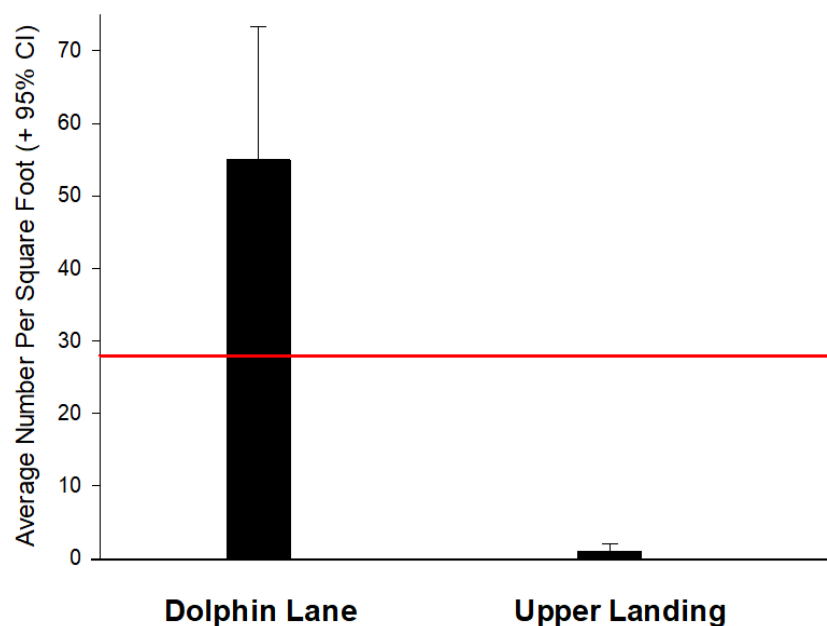


Temperature recorders were not recovered from either of the **Sipayik** sites.

Appendix F: Clam Recruitment Density Results

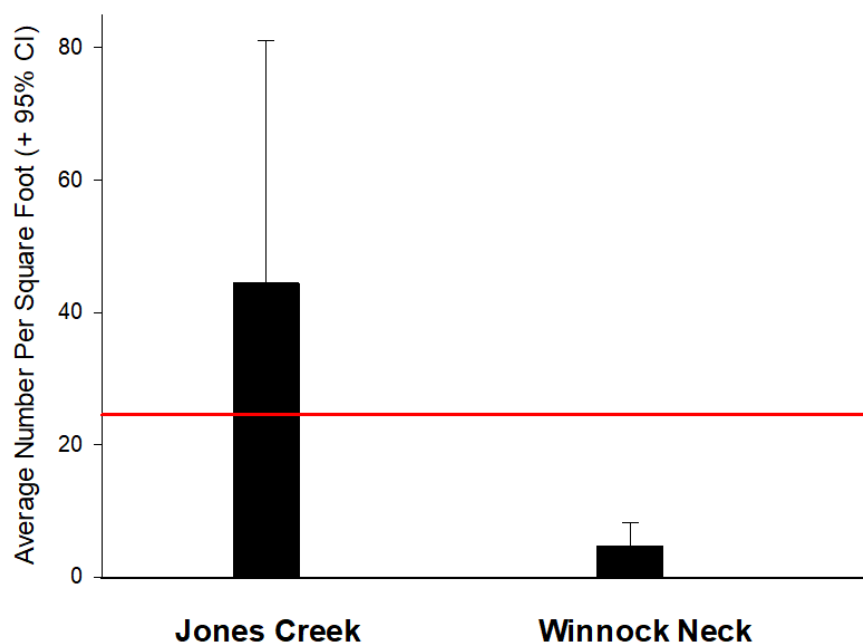
Southwest Region

Wells:



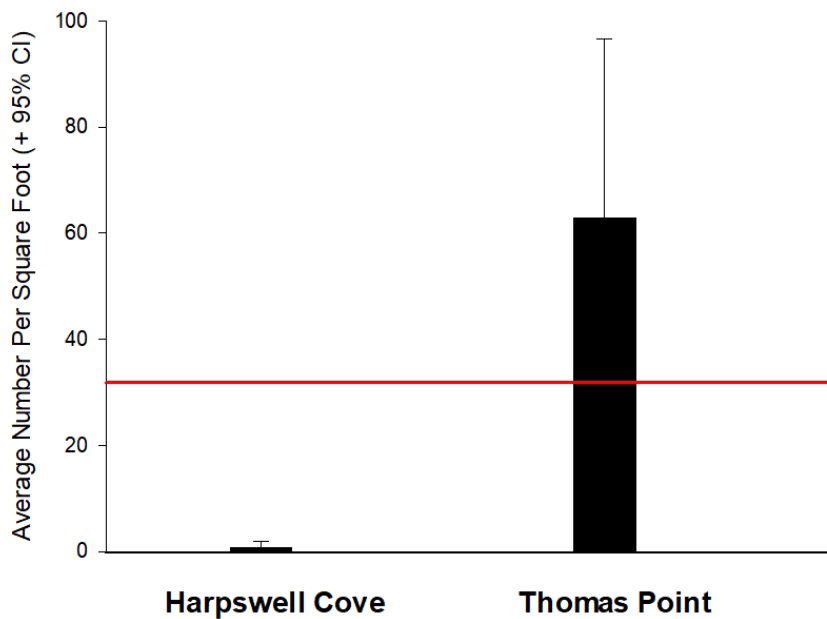
The average density of soft-shell clam recruits was 54.99 per square foot at Dolphin Lane and 0.97 per square foot at Upper Landing. The red line represents the combined average number of recruits across both sites (27.98 clams/ft²).

Scarborough:



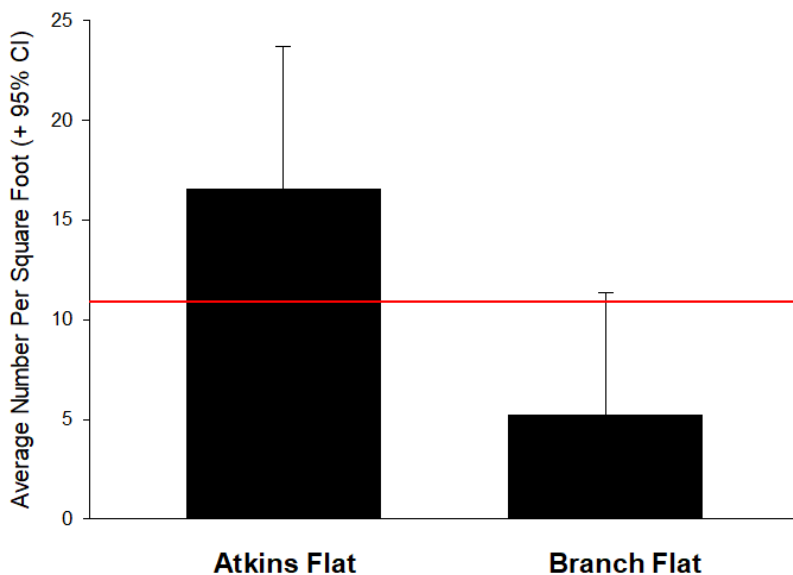
The average density of soft-shell clam recruits was 44.44 per square foot at Jones Creek and 4.66 per square foot at Winnock Neck. The red line represents the combined average number of recruits across both sites (24.55 clams/ft²).

Brunswick:



The average density of soft-shell clam recruits was 0.67 per square foot at Harpswell Cove and 62.94 per square foot at Thomas Point. The red line represents the combined average number of recruits across both sites (31.81 clams/ft²).

Phippsburg:

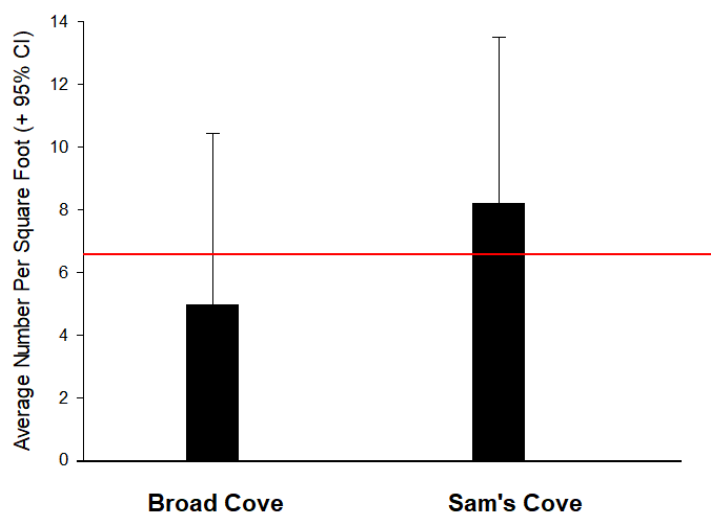


The average density of soft-shell clam recruits was 16.56 per square foot at Atkins Flat and 5.23 per square foot at Branch Flat. The red line represents the combined average number of recruits across both sites (10.90 clams/ft²).

Appendix F: Clam Recruitment Density Results

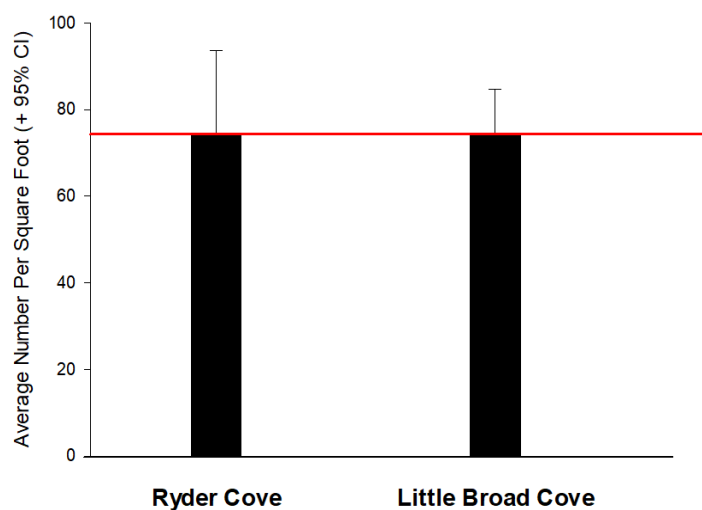
Midcoast Region

Bremen:



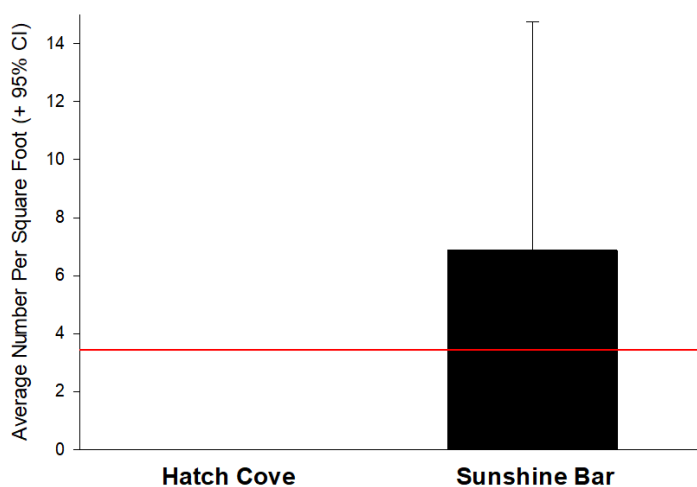
The average density of soft-shell clam recruits was 4.97 per square foot at Broad Cove and 8.20 per square foot at Sam's Cove. The red line represents the combined average number of recruits across both sites (6.59 clams/ft²).

Islesboro:



The average density of soft-shell clam recruits was 74.52 per square foot at Ryder Cove and 74.06 per square foot at Little Broad Cove. The red line represents the combined average number of recruits across both sites (74.29 clams/ft²).

Stonington & Deer Isle:

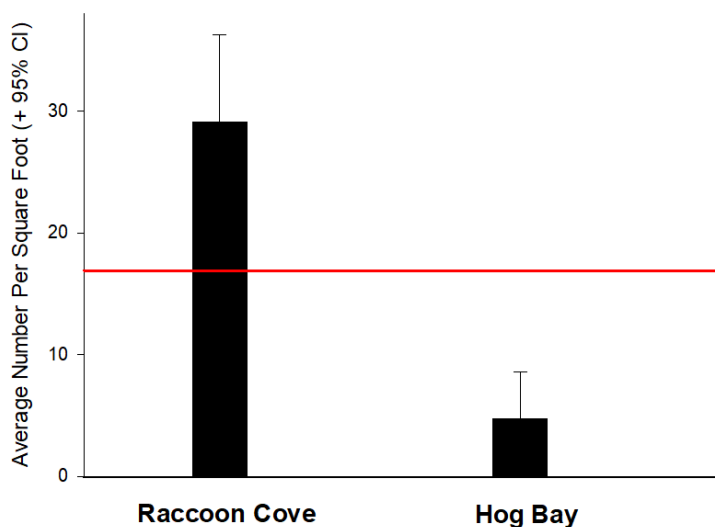


No recruits were found in boxes at Hatch Cove in 2023. The average density of soft-shell clam recruits was 6.87 per square foot at Sunshine Bar. The red line represents the combined average number of recruits across both sites (3.44 clams/ft²).

Appendix F: Clam Recruitment Density Results

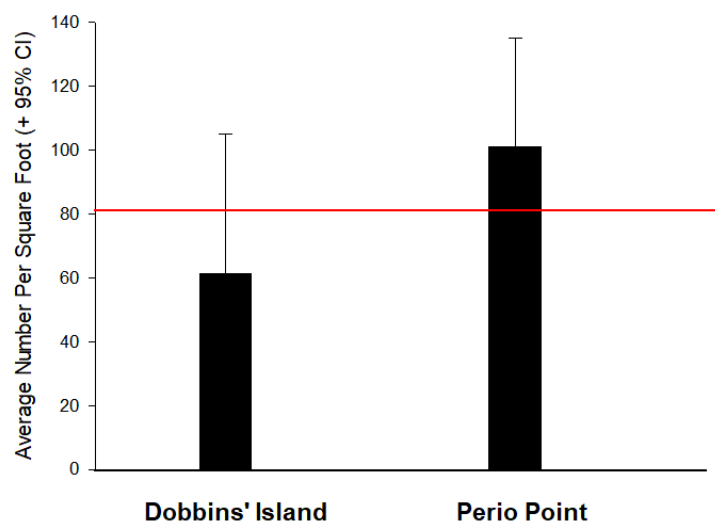
Downeast Region

Frenchman Bay:



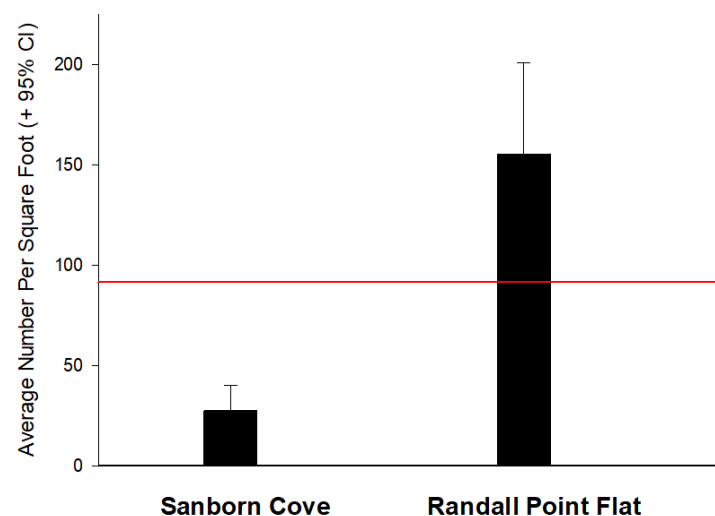
The average density of soft-shell clam recruits was 4.72 per square foot at Hog Bay and 29.11 per square foot at Raccoon Cove. The red line represents the combined average number of recruits across both sites (16.92 clams/ft²).

Beals:



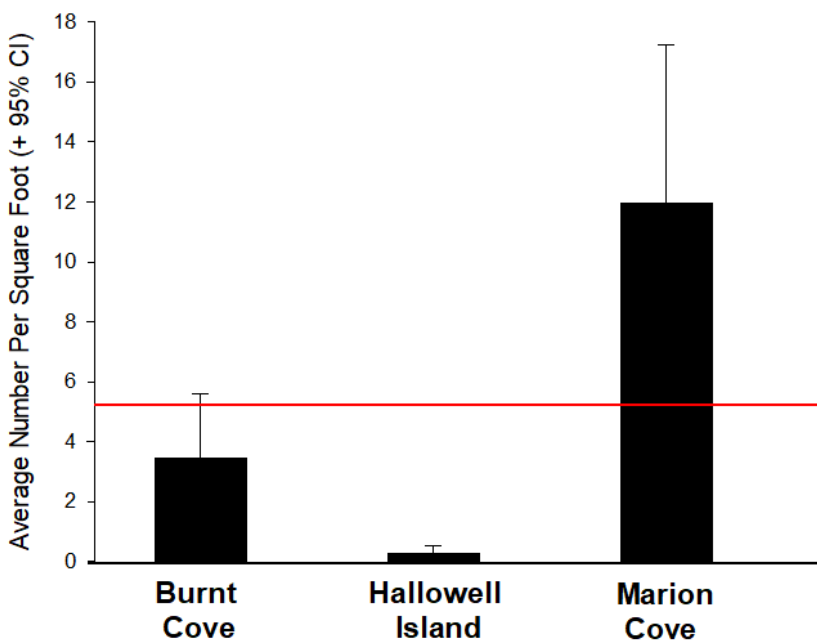
The average density of soft-shell clam recruits was 61.25 per square foot at Dobbins' Island and 101.23 per square foot at Perio Point. The red line represents the combined average number of recruits across both sites (81.24 clams/ft²).

Machiasport:



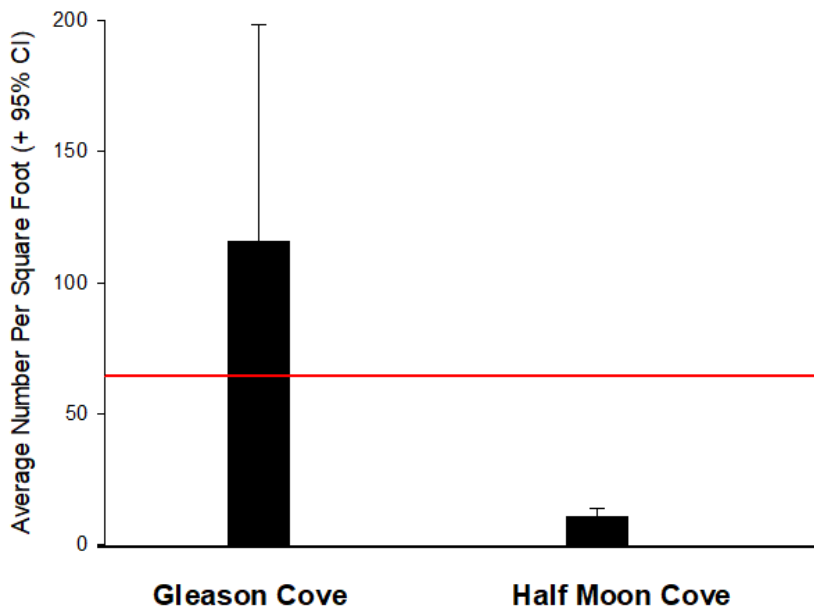
The average density of soft-shell clam recruits was 27.42 per square foot at Sanborn Cove and 155.5 per square foot at Randall Point Flat. The red line represents the combined average number of recruits across both sites (91.46 clams/ft²).

Edmunds/Trescott:



The average density of soft-shell clam recruits was 0.26 per square foot at Hallowell Island, 11.94 per square foot at Marion Cove, and 3.43 per square foot at Burnt Cove. The red line represents the combined average number of recruits across all sites (5.21 clams/ft²).

Sipayik:

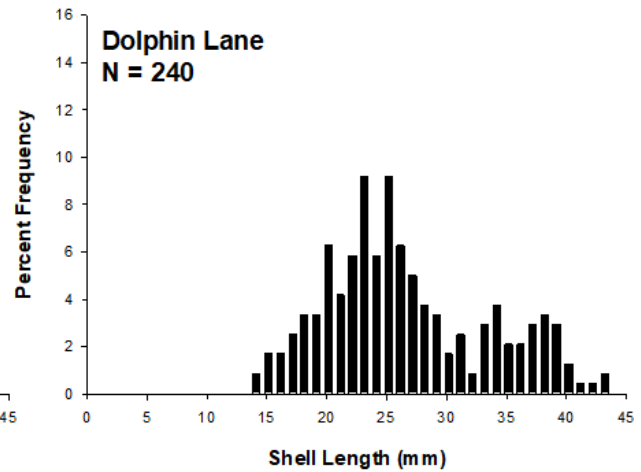
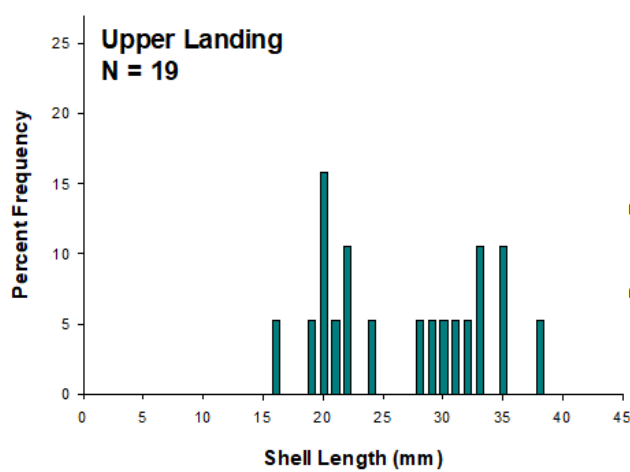


The average density of soft-shell clam recruits was 115.91 per square foot at Gleason Cove and 10.81 per square foot at Half Moon Cove. The red line represents the combined average number of recruits across both sites (63.36 clams/ft²).

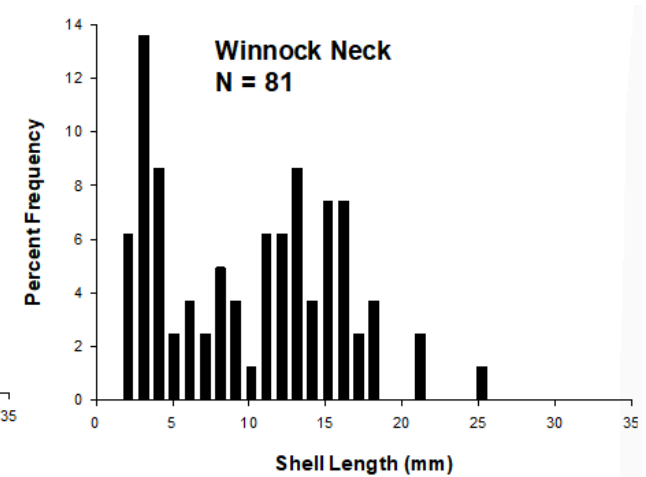
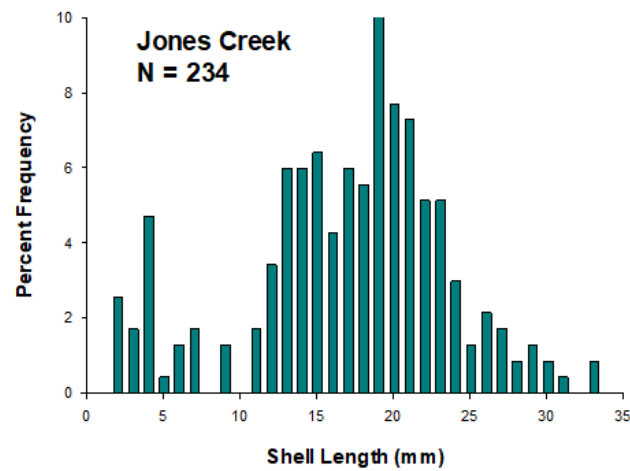
Appendix G: Clam Recruitment Size-Frequency Distributions

Southwest Region

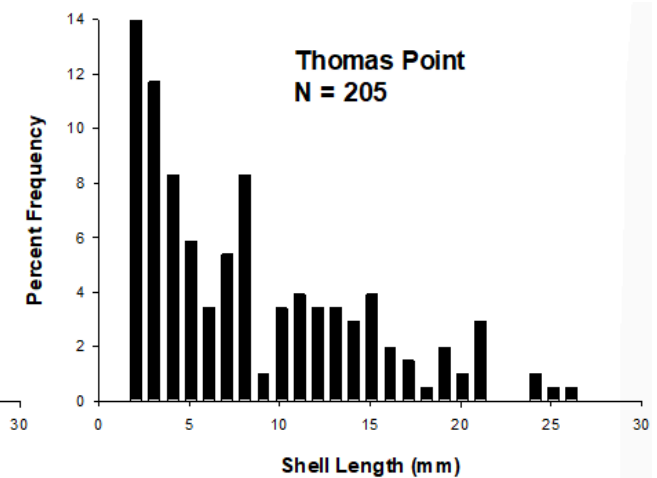
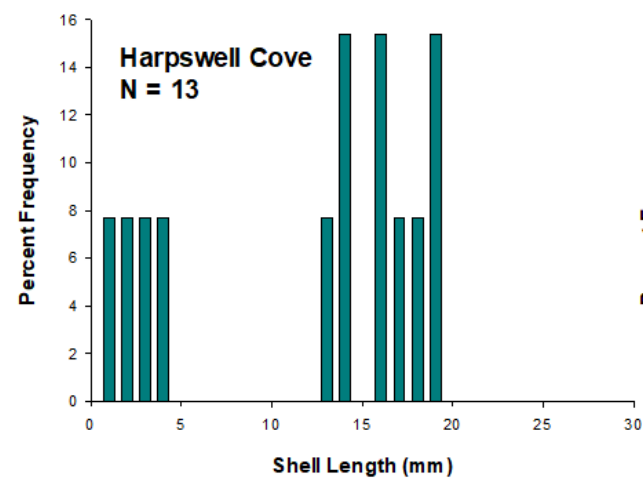
Wells:



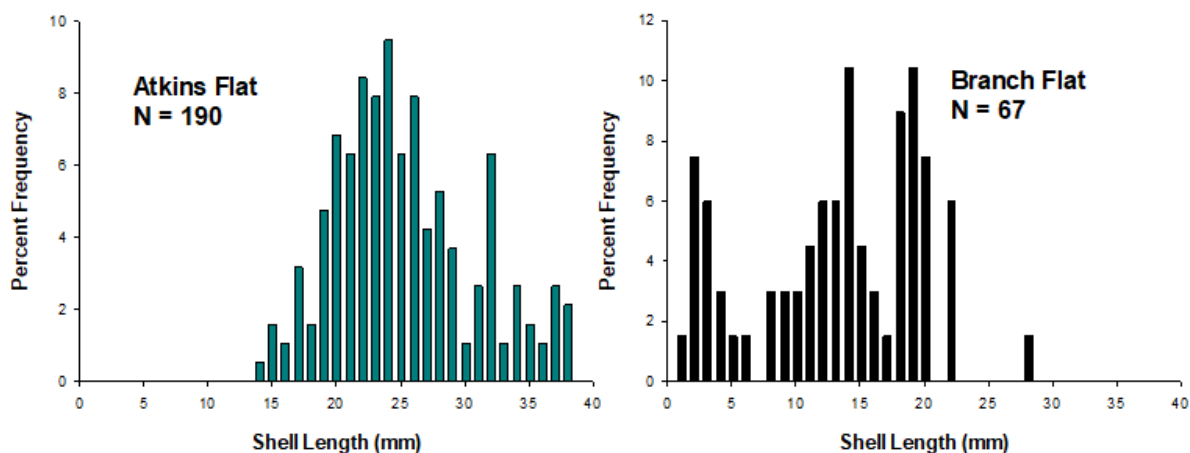
Scarborough:



Brunswick:



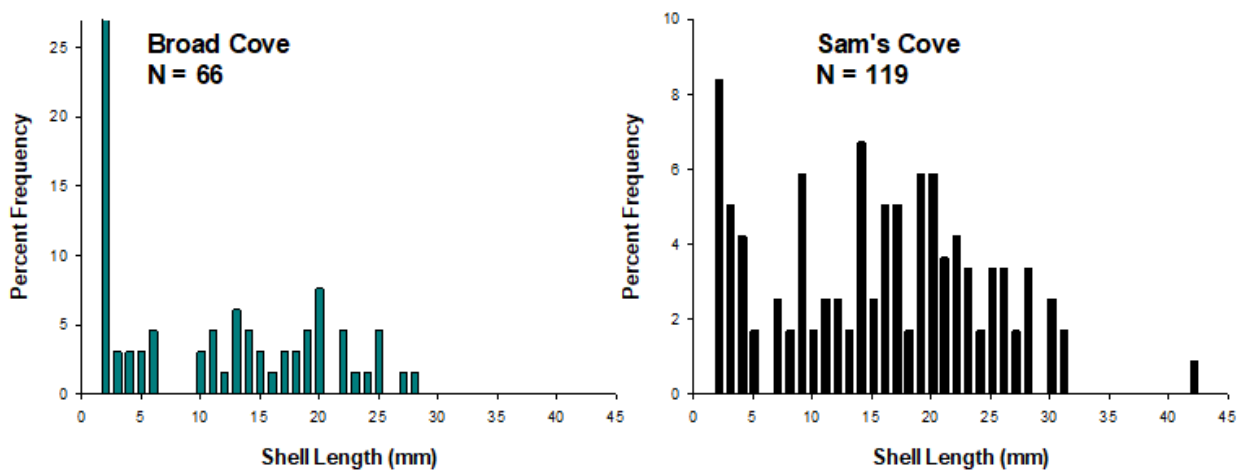
Phippsburg:



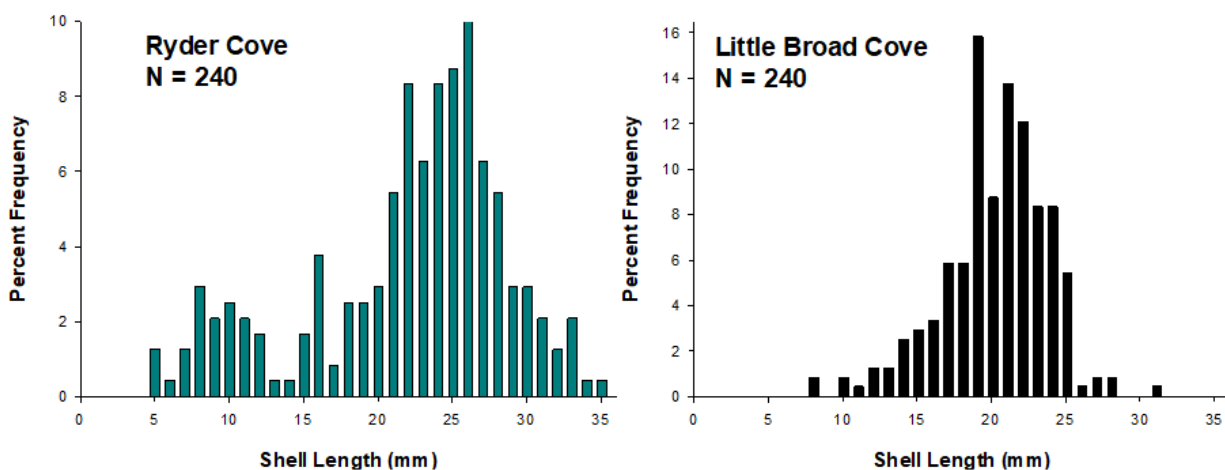
Appendix G: Clam Recruitment Size-Frequency Distributions

Midcoast Region

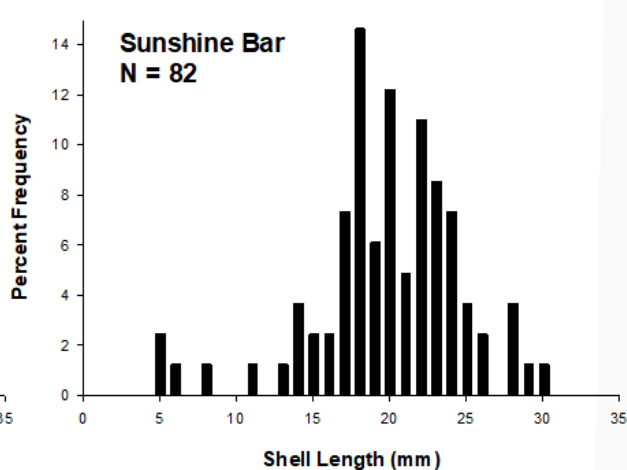
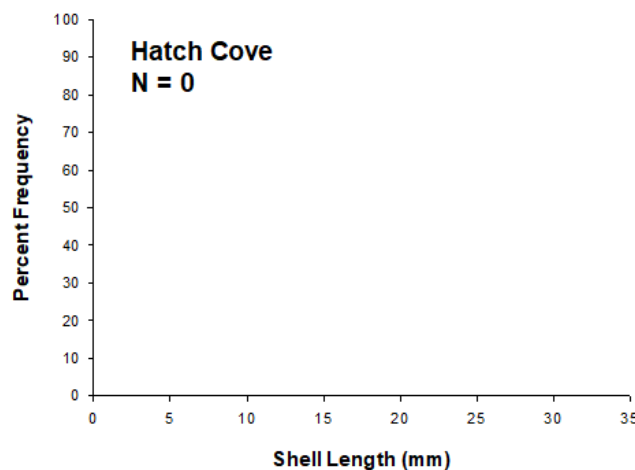
Bremen:



Islesboro:

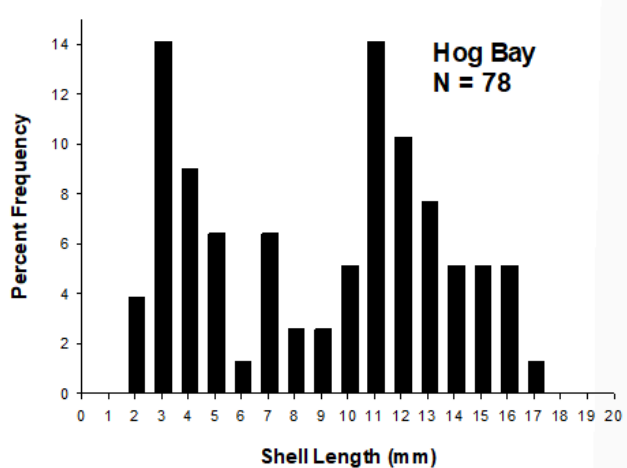
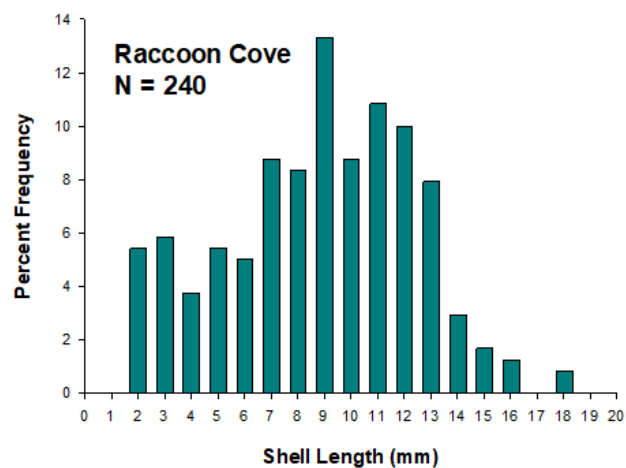


Stonington/Deer Isle:

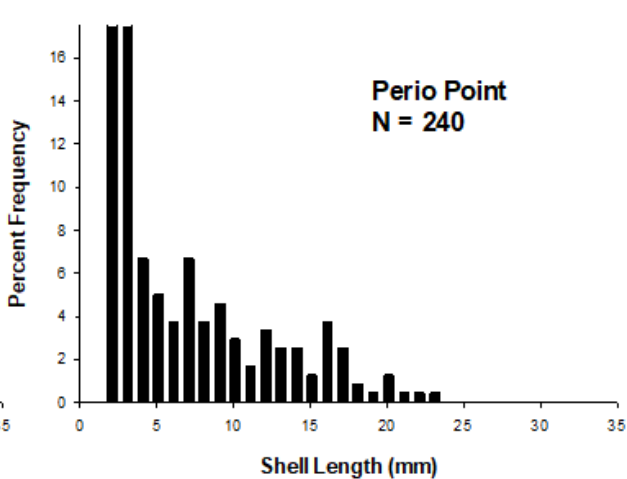
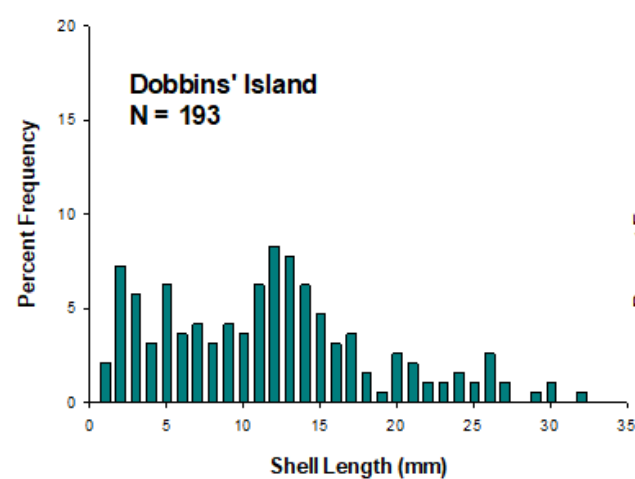


Appendix G: Clam Recruitment Size-Frequency Distributions
Downeast Region

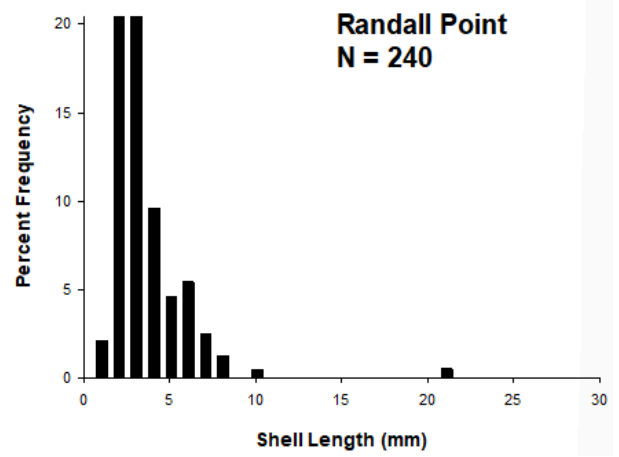
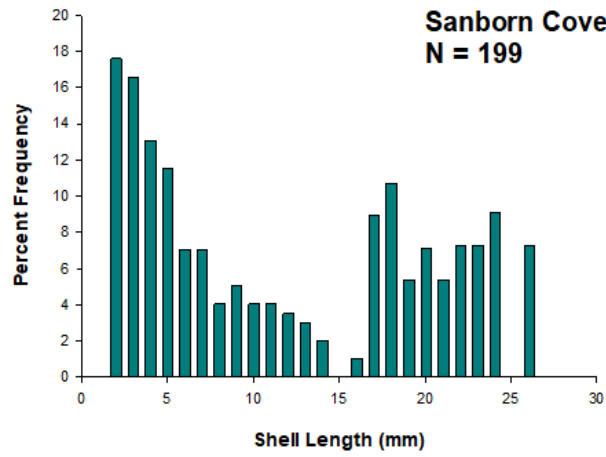
Frenchman Bay:



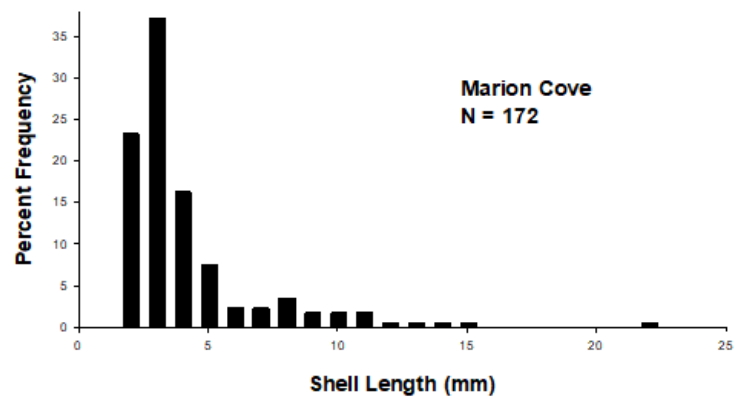
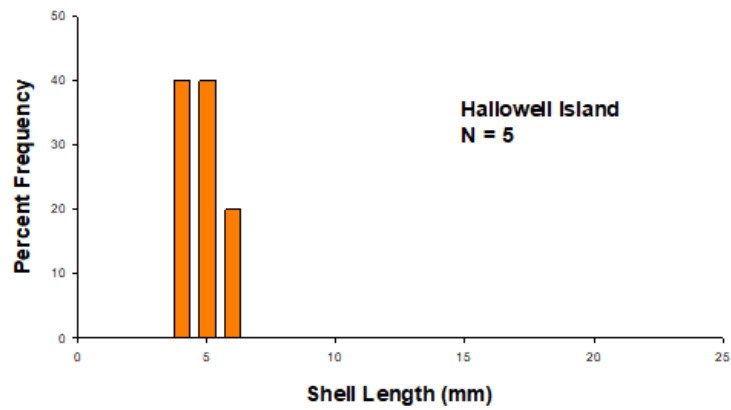
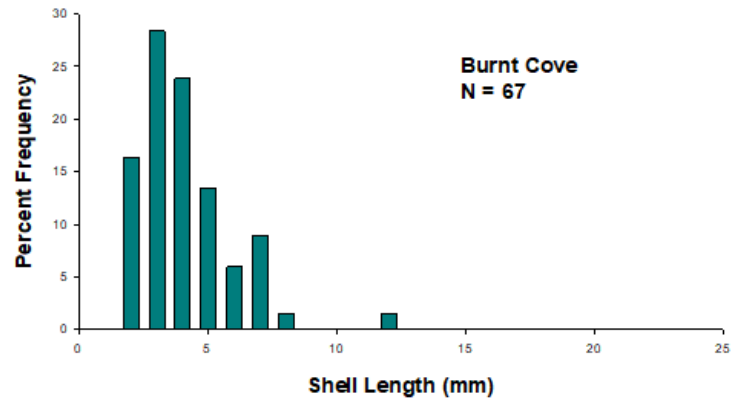
Beals:



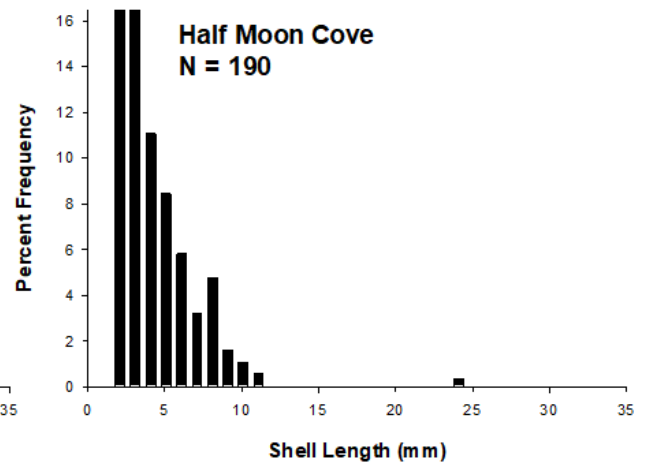
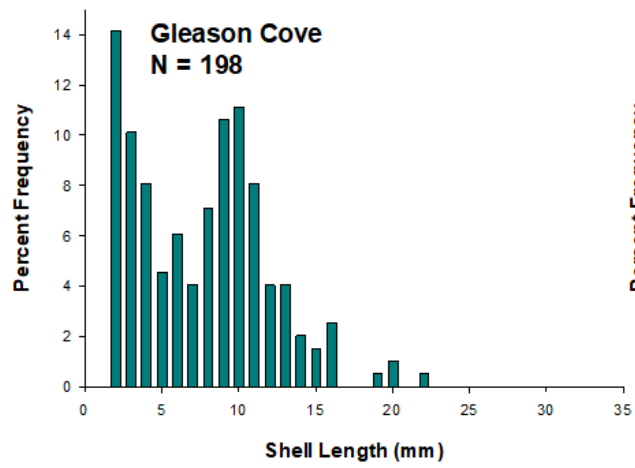
Machiasport:



Edmunds/Trescott:



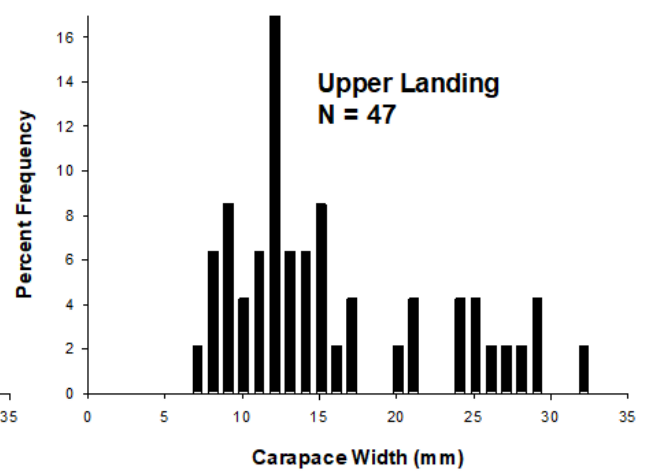
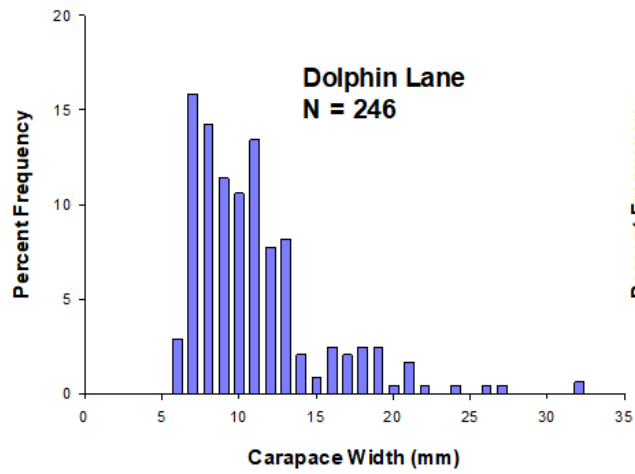
Sipayik:



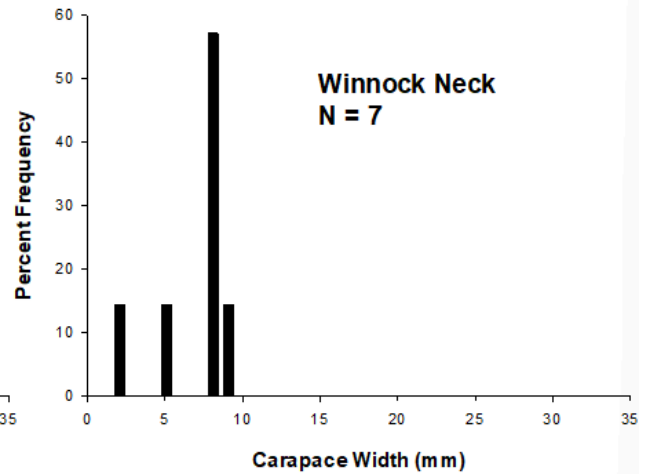
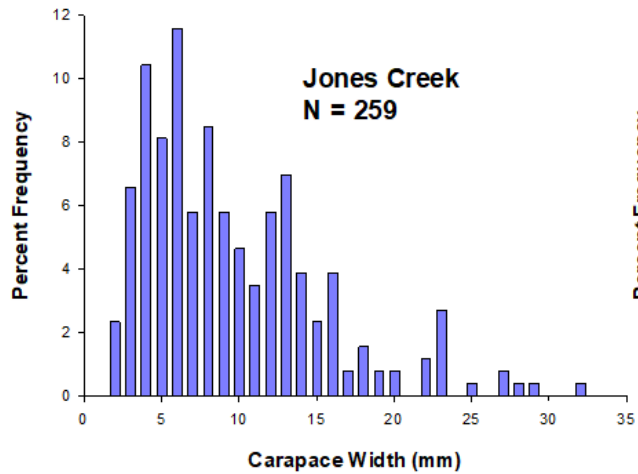
Appendix H: Green Crab Size Distribution

Southwest Region

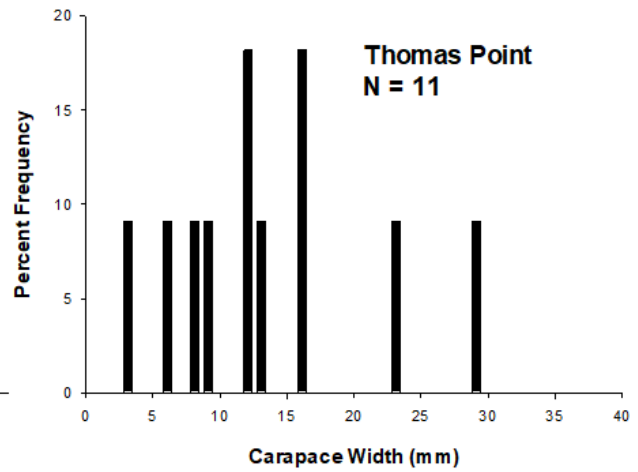
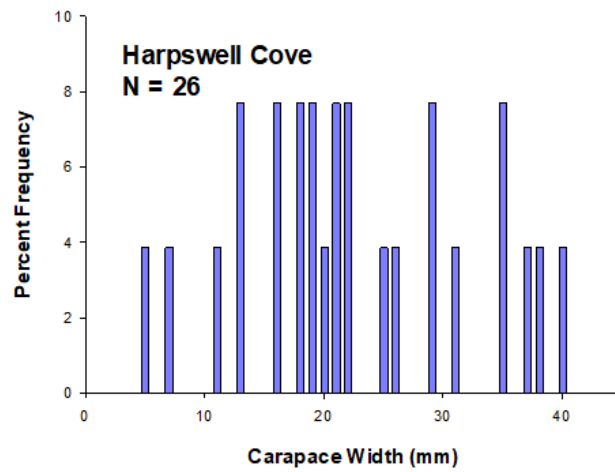
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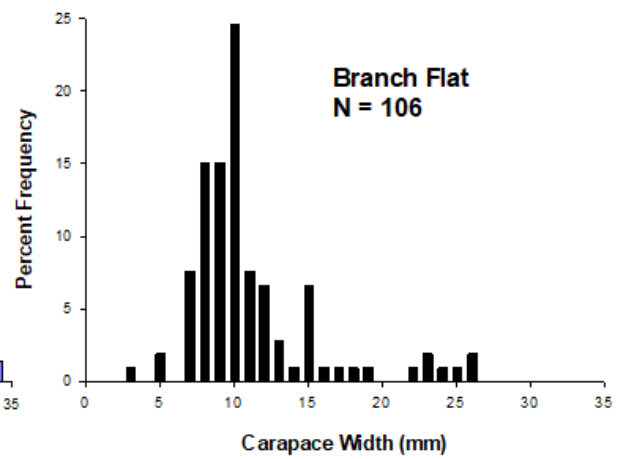
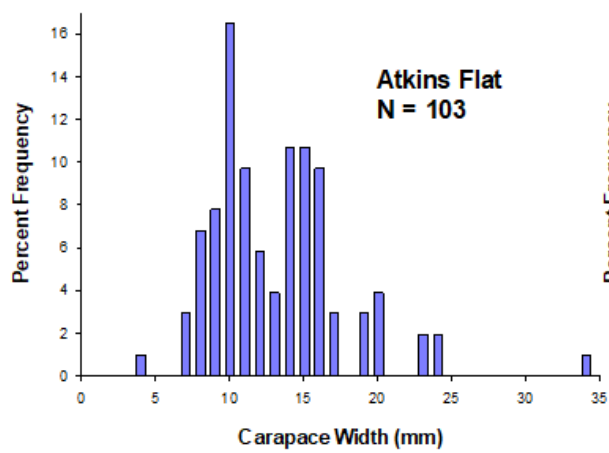
Scarborough:



Brunswick:



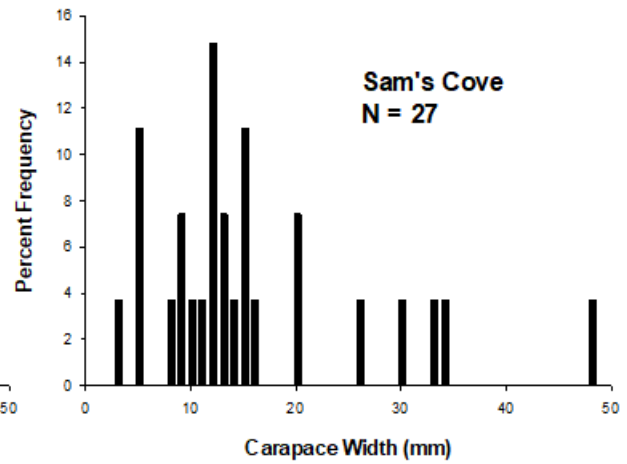
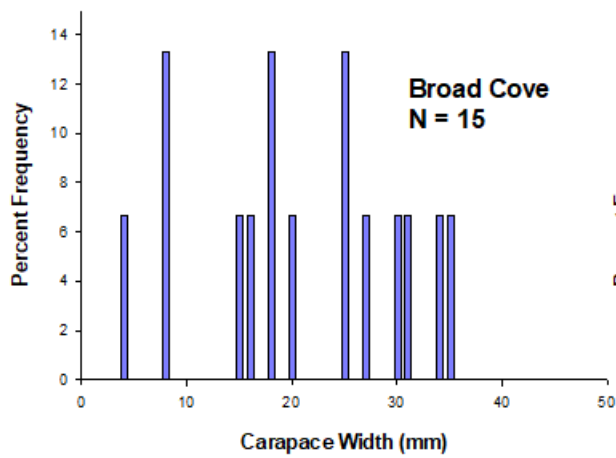
Phippsburg:



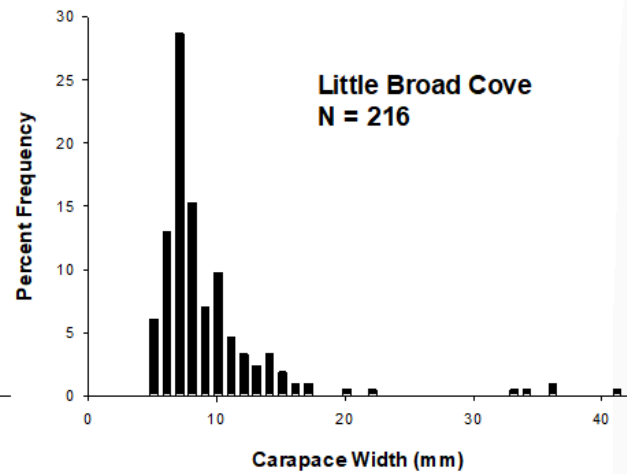
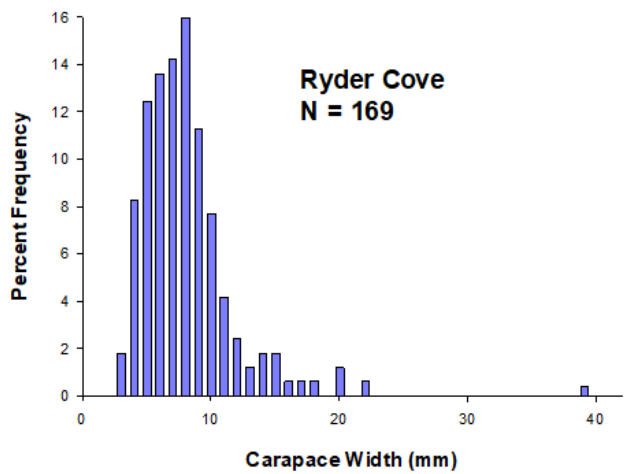
Appendix H: Green Crab Size Distribution

Midcoast Region

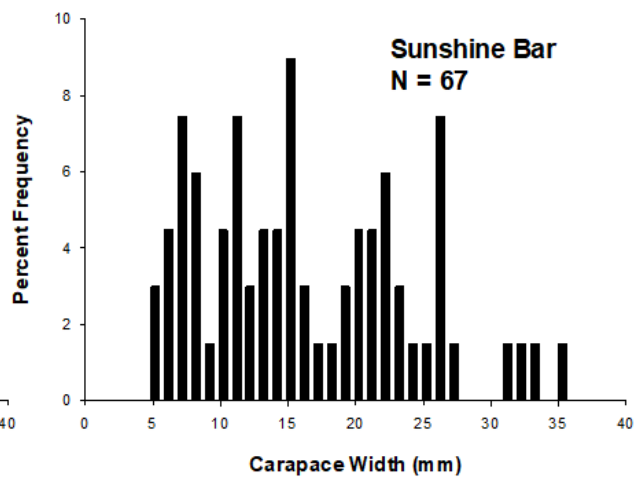
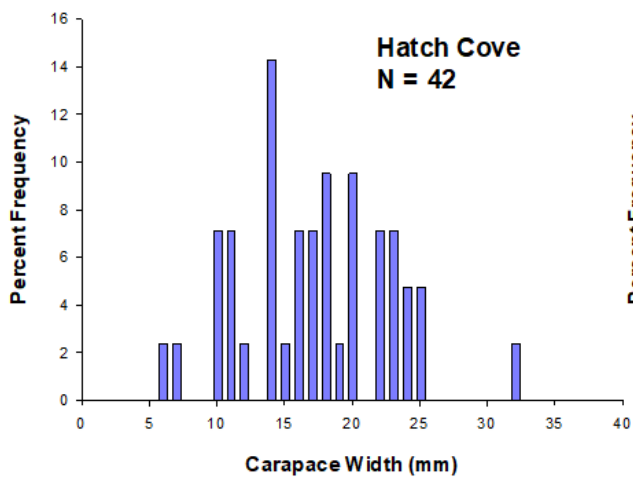
Bremen:



Islesboro:



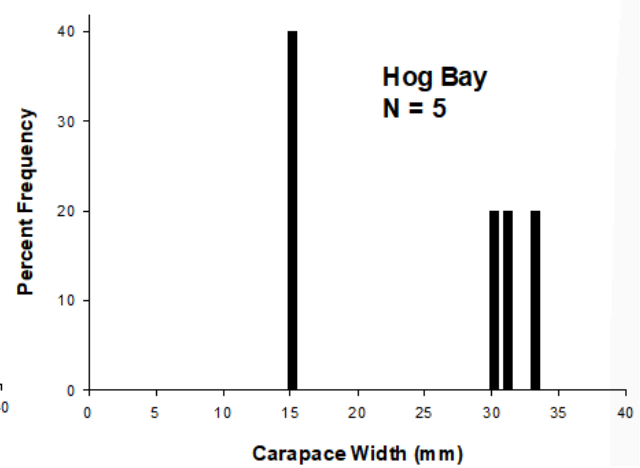
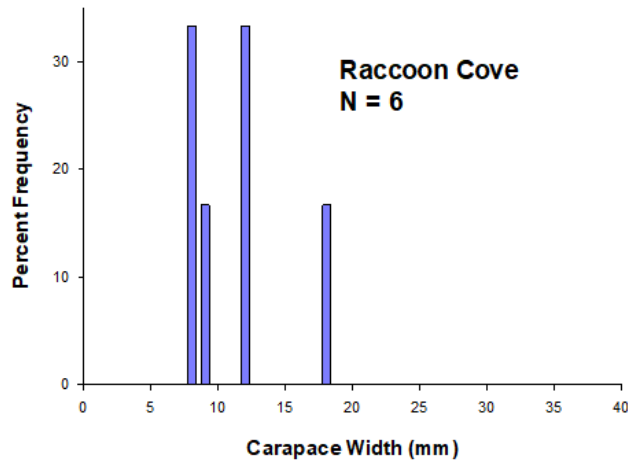
Stonington:



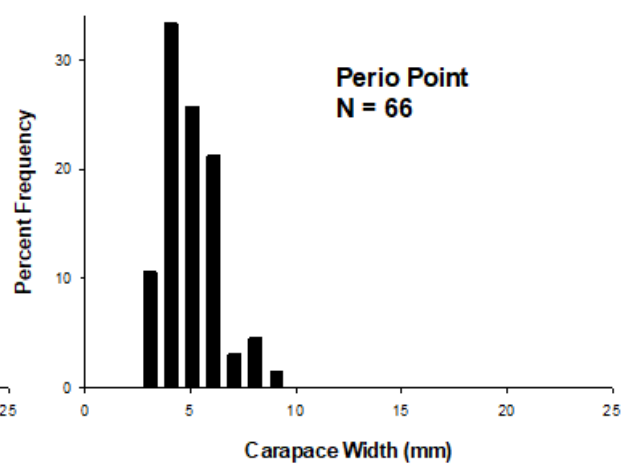
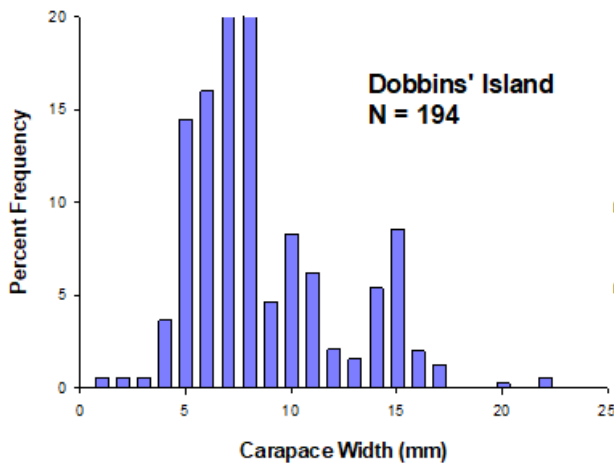
Appendix H: Green Crab Size Distribution

Downeast Region

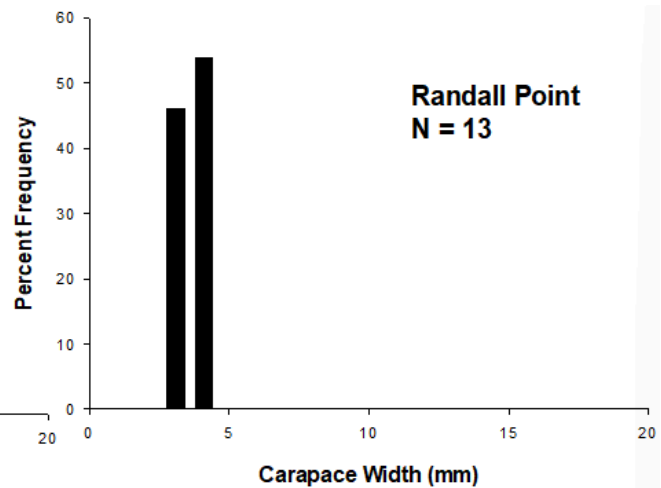
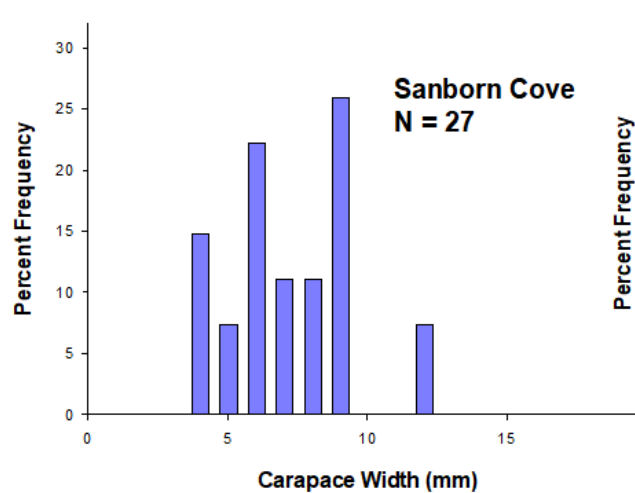
Frenchman Bay:



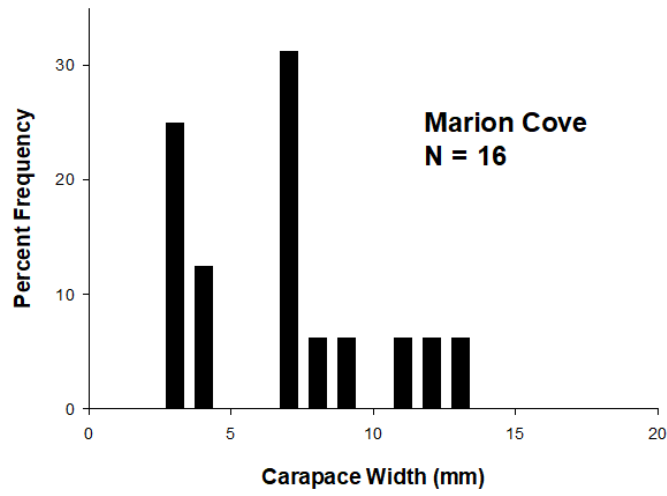
Beals:



Machiasport:

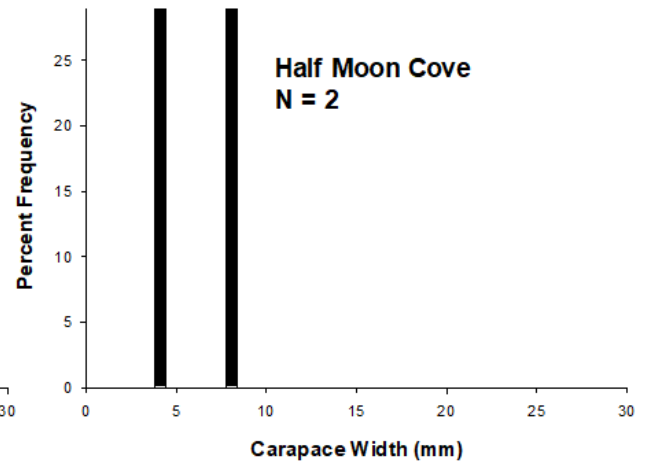
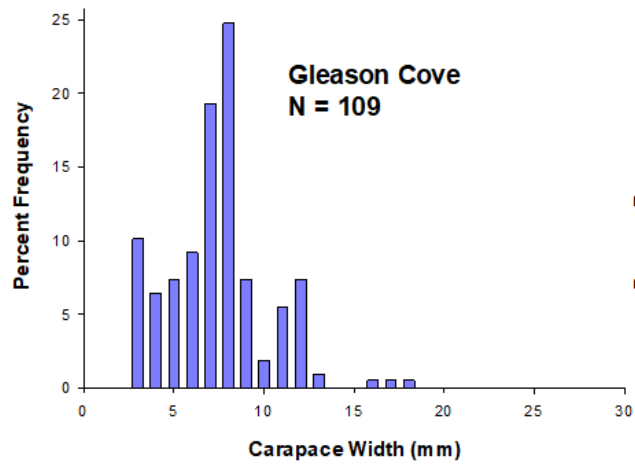


Edmunds/Trescott:



No green crabs found in boxes at Hallowell Island or Burnt Cove.

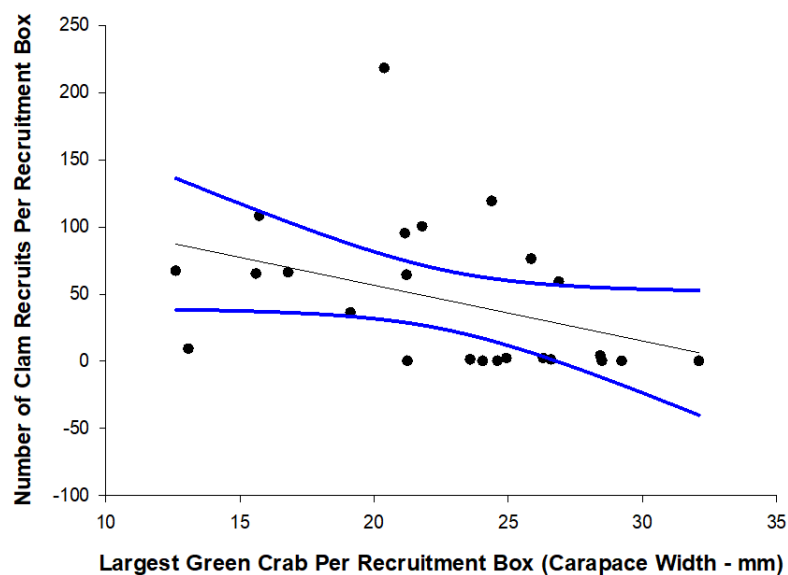
Sipayik:



Appendix I: Relationship Between Largest Crab and Number of Clam Recruits

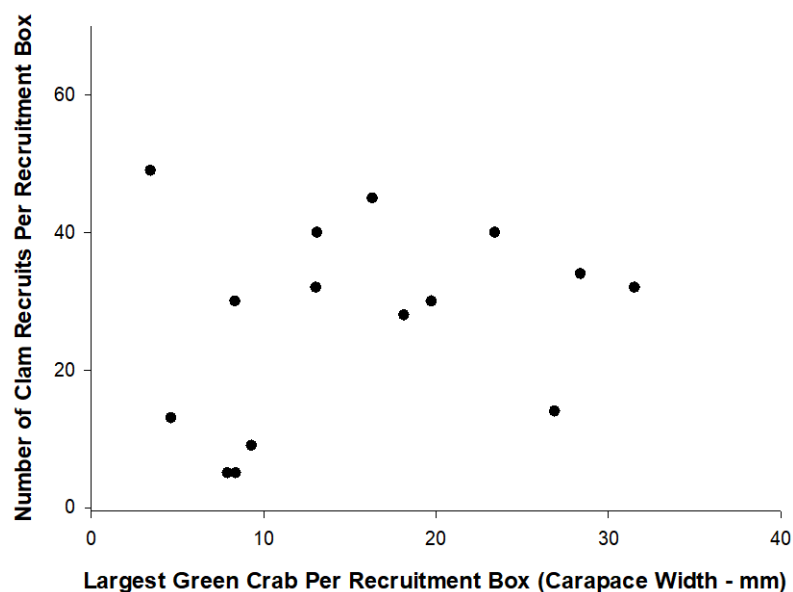
Southwest Region

Wells:



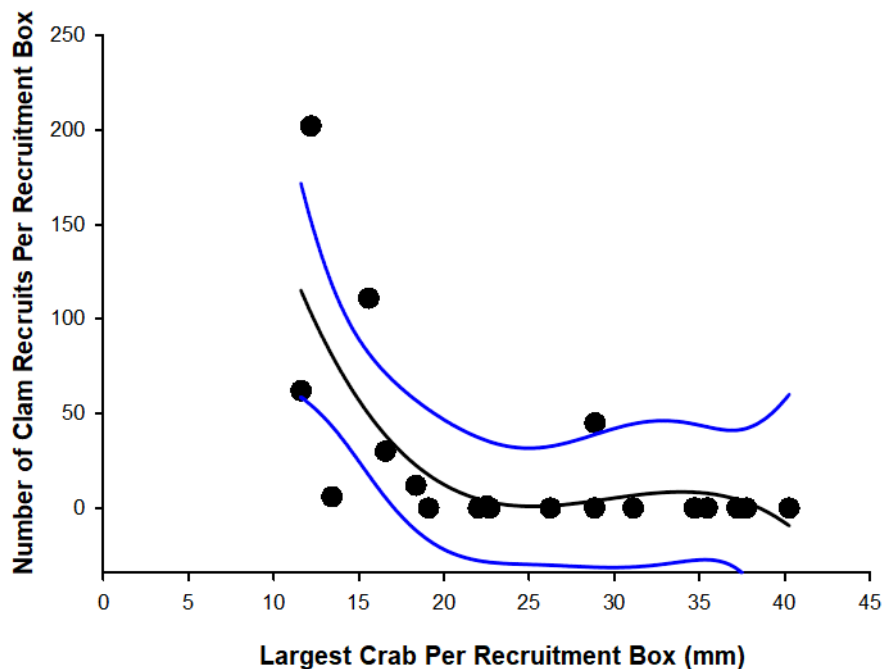
Relationship between number of recruits per box vs. the largest crab in the same box ($r^2 = 0.152$, and the linear equation is: $139.69 - 4.15x$). The blue lines represent the 95% confidence interval associated with the line of best fit (regression line).

Scarborough:



Relationship between number of recruits per box vs. the largest crab in the same box. There was no significant linear ($p=0.308$; $r^2 = 0.071$), quadratic ($p=0.292$; $r^2 = 0.1614$), or cubic ($p=0.072$; $r^2 = 0.406$).

Brunswick:



Phippsburg:



Appendix I: Relationship Between Largest Crab and Number of Clam Recruits

Midcoast Region

Bremen:



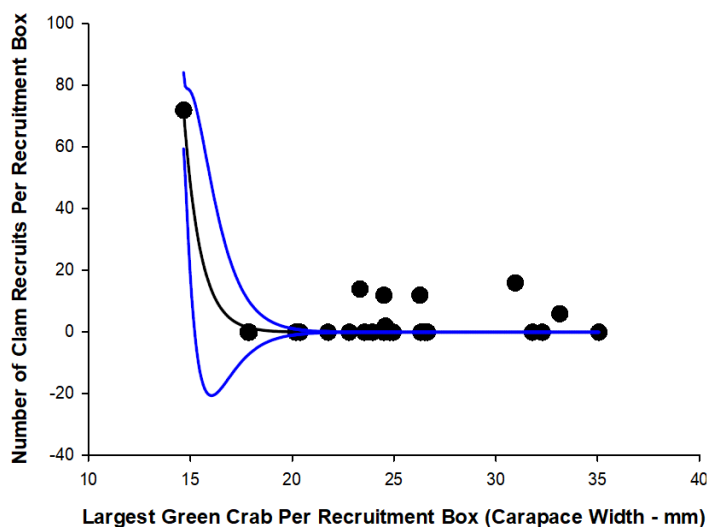
Relationship between number of recruits per box vs. the largest crab in the same box ($r^2 = 0.242$, and the linear equation is: $16.7 - 0.438x$). The blue lines represent the 95% confidence interval associated with the line of best fit (regression line).

Islesboro:



Relationship between number of recruits per box vs. the largest crab in the same box ($r^2 = 0.495$, and the quadratic equation is: $310.27 - 18.15x + 0.34x^2$). The blue lines represent the 95% confidence interval associated with the line of best fit (regression line). A lack-of-fit test determined that the relationship was quadratic ($F = 18.52$, $df = 1, 21$, $p = 0.0003$), not cubic ($F = 1.26$, $df = 1, 20$, $p = 0.276$).

Stonington:

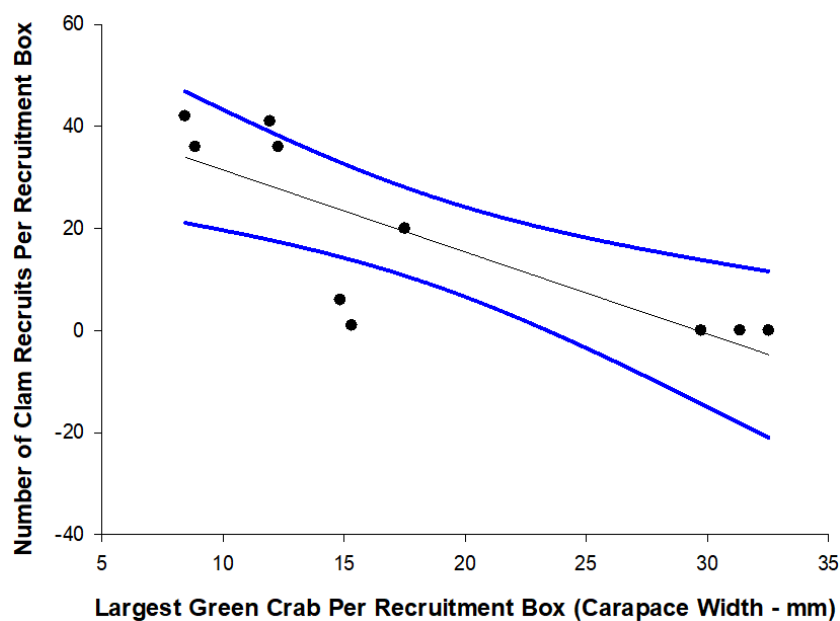


Relationship between number of recruits per box vs. the largest crab in the same box ($r^2 = 0.849$, and the exponential decay equation is: $y = 4.005 \times 10^9 (e^{-1.219x})$). The blue lines represent the 95% confidence interval associated with the line of best fit (regression line). A lack-of-fit test determined that the relationship was curvilinear ($F = 28.79$, $df = 3, 19$, $p < 0.001$).

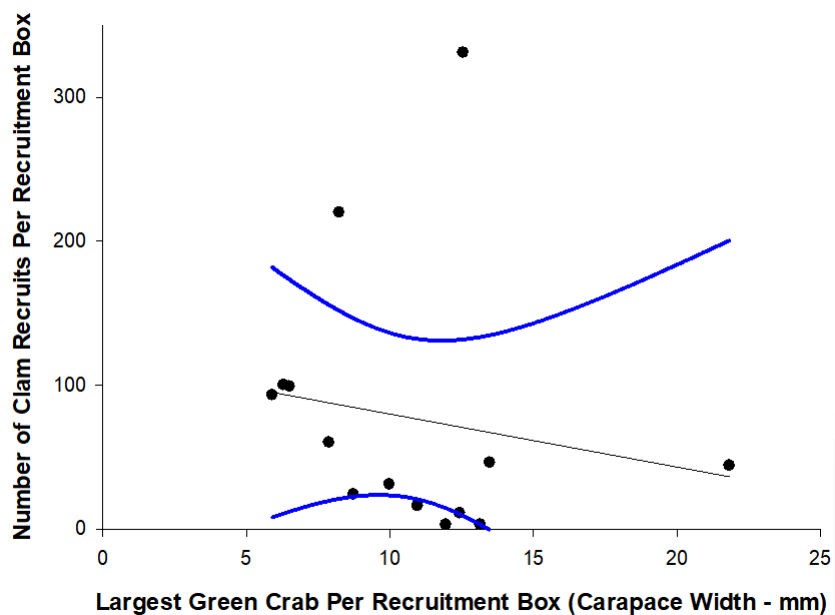
Appendix I: Relationship Between Largest Crab and Number of Clam Recruits

Downeast Region

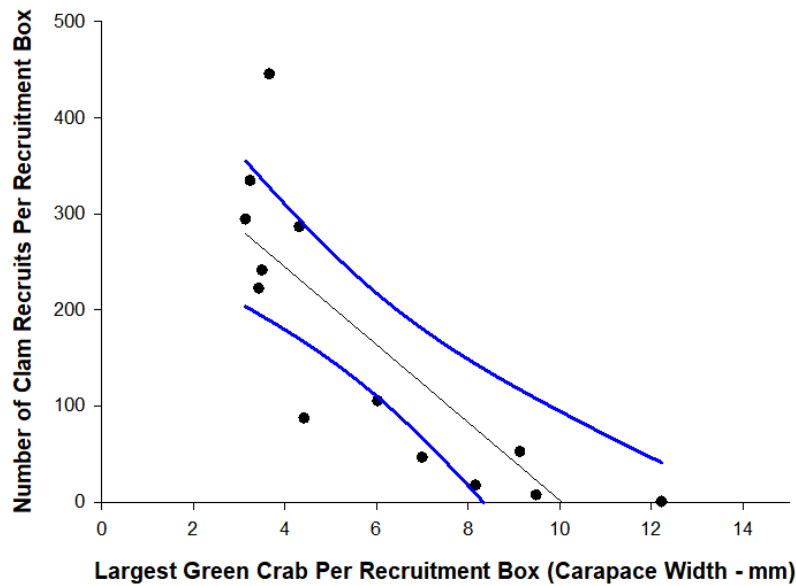
Frenchman Bay:



Beals:

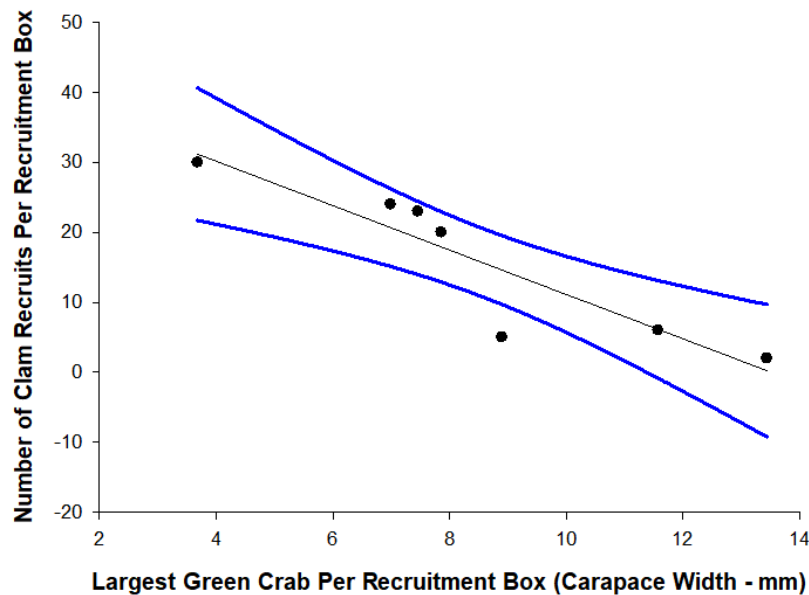


Machiasport:



Relationship between number of recruits per box vs. the largest crab in the same box ($r^2 = 0.671$, and the equation is: $406.5 - 40.463x$). The blue lines represent the 95% confidence interval associated with the line of best fit (regression line). A lack-of-fit test demonstrated that there was no significant increase in fit to a quadratic model ($F = 3.92$, $df = 1, 10$; $p = 0.076$)

Edmunds/Trescott:



Relationship between number of recruits per box vs. the largest crab in the same box ($r^2 = 0.829$, and the equation is: $42.87 - 3.173x$). The blue lines represent the 95% confidence interval associated with the line of best fit (regression line).

Sipayik:



Relationship between number of recruits per box vs. the largest crab in the same box ($r^2 = 0.31$, and the equation is: $460.3 - 34.18x$). The blue lines represent the 95% confidence interval associated with the line of best fit (regression line).