Final Report

Exploring the effects of winter harvesting closures for Northern Quahogs (*Mercenaria mercenaria*) in Freeport

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Submitted to: Town of Freeport Shellfish Conservation Commission

Prepared by: Ethel Wilkerson (Contractor, formerly Manomet – Principal Investigator), Jessica Gribbon Joyce (Tidal Bay Consulting – Project Manager), and Charles Tetreau (Town of Freeport – Marine Resource Conservation Officer/Harbormaster).

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I. Introduction

In early 2019, the Maine Shellfish Restoration and Resilience Project (MSRRP), a collaborative partnership of the Broad Reach Fund, the Maine Shellfish Advisory Council, the University of Maine, and the Mitchell Center for Sustainability Solutions, funded a proposal from the Town of Freeport to establish a pilot project investigating the effects of winter harvesting on northern quahogs (*Mercenaria mercenaria*). The purpose of the projects funded by the MSRRP is to support new or expanding projects that restore shellfish flats, improve clam flat or mussel bed productivity, find and fix pollution, work with town and state officials to open closed flats, increase volunteer participation in co-management and conservation activities, strengthen civic partnerships, and/or update shellfish conservation and co-management policies. These projects are focused on community engagement as much as the research or conservation initiatives.

The MSRRP advisory committee, comprised of scientists, agency staff, harvesters, and other stakeholders, reviewed the Freeport Shellfish Conservation Commission's proposal and awarded $2,578 for this project. A portion of these funds were allocated through a subcontract to Manomet and Tidal Bay Consulting, LLC to assist with the project, although much of the staff time has been offered with in-kind donated services. This was a collaborative project with Freeport's Marine Resource Conservation Officer, members of the Freeport Shellfish Conservation Commission and seven volunteer commercial shellfish harvesters, who were all integral to the development and implementation of this project.

II. Goal and Objectives

The goal of this study is to determine if digging (i.e., turning over mud) in freezing air temperatures has an effect on quahog mortality through *either* exposure to cold or other stressors, including increased risk of predation. This study aims to gauge the effectiveness of winter harvesting closures as a municipal conservation measure. The results will help harvesters and municipal shellfish committee members to better understand how quahogs respond to disturbance by digging during winter months, thus informing conservation and management decisions.

The objectives of Freeport's pilot project are: 1) assess feasibility of transplanting quahogs within the same cove; 2) gauge interest in participation among local harvesters, and receptivity of local and state shellfish managers in exploring this research question; 3) generate preliminary field data on mortality of quahogs from winter disturbance at a single site; and 4) test field methodology to refine for potential future studies with larger scale and geographic scope.

III. Background

Clam harvesters in the Town of Freeport, along with harvesters in other neighboring coastal communities have increasingly sought to diversify the intertidal species they target as soft-shell clam populations have declined. Statewide, there has been a declining trend of soft-shell clam landings since 2012. In Casco Bay, soft-shell clams have followed that declining trend, while quahog landings have steadily increased since 2012 (Figure 1, DMR 2020). Thus, quahogs are providing an important source of supplemental income for harvesters throughout southern Maine, including Freeport.

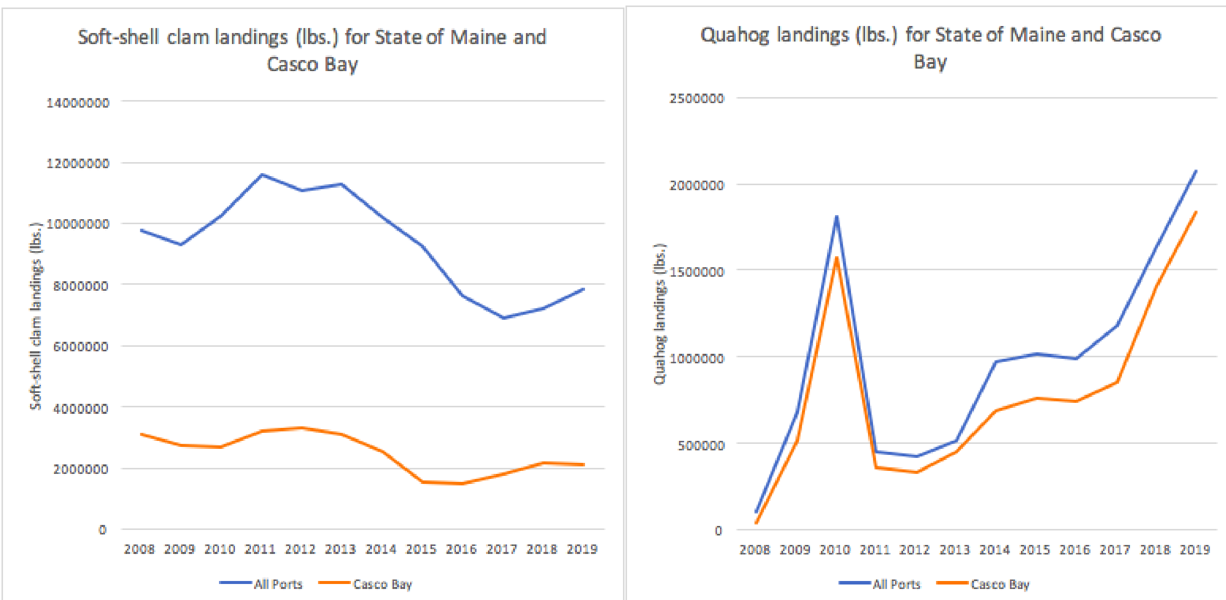

Figure 1. Soft-shell clam and quahog landings (lbs.) in Casco Bay and all ports in Maine from 2008-2019. 2019 data are preliminary (source: Maine Department of Marine Resources commercial fishing landings data).

Available research on cold tolerance of quahogs indicate they are more susceptible to cold temperatures than other bivalve species (Stanley and DeWitt, 1983). Taking this into consideration, the Town of Brunswick has implemented winter harvesting closures for quahogs in Middle Bay for the past five years. Anecdotal evidence suggests these closures are having a positive impact on the local populations of quahogs, whereas resources across Middle Bay in Harpswell are not as numerous (personal communication with Dan Devereaux, January 2, 2019). Furthermore, the harvesters have observed high rates of juvenile mortality of quahogs during the winter in areas where clams and/or worms are harvested.

Research on the physiology of quahogs show a temperature range from approximately -6°C (21.2°F) up to about 35°C (95°F) (Stanley and DeWitt, 1983). Below this threshold adults die when 64% of the tissue water has changed to ice (Williams 1970 *in* Stanley and DeWitt, 1983).

However, much of the evidence to support winter closures is anecdotal, as there have been no targeted studies on the direct impact of winter harvesting on quahog mortality.

After learning about the success of winter harvesting closures for quahogs in Brunswick, and discussing supporting evidence with Maine Department of Marine Resources (DMR), the Freeport Shellfish Conservation Commission implemented their first winter harvesting closure for quahogs on December 1, 2018, which was in effect through February 28, 2019. Winter closures can be unpopular among some shellfish harvesters because they present an economic hardship on individuals already affected by declining soft-shell clam landings.

IV. Timeline

The project timeline was as follows:

November 2018 – Maine Shellfish Restoration and Resilience Project released the request for proposals (RFP).

December 12, 2018 – Freeport Shellfish Conservation Commission discussed projects to consider submitting a proposal for, and the quahog study was selected as a priority.

January 10, 2019 – Freeport Shellfish Conservation Commission reviewed the draft grant proposal and voted to sign the letter of support for the proposal.

March 2019 – Received notification of the grant award. At the March 14 Commission meeting, the project team shared the summary outreach document for the study and received feedback on materials, siting, and other study parameters.

April 2019 – Conservation closure and other documents submitted to Maine DMR and were later approved.

May 6, 2019 – Project was sited and quahogs were transplanted with the help of three harvesters who received conservation points for volunteering.

July 10, 2019 – The project team surveyed the condition of quahogs in two plots to determine the success of the quahog transplant and survival. One harvester volunteered.

October 16, 2019 – The project team surveyed the condition of quahogs in two different plots to determine the success of the quahog transplant and survival. One harvester volunteered.

January 22, 2020 – The project team conducted the ‘disturbance’ (i.e., digging through plots, but not harvesting any quahogs) of 10 plots. One harvester volunteered.

May 14, 2020 – The project team dug through the remaining plots to count and assess quahog condition. Two harvesters volunteered.

June - August 2020 – Data analysis and reporting

September 2020 – Presentation to the Freeport Shellfish Conservation Commission.

V. Methodology

A. Study Layout

In early spring of 2019, a 50' x 50' study site was established in the upper intertidal zone of Staples Cove in Freeport, Maine (Figure 2). The study site was selected with input from Freeport's Marine Resource Conservation Officer, the Freeport Shellfish Conservation Commission, and harvesters. On May 6, 2019, the Town of Freeport and Maine DMR placed a conservation closure on the study site to prevent disturbance of the area from commercial and recreational harvesting.

Thirty-five research plots, 2'x2' in size, were established within the study site. The borders of each plot were delineated by 12" galvanized nails. Harvesters dug through 25 of these plots to remove shellfish prior to receiving transplanted quahogs (green plots, Figure 3), five plots had shellfish removed but did not receive transplanted quahogs (yellow plots, Figure 3), and five plots had neither shellfish removed nor quahogs transplanted (grey plots, Figure 3).

In the spring of 2020, harvesters dug through plots that had shellfish removed, but not transplanted. This provided an estimate of the number of quahogs that may have naturally settled in the plots. The five plots that did not have shellfish removed or transplanted were harvested to determine the naturally occurring density of quahogs within the study area.

Figure 2. Aerial view of the 50' x 50' study site (red box) in Staples Cove, Freeport, Maine (Source: Google Earth).

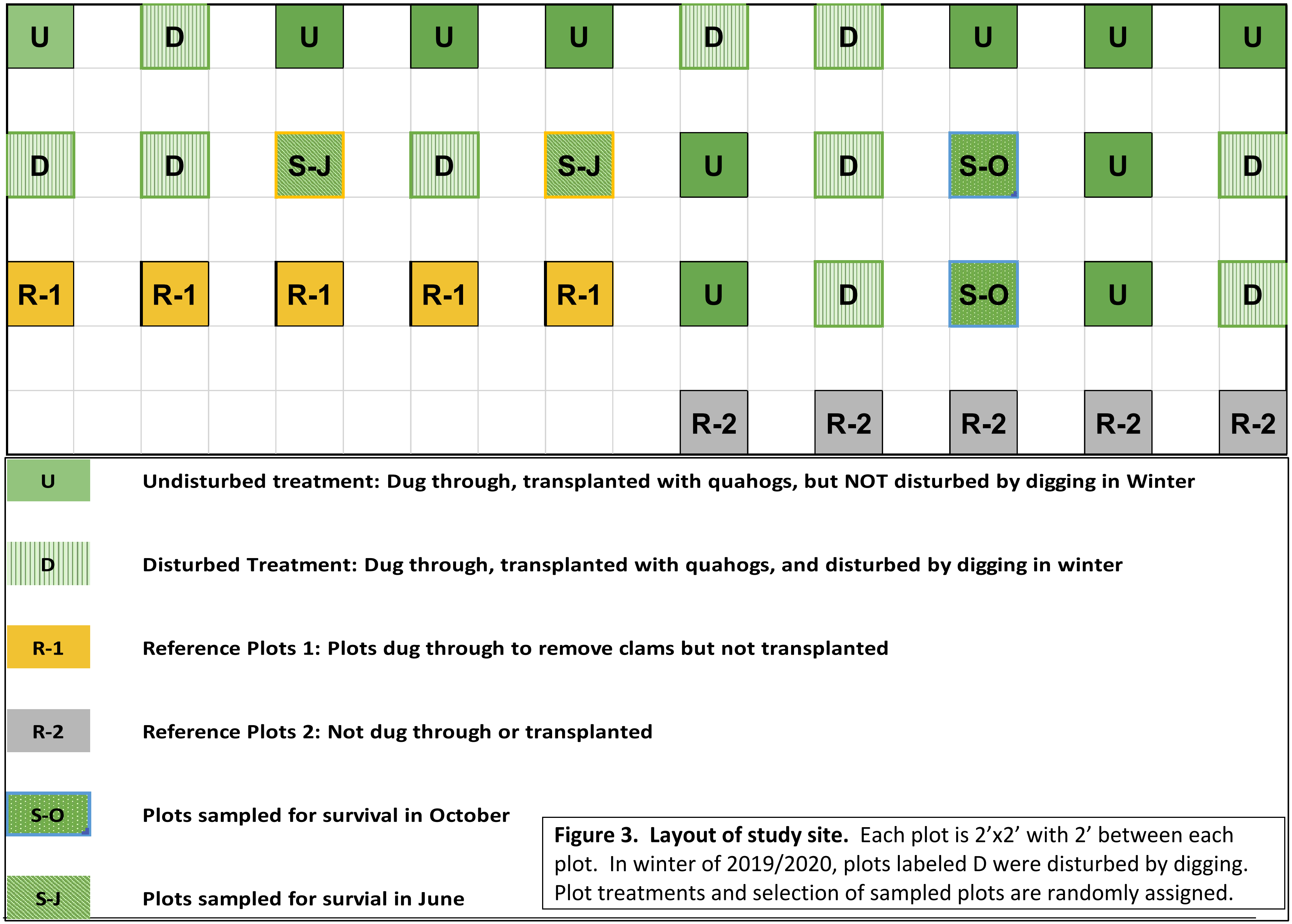

Figure 3. Layout of study site. Each plot is 2’x2’ with 2’ between each plot. In winter of 2019/2020, plots labeled D were disturbed by digging. Plot treatments and selection of sampled plots are randomly assigned.

B. Transplanting

On May 6, 2019, three harvesters dug 750 quahogs from Staples Cove and transplanted them by hand into the plots. Quahogs dug were between approximately 3-10 cm shell length. All quahogs were pooled into two size classes, small (approx. <5cm) and large (approx. >5cm) and placed 20 smaller quahogs and 10 larger quahogs per plot. This approach was adopted to account for differential transplant survival rates, predation risk on different size classes, and to address any potential differences in recovery rates of different size quahogs by harvesters. Larger quahogs are believed to have lower post-transplant survival because they have larger energetic needs than smaller quahogs, while smaller quahogs are more susceptible to green crab predation.

C. Preliminary Assessment

On July 10, 2019 and again on October 16, 2019, harvesters dug two randomly selected plots to assess the condition of transplanted quahogs (S-O & S-J, Figure 3). The earlier sampling date was selected to check for condition of quahogs early in the experiment to give sufficient time to re-transplant quahogs if high mortality or predation was discovered. The fall sampling data was conducted to check condition of transplanted quahogs near the end of the growing season. As the purpose of these plots was to obtain a baseline and interim measure of quahog condition after transplanting, the data was not used in any statistical analysis.

D. Assessment Criteria

Commercial shellfish harvesters dug through the plots for sampling. Quahogs were collected and tallied into two categories (good condition or dead) based on the condition of the shell and strength of the abductor muscle (Table 1). We did not test for respiration, metabolic activity or other indicators to be able to conclude if the quahog was alive at the time of recovery but based the assessment on physical parameters: condition of the shell (no visible chips, cracks, or degradation) and strength of the abductor muscle (shell could not be pried open with a tool). We did not measure quahogs upon recovery, nor record any information on quahog size.

Table 1. Condition assessment criteria for quahogs

Good Condition	Dead
• Shell does not have visible chips, cracks, or degradation • Shell could not easily be pried open with a tool • When quahogs were knocked together sound indicated presence of tissue within shell	• Shell could be easily pried open with a tool • Tissue was absent from shell or tissue was observed to be dead and/or decayed • Interior of shell was filled with mud, sediment, or water

E. Winter Disturbance

Winter disturbance entailed digging the plots with a clam hoe in a manner that is similar to manual harvesting. A single harvester dug all plots to standardize the depth and intensity of disturbance among plots.

The target air temperature range for disturbance was between 13°F and 21°F. This range was selected because it represents temperatures between the median and lower quartile of minimum daily air temperatures in December, January, and February of the past two winters (12/2017, 1/2018, 2/2018, 12/2018, 1/2019, 2/2019) (Data from USGS weather station USC00174782 on Long Island, ME). This range represents air temperatures that are as cold as the median daily air temperature but warmer than the coldest 25% of minimum air temperatures. Approximately 50% of days during this period have warmer temperatures than this range and 25% have colder minimum temperatures.

The week prior to the winter disturbance, Staples Cove started to become covered in ice, and there was concern that all of the plots could be iced in if the field work was not conducted in January. In the week leading up to the field work, temperatures were consistently in the target air temperature range. On the afternoon of January 22, 2020 (low tide ~3:37 PM, tidal height -0.51 ft.), ten randomly selected plots were disturbed by digging from approximately 2:35-3:00 PM (Figure 4). Two plots were covered in ice, one of which was randomly selected to be disturbed but due to ice cover a different plot was randomly selected for disturbance.

The air temperature during the time of disturbance (2:35-3:00 PM) was 26.4^{o}F, 5.4^{o}F above the target temperature range (Figure 5). The average hourly air temperature recorded in Portland (the closest weather station with hourly readings) averaged 28^{o}F for the 24-hour period following the disturbance (Table 2), and average hourly air temperatures remained above the target range for over 7-, 14-, and 21-day periods after the disturbance with periodic dips into the target temperature range (Figure 5 and Table 2). Seawater temperatures at the time of disturbance and for 21 days post-disturbance ranged between 37^{o}F and 42^{o}F (Table 2).

The original plan was for the plots to be disturbed on two separate occasions but due to weather, tides, and harvester availability the plots were only disturbed once during the study. There were a limited number of hours falling within the target temperature zone making scheduling challenging. The average temperature at the National Weather Service station in Portland, Maine during the month of January was 29.8^{o}F, which was 7.5^{o}F above normal and tied for the fourth warmest January on record. The average temperature in February was also 29.8^{o}F, which was 4.8^{o}F above normal.[1]

[1] NOAA, National Weather Service monthly climate reports with preliminary data that have not undergone revision by the National Climatic Data Center: https://w2.weather.gov/climate/index.php?wfo=gyx

Table 2. Mean, minimum, and maximum hourly air and water temperatures for the 24-hour period after disturbance and for the 7-, 14-, and 21-day periods after disturbance by digging occurred.		
	Air Temp (ºF) Mean (min, max)	Water Temp (ºF) Mean (min, max)
24-hr Post-Disturbance	28 (17, 41)	39 (37, 40)
7 days Post-Disturbance	36 (17, 47)	40 (37, 42)
14 days Post-Disturbance	34 (15, 47)	40 (37, 42)
21 days Post-Disturbance	32 (1, 47)	39 (37, 42)
Data source: hourly air temperatures were recorded at the NOAA weather station in Portland, ME (station number 72606014764) and water temperatures were recorded from the Casco Bay Buoy (44007).		

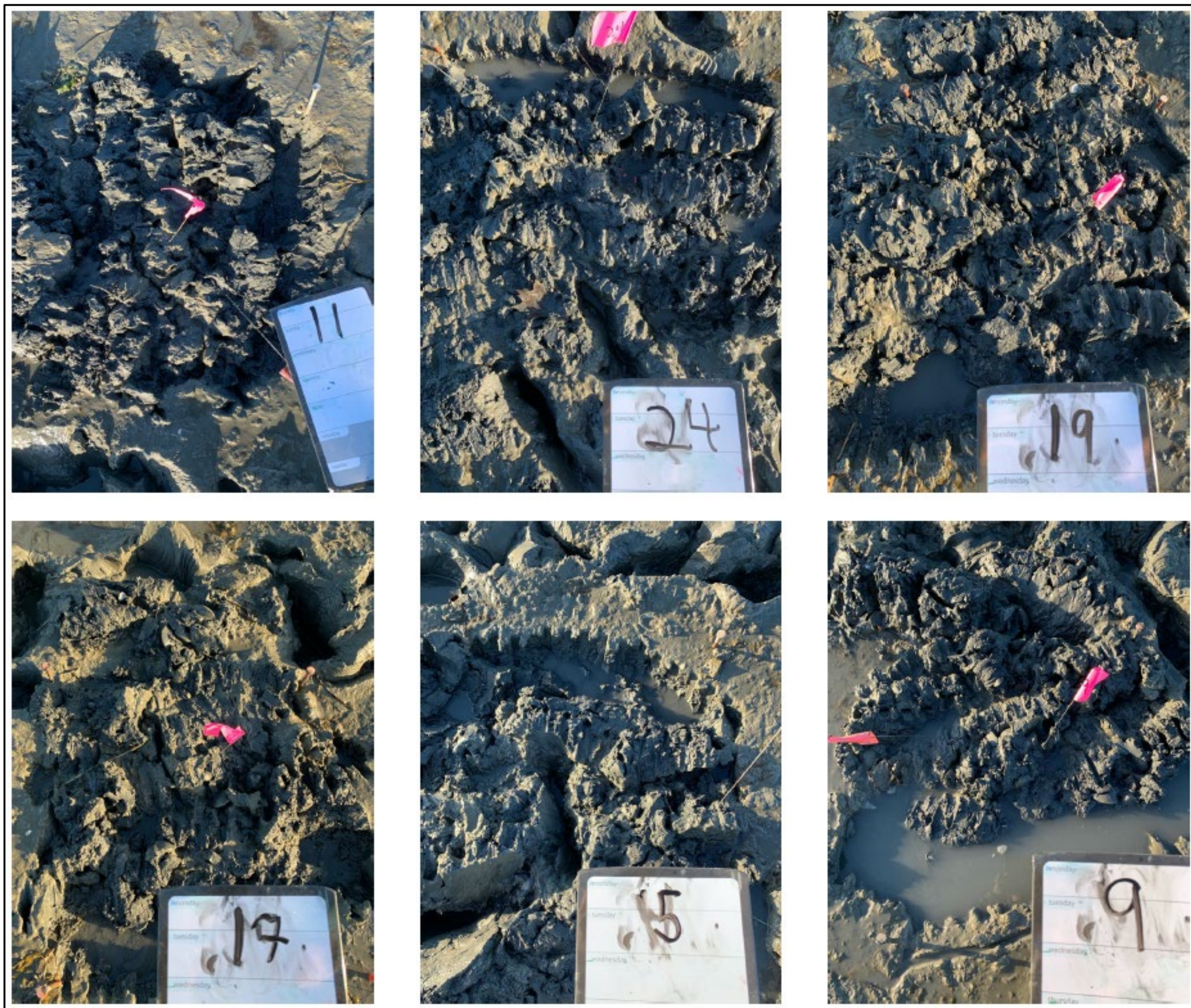

Figure 4. Photos of a selection of plots disturbed in January.

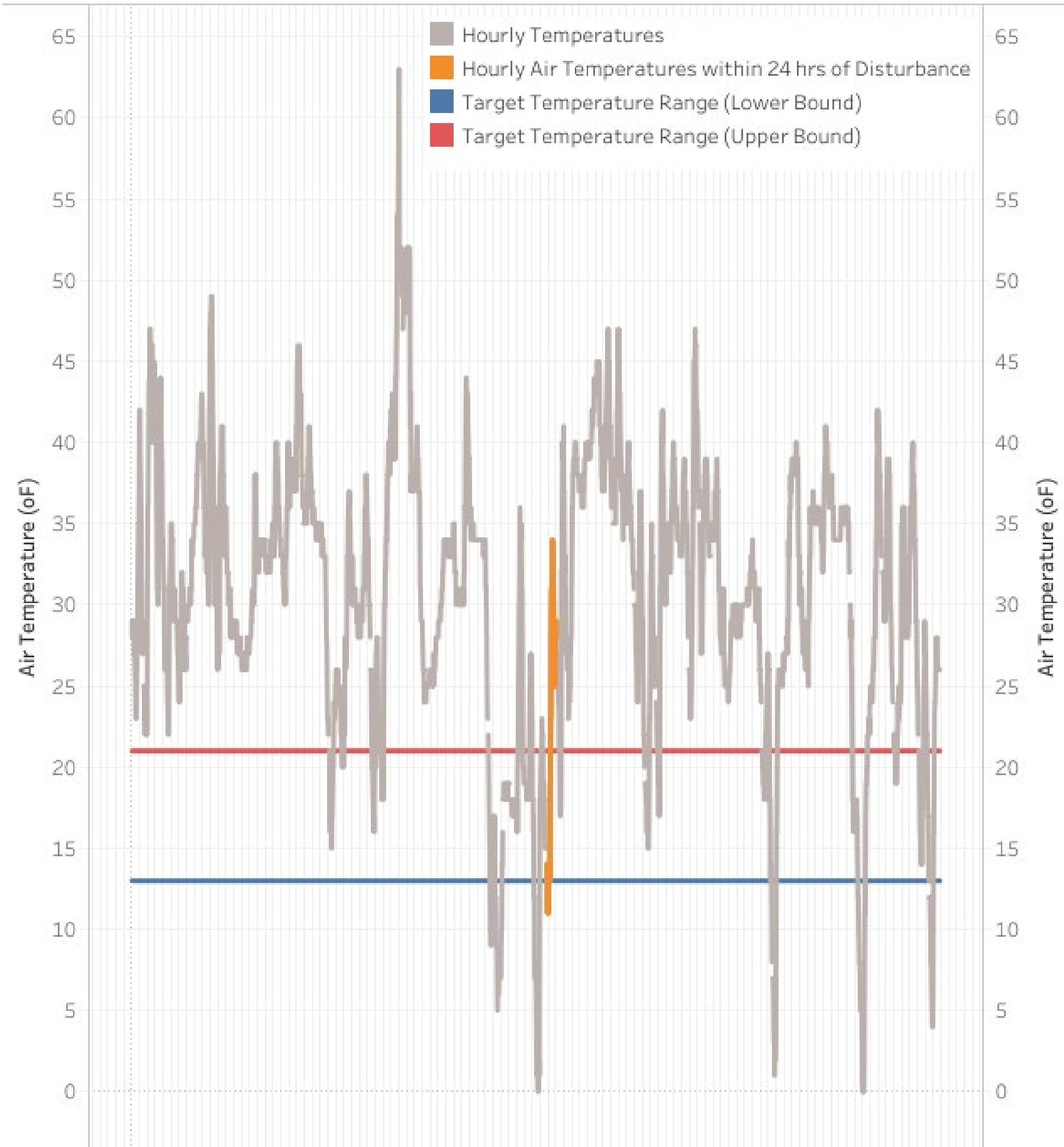

Figure 5. Hourly air temperatures from December 22, 2019 through February 21, 2020. Data from NOAA weather station in Portland, ME (station number 72606014764).

F. Post-Disturbance Assessment

On May 14, 2020 (low tide: 11:58 AM, tidal height: 0.6 ft) the condition of quahogs in disturbed (D, Figure 3) and undisturbed (U, Figure 3) plots was assessed using previously described assessment protocols (Table 1). To reduce any intentional or unintentional bias, neither the harvesters nor the data recorders knew the treatment group (disturbed or undisturbed) of the plots. Two harvesters thoroughly dug through the plots to ensure all quahogs were removed. The air temperature was 64°F, and the work was conducted from approximately 10:00 AM to 12:00 PM.

R-1 plots that had shellfish removed in spring of 2019, but not transplanted, were also dug to get an estimate of the number and size of quahogs that may have settled in the plots during the 2019 growing season. R-2 plots that did not have shellfish removed or transplanted were also harvested to determine the density and size of naturally occurring quahogs within the study area.

VI. Results

A. Study Site/Transplanting

In June of 2019, one month after transplanting, the recovery rate of quahogs in good condition was 93% and 96% (S-J plots, Figure 3). In October of 2019, five months after transplanting the recovery rate of quahogs in good condition was 77% and 80% (S-O plots, Figure 3). In early May of 2020, almost a year after transplanting, the recovery rate of quahogs in good condition was 64.8% in the undisturbed plots (n=11, U plots Figure 3). These results are summarized in Table 3, and the raw data are included in Appendix I.

Table 3. Condition classes and recovery of transplanted plots sampled in July and October 2019. In Figure 3, plots sampled in July are labeled S-J and plots sampled in October are labeled S-O.

Date	Plot	Good	Dead	Recovery Rate
July, 2019	16	28	1	93%
July, 2019	18	29	1	96%
October, 2019	13	24	1	80%
October, 2019	23	23	3	77%

B. Disturbance of Plots During Winter

In the disturbed plots, the number of quahogs recovered in good condition (shell does not have visible chips, cracks, or degradation or could not easily be pried open with a tool) ranged from 5 to 16 quahogs per plot with an average of 9.6 quahogs per plot (Table 4). This is less than half of quahogs recovered in good condition from the undisturbed plots. In the undisturbed plots, the number of quahogs recovered in good condition ranged from 13 to 23 quahogs per plot with an average of 19.5 per plot (Table 4).

The percent recovery rate of transplanted quahogs was calculated by dividing the number of quahogs in good condition by the total number of quahogs transplanted to each plot. There was a significant difference in the recovery rate of quahogs in good condition between disturbed and undisturbed plots (ANOVA, $F_{1,19}$, p = 2.36e-06, Figure 6). The percent recovery rate of quahogs in good condition was 65% in undisturbed plots, and 32% in disturbed plots (Table 5). This indicates that disturbing quahogs during winter months reduced the number of quahogs that appear to be in good condition.

Table 4. The number of quahogs determined to be in good condition within undisturbed and disturbed treatments.

	Undisturbed Plots (n=11)	**Disturbed Plots** (n=10)	**Difference** (Disturbed – undisturbed)
Minimum quahogs per plot	13	5	-8
Maximum quahogs per plot	23	16	-7
Average number of quahogs per plot	19.5	9.6	-9.9

Table 5. The recovery rates of quahogs (minimum, maximum, and average) in good condition by treatment group.

	Undisturbed Plots (n=11)	**Disturbed Plots** (n=10)	**Difference** (Disturbed – undisturbed)
Minimum within treatment group	43.3%	16.7%	-26.6%
Maximum within treatment group	76.7%	53.3%	-23.4%
Average by treatment group	64.8%*	32.0%**	-32.8%

*The average recovery rate of the undisturbed plots was significantly different from the disturbed plots.

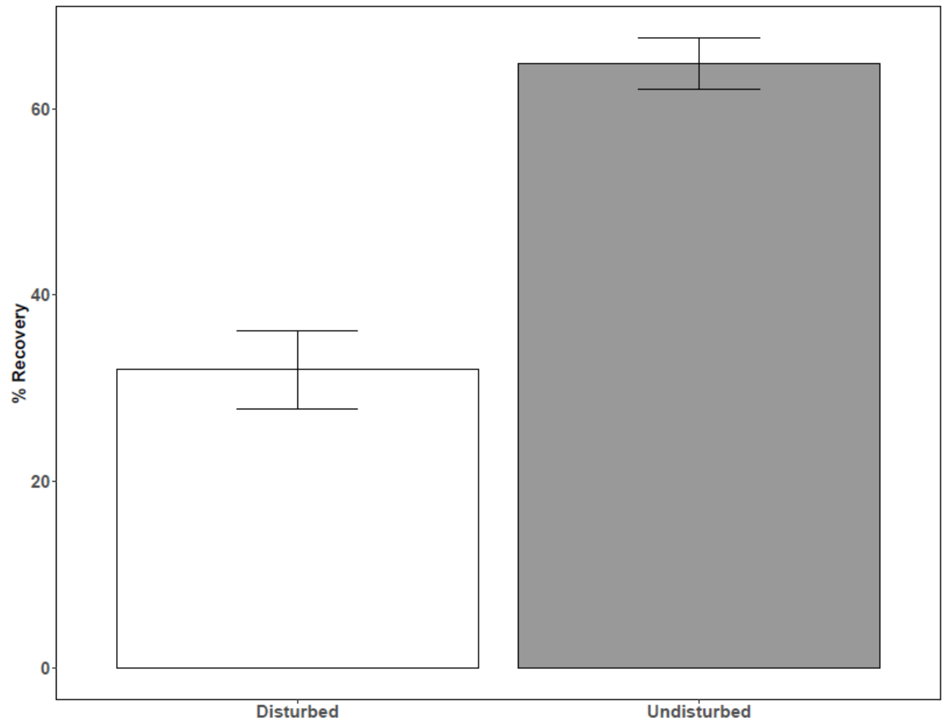

Figure 6. Bar plot with ±1 standard error (SE) bars showing percent recovery for disturbed plots (n=10) and undisturbed plots (n=11). Treatments were significantly different from one another (ANOVA, $F_{1,19}$, p = 2.36e-06).

C. Reference Plots

Reference plots 1 (R-1 plots, Figure 3) were dug through to remove quahogs in May 2019 but did not receive transplanted quahogs. In May 2020, no quahogs were recovered from four plots and one plot had one quahog recovered. Reference plots 2 (R-2 plots, Figure 3) were not dug through, nor received transplanted quahogs in May 2019. In May 2020, three plots contained one quahog and two plots contained no quahogs.

VII. Discussion

Disturbance of plots during the winter resulted in 50% fewer quahogs recovered in good condition, a statistically significant reduction. Disturbance of quahogs by digging relocated many of the quahogs to the surface, or near the surface of the mud. This likely increased their vulnerability to several stressors, including exposure of tissue to freezing air temperatures, reduced metabolic capacity to respond to disturbance, increased exposure to currents and predators, and reduction of stored energy reserves. These factors may have resulted in a significant reduction of quahogs recovered in good condition within the disturbed plots.

The air temperature during the disturbance event and for most of the seven-day window after the disturbance was above the target temperature range of 13-21^{o}F. The risk for freezing of tissue was reduced because of the relatively mild air temperatures (range: 17-47^{o}F, average:

36°F) for seven days after disturbance. Nevertheless, the significant difference between the two plots indicates that disturbance of plots at air temperatures above our target range still decreased quahog survival.

In warmer months, quahogs brought to the surface or near the surface of the mud can rebury themselves. However, cold water reduces the metabolic activity of quahogs (Loosanoff, 1939; Ansell, 1964) and at temperatures below 41°F quahogs reduce metabolism to approximately 5% of the normal metabolic rate (Zarnoch and Schreibman 2008). Average hourly seawater temperature in Casco Bay was ≤40°F during the 21 days after disturbance indicating that quahogs would have limited metabolic activity, making it energetically difficult for quahogs to rebury themselves after the disturbance (digging activity). Quahogs may have been vulnerable after disturbance even with milder air temperatures (17-47°F) if disturbed quahogs were unable to adequately rebury themselves due to reduced metabolic activity. This also increases their risk to predation from birds or other animals that are active during winter months.

Even if the disturbance does not immediately kill quahogs, it may weaken the quahogs by taxing their stored resources threatening longer-term survival. Over the winter and early spring, quahogs rely on stored energic resources to sustain them until food sources become available again (Zarnoch and Schreibman 2008, Bricelj et al. 2007). Utilizing these stored resources to respond to disturbance may reduce survival in the spring when water temperatures are warm enough to increase metabolic and respiratory functions but food is scarce (Zarnoch and Schreibman 2008, Zarnoch and Sclafani 2010).

<u>Other Considerations</u>

COVID-19 delayed the spring field work by approximately one month, as a typical winter harvesting closure would be lifted by the end of March, and initial plans were to conduct this work in April. However, due to the uncertainty around safety protocols in the field in April, work was delayed until May. A study in eastern Canada saw increased quahog mortality in May compared to August through April (Gionet et al. 2009). Therefore, it is unknown whether this delay affected the results of the study.

We do not definitively know the fate of the transplanted quahogs that were "missing" from within the plots. They may have drifted outside of the plot boundaries, died on site and washed away, been preyed upon at the site, or carried away by predators. However, due to reductions in metabolic activity of quahogs during the winter months, quahogs would likely have difficultly reburying themselves after being brought to the surface of the mud, leaving them vulnerable to freezing, movement offsite, or predation.

In this study, plots had twenty smaller quahogs (approximately 3-5 cm shell length) and 10 larger quahogs (approximately 5-10 cm shell length). During winter disturbance, all quahogs remained on site. This differs from traditional winter harvesting disturbance in which the legal sized quahogs would be harvested and only the sub-legal quahogs would remain on site. Cold weather stressors would be similar for all sizes of quahogs, although smaller quahogs have been found to be more vulnerable to overwintering stress (Bricelj et al. 2007) and predation (Kraeuter 2001). To account for variations in vulnerability, we transplanted both small and large quahogs within each plot.

This is a small pilot study, focused in one specific area of the upper intertidal in Casco Bay. The results may differ in locations lower in the intertidal with less exposure to air during the winter months. Other site-specific characteristics (substrate, aspect, exposure to wind, local microclimate, currents, etc.) may also influence the vulnerability of quahogs to disturbance and temperature exposure. While winter disturbance stressors would be the same (e.g. freezing of tissue, reduced metabolic capacity to respond to disturbance, increased exposure to predators, and reduction of stored energy reserves), the site-specific constraints may introduce variability.

A larger study with multiple sites is necessary for results that take variability of site characteristics into account. Considerations for a larger study could include: designing a study with more plots and/or larger plots; including several sites within different tidal heights in the intertidal/subtidal; adding sites in different coves/rivers to assess the effects of different sediment types; using temperature loggers; assessing mortality rates based on size classes; and potentially adding other treatments to address for factors such as predation.

VIII. Conclusions

This study was small and limited to only one site in Casco Bay, although this preliminary study indicates that quahogs are vulnerable when they are brought to the surface from harvesting activities during winter months. The recovery rate of quahogs in good condition from plots disturbed by digging activity was less than half of undisturbed plots.

As a matter of practice, harvesters should take steps to reduce disturbance of quahogs during cold weather. This could entail burying any sub-legal quahogs turned up when digging. Utilizing the precautionary principle by instituting seasonal harvesting closures or real-time closures based on a certain temperature range may provide a conservation benefit; however, closures result in lost revenue to harvesters. Therefore, local shellfish committees should carefully weigh this biological and economical balance. Expanding this research beyond a pilot phase is warranted to ensure these results are consistent across multiple sites before widespread management actions are enacted.

As the Gulf of Maine is one of the fastest warming bodies of water in the world (Pershing et al. 2015), and as air temperatures increase with climate change, the abundance and distribution of species in the intertidal and ocean will continue to change. In southern and mid-coast Maine, quahogs have recently become an important species for harvesters as the populations of soft-shell clams have declined. The increase in quahog landings and associated economic importance to harvesters highlights the importance of gaining a better understanding of quahog conservation and management by applying research conducted in other states and initiating new research in Maine.

IX. Acknowledgments

The shellfish harvesters volunteering for this project demonstrated a strong interest and willingness to participate. During discussions on available conservation activities for harvesters to earn their annual conservation points, harvesters expressed their interest in participating in activities that have direct benefits to the resource, in contrast to a shoreline clean-up, for example. This project provides preliminary insight into a management question on the direct impacts of winter harvesting on quahog mortality that previously had little to no existing scientific research. Given the high level of interest in this collaborative research project, it would appear as though there is support to broaden this study beyond this small-scale, pilot project. Ultimately the Freeport Shellfish Conservation Commission and the research community will decide the next steps, including whether to seek funding for continued research.

We would like to thank the following harvesters for volunteering: Fred Ward, Mike Soule, Chad Jordan, Todd Donahue, Jason York, Rob Gayton, and Tom Bennett. We would like to thank Dr. Marissa McMahan (Manomet) for completing the statistical analysis. We would also like to acknowledge Sara Randall and Dr. Brian Beal (Downeast Institute) for their thorough review, which improved the clarity of the report.

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Appendix I

Raw Data - Quahog Study Plots						
Plot #	Treatment	Alive	Dead	Unknown	Total Recovered	Date Dug
1	Undisturbed	21	3	0	24	May-20
2	Undisturbed	23	5	0	28	May-20
3	Undisturbed	22	3	0	25	May-20
4	Disturbed	16	1	0	17	May-20
5	Disturbed	10	1	0	11	May-20
6	Undisturbed	18	1	0	19	May-20
7	Undisturbed	21	0	0	21	May-20
8	Undisturbed	18	3	0	21	May-20
9	Disturbed	6	2	0	8	May-20
10	Undisturbed	20	1	0	21	May-20
11	Disturbed	5	0	0	5	May-20
12	Undisturbed	21	3	0	24	May-20
13	S-O	24	1	0	25	Oct-19
14	Disturbed	8	1	0	9	May-20
15	Undisturbed	18	1	0	19	May-20
16	S-J	28	1	0	29	Jul-19
17	Disturbed	7	2	0	9	May-20
18	S-J	29	1	0	30	Jul-19
19	Disturbed	16	1	0	17	May-20
20	Disturbed	12	0	0	12	May-20
21	Disturbed	6	0	0	6	May-20
22	Undisturbed	13	2	0	15	May-20
23	S-O	23	3	0	26	Oct-19
24	Disturbed	10	0	0	10	May-20
25	Undisturbed	19	0	0	19	May-20
26	R-1	0	0	0	0	May-20
27	R-1	0	0	0	0	May-20
28	R-1	1	0	0	1	May-20
29	R-1	0	0	0	0	May-20
30	R-1	0	0	0	0	May-20
31	R-2	0	0	0	0	May-20
32	R-2	1	0	0	1	May-20
33	R-2	0	0	0	0	May-20
34	R-2	1	0	0	1	May-20
35	R-2	1	0	0	1	May-20