Massachusetts Division of Marine Fisheries
B-120 Buzzards Bay Shellfish Injury and Lost Shellfishing
2015-2017 Progress Report

Prepared for the B-120 Buzzards Bay Trustee Council
Submitted July 2018

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Executive Summary

In response to the 2003 Bouchard oil spill, which resulted in the release of 98,000 gallons of fuel oil into Buzzards Bay, Massachusetts, a settlement was secured to restore natural resources and manage natural use injuries across the impacted area. Among the issues addressed were injuries to shellfish resources and the recreational shellfishery in Buzzards Bay, which Massachusetts Division of Marine Fisheries (DMF) aims to address with four specified restoration strategies. These include 1) a project in which contaminated quahog broodstock are transferred from donor areas in the Taunton River into designated sites within Buzzards Bay communities, 2) out-planting of hatchery quahog seed reared in municipally maintained upwellers, 3) out-planting of hatchery oyster seed reared in municipally maintained upwellers, and 4) assisting The Nature Conservancy (TNC) in monitoring bay scallop restoration efforts in Bourne, MA (Draft Restoration Plan and Environmental Assessment). The following report summarizes methods and results of these restoration activities and ongoing monitoring from 2015 to 2017.

In October 2015, DMF initiated a five-year quahog relay and transplant project to oversee the planned and scheduled transplant of quahog broodstock secured from a fecal coliform-contaminated closure area (donor site) in the Taunton River and placement into designated transplant sites within Buzzards Bay municipalities. Pre-relay surveys of the transplant sitesw were conducted prior to October 2015. The rationale for this project is that broodstock taken from closed waters with high quahog densities will be relocated to municipally-managed sites, strategically opened to harvesting, in order to enhance recreational fisheries and contribute to stock enhancement within and in the vicinity of the transplant site(s). It is anticipated that this program will result in enhancement of local quahog populations which then is expected to contribute to managed, sustainable recreational shellfisheries. In 2015, quahogs were relayed to sites in four municipalities (Gosnold, Mattapoisett, New Bedford and Westport). In 2016, the quahog broodstock relay program was expanded to include contaminated quahog relays within a total of nine municipalities (Gosnold, Mattapoisett, New Bedford, Westport, Bourne, Dartmouth, Fairhaven, Marion and Wareham). Due to reduced staffing levels at MA DMF and limited staffing and resources within some Buzzards Bay shellfish departments during the fall/winter of 2016 and most of 2017, much of the planned monitoring of B-120 sites planted with shellfish in 2016 had to be conducted in 2017. As a result, DMF postponed the contaminated quahog relays originally planned for 2017. It is planned to continue these relays in all nine municipalities during the 2018 season.

With the advent of commercial and municipal shellfish hatcheries and the development of cost-effective nursery techniques such as upwellers (i.e., moored, floating flow-through systems termed “FLUPSYs”), oyster and quahog reseeding programs have flourished throughout the Northeast. Many municipal and certain non-governmental organizations implement oyster and/or quahog management programs that include reseeding shellfish to enhance local stocks. The B-120 Buzzards Bay recreational shellfishing injury funds are being utilized to purchase seed quahogs and oysters from commercial hatcheries for intermediate grow-out and outplanting to restoration sites. In

Massachusetts, many municipalities do not have upweller capacity or staff to tend and manage the nursery grow-out of substantial numbers of oysters. As a result, municipal shellfish managers often purchase larger, field plant sized oysters (≥ 20 mm) for direct seeding in municipal public shellfish beds.

In 2017, B-120 funds were utilized to purchase hatchery reared oysters from Muscongus Bay Aquaculture in Maine. The Wareham and Marion Shellfish Departments purchased two size classes of oysters for intermediate grow out; smaller oysters (≥ 2 mm) were placed in town-owned upwellers, and larger oyster seed (9-13 mm) were placed in floating cages. All of these oysters were out-planted to restoration sites during fall 2017. The Bourne Shellfish Department used their allotted portion of the B-120 funds to purchase a smaller number of larger oysters (41-78 mm) from the town of Falmouth. The purchase of these larger oysters was beneficial to the restoration project because larger seed has higher survival rates and allowed for direct out-planting to the town restoration site.

During 2016, *DMF* oversaw a program whereby the towns of Wareham, Dartmouth, and Fairhaven purchased upweller kits for growing out small quahog seed for restoration of recreational fishing areas. The upwellers were constructed in 2016 and installed at town locations during 2017. Hatchery-reared 5-9 mm quahogs were placed in the upwellers in July 2017 and out-planted at restoration sites in late-October 2017. Supplemental B-120 funds are expected to be secured to purchase additional quahog seed for nursery grow-out and out-planting in 2018 and 2019.

In 2016*, DMF* assisted The Nature Conservancy (TNC) with their bay scallop restoration efforts in Squeteague Harbor, Bourne. Divers conducted surveys designed to identify and quantify different habitat strata and to estimate average scallop size and abundance by strata type.

This report summarizes the rationale, methods, and results of these four projects.

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I. *Quahog Relays and Stock Enhancement*

Obtaining Quahog Broodstock

In October 2015, *DMF* oversaw the transplant of bacterial-contaminated quahogs from closed waters of the Taunton River (donor site) to a total of four sites within Gosnold, Mattapoisett, New Bedford, and Westport, and in late summer/fall 2016 these transplants occurred in a total of nine sites within Gosnold, Mattapoisett, New Bedford, Westport, Bourne, Dartmouth, Fairhaven, Marion and Wareham (Refer to Appendix I for transplant site locations).

Prior to conducting transplants in 2015 and 2016, *DMF* collected quahog samples from the Taunton River donor site for shellfish disease testing at Kennebec River Biosciences in Maine. A full suite of pathology screenings were performed by Kennebec River Biosciences, including examination for any external or internal morphological abnormalities and pests, predators and parasites. No evidence of shellfish diseases was found in any of the samples. Pathology screening results for the tested donor site quahogs are presented in Appendix II.

DMF established contracts with three qualified dredge boat captains to collect and transport broodstock quahogs from the donor site to each of the transplant sites. *DMF* issued contaminated shellfish relay permits to the participating municipalities to transplant quahogs under predetermined and specific conditions into the preselected areas within each of the localities' waters. In 2015, *DMF* originally estimated that each municipality would receive 820 bushels of quahogs based on an estimated price of $16.50 per bushel. Because the final unit price was $17.50 per bushel, all municipalities received fewer quahogs than originally anticipated. Due to limited acreage of suitable quahog habitat at the selected site, Gosnold requested and received a total of 70 bushels of quahogs, and the remaining three municipalities each received a minimum of 800 bushels of quahogs. In 2016, Gosnold again requested 70 bushels due to a small transplant site, and the remaining eight municipalities received a minimum of 800 bushels.

Site Selection Methods

Subsequent to receiving the pathology report, *DMF* worked with the local shellfish departments to determine prospective transplant (receiving) sites. Each municipality planted quahogs at one site (Refer to Appendix I). Site selection was determined by factors including suitable quality and quantity of benthic habitat available, the availability and proximity of the site to public access for public recreational fishing, a recreational shellfishing-only site designation, degree to which the area was previously affected by the B-120 oiling that resulted in harvest closures, proper Shellfish Growing Area classification, and lack of a substantial quahog population present in the site.

Prior to planting, *DMF* biologists and local Shellfish Constables worked collaboratively to survey the selected sites in order to document habitat conditions, level of shellfish abundance and size classes of shellfish at each of the sites.

Sampling methods for these surveys varied slightly based on the different hydrographic conditions at each site. At every site, the proposed area was initially assessed for potential suitability of quahog habitat and any sections of the area that were unsuitable (shoreline boulder field, eelgrass beds and soft muddy substrate) were noted and avoided. Transect locations were then selected within the suitable areas to obtain a representative sample of the habitat and substrate conditions as well as the

resident shellfish population. In 2015 and 2016, transects were generally run parallel to shore covering the depth and section of area that would be planted. In 2017, quahog restoration sites planted in 2015 and 2016 were sampled using transects that were run perpendicular to shore to allow for the quantification of habitat and substrate variability that often correlates with depth. Transect locations were marked with rebar stakes and measured out with transect tapes. Most surveys were conducted by DMF and shellfish department staff within the subtidal zone during low tide. Transects were established and sampled in shallow water by survey teams working from shore. One site (Westport) required sampling from a boat, and boats were driven along the transect line using onboard geospatial navigation systems. One other site required dive surveys (New Bedford) and these transects were laid out with a lead line anchored on either end and marked with buoys on the surface.

In 2015, a minimum of 80 quadrats were sampled per site. Transect lengths varied depending on site length, and quadrats were sampled at every 10 feet along a given transect. In 2016 and 2017, transects were consistently 100-150 feet in length and quadrats were again sampled at ten foot intervals along a transect line. The total number of quadrats that were sampled per survey varied somewhat depending on number of personnel helping with the survey, weather conditions, and bottom type of the site. Total number of quadrats sampled per site is noted in each site summary section below. These quadrats were one square foot in area, and were raked using either a basket or hand rake (12-inches across, shore/dive surveys) or bull rake (18 inches across, boat surveys) to a depth of 8-12 inches. All quahogs were counted and measured, and all other shellfish, predators vegetation type and percent cover, substrate type, and sampling depth were recorded. The minimum threshold density for quahogs was three individuals per square foot; locations with densities above this were deemed productive and were not selected as a transplant site. GPS coordinates were taken at the start and end of each transect so that the exact sampling locations could be mapped and to ensure planting occurred in the surveyed areas.

Site Selection Results

Summaries of each site survey from 2015 - 2017 are detailed below, and a summary table of B-120 quahog transplant sites is presented in Table 1. The range of water depths at each site are reported as feet below mean low water (MLW). Positive depth values indicate depths below MLW and negative depth values indicate height above MLW (within the intertidal zone).

Maps of the thirteen quahog transplant sites are provided in Appendix I.

Municipality	Site Name	Year Planted	Area Planted (acres)	Depth Range at MLW (ft.)
GOSNOLD	West End-Cuttyhunk Pond	2015	0.5	0.5 - 4.5
MATTAPOISETT	Hiller Cove	2015	1.5	2 - 3
NEW BEDFORD	Oaklawn Street - Clark's Cove	2015	0.9	2 - 5
WESTPORT	The Let - Westport River, SE Section	2015	1.6	1 - 3
BOURNE	Tahanto Flats	2016	4	0 - 1.5
DARTMOUTH	Apponagansett Bay	2016	1	-1.5 - 0.5
FAIRHAVEN	West Island North, Jack's Cove	2016	3	0 - 2
GOSNOLD	Nashawena	2016	0.3	0 - 3
MARION	Planting Island Cove	2016	1.5	-2.5 - 1
MATTAPOISETT	Brandt Island Cove	2016	2.7	2.7 - 4.2
NEW BEDFORD	Dudley St. Clark's Cove	2016	1	0.75 - 9.75
WAREHAM	Sunset Cove	2016	2	0 - 2.5
WESTPORT	The Let - Westport River, NE Section	2016	8	0.5 - 1.5

Table 1. Summary of 2015 and 2016 B-120 Quahog Transplant Sites. Positive depth values indicate depth below MLW and negative depth values indicate height above MLW.

2015 Sites

Gosnold – Cuttyhunk Pond (west end)

In consultation with *MarineFisheries* personnel, Seth Garfield on behalf of the Gosnold Shellfish Constable, Asa Lombard, has identified the western end of Cuttyhunk Pond for a quahog transplant in 2015 based on the substrate suitability and lack of previous propagation efforts in the area. The site is accessible from Gulf Road and by vessel. Under its authority at G.L sec 52, the town has designated the site as a recreational shellfishing only area.

All of Gosnold was closed to shellfishing on April 28, 2003 due to the oil spill and re-opened on May 22, 2003. The transplant site in Cuttyhunk Pond is classified as "CONDITIONALLY APPROVED" and meets NSSP standards for direct shellfish harvest when in the open status. During the survey, 80 ft^2 quadrats were sampled. The outermost transect was located in an eelgrass bed and the site was adjusted to provide a buffer from the eelgrass. Without the outermost transect, the 60 remaining quadrats have a quahog density of 0.26 quahogs/ft^2. The area was closed for 1 year.

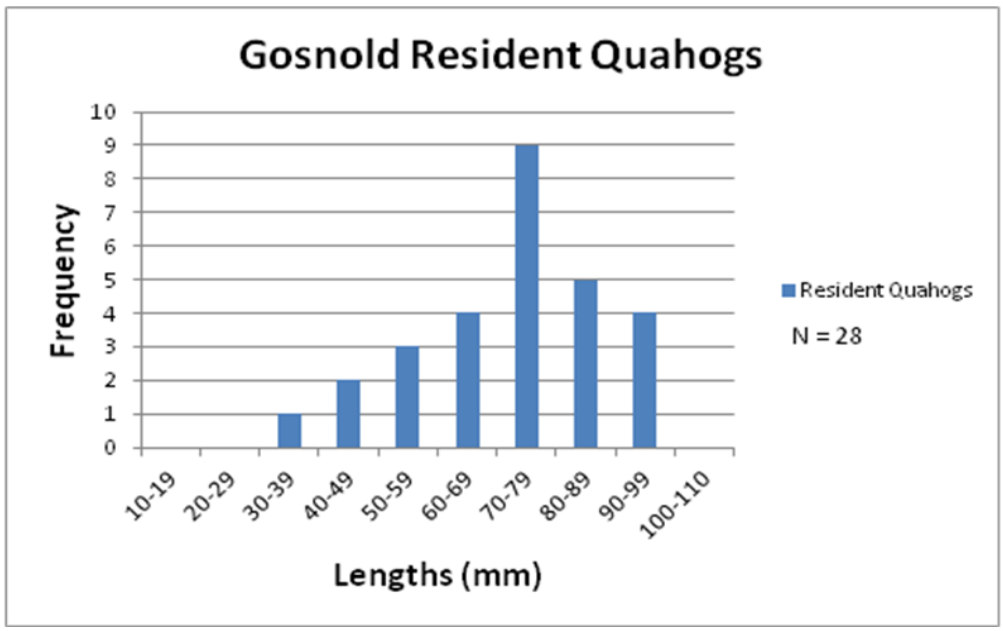


Figure 1. Resident Quahog Length Frequencies at Gosnold B-120 Site.

Mattapoisett – Hiller Cove

In consultation with *DMF* personnel, the Mattapoisett Shellfish Constable Kathy Massey, chose the area outside of the seasonal closure in Hiller Cove for a quahog transplant. The shellfish constable stated that the area is very favorable substrate for quahogs and has been utilized recreationally in the past. The beach parking lot provides parking and an access point for this site. Under its authority at G.L. 130 sec 52 the town has designated the site as a recreational shellfishing only area.

All of Mattapoisett, including Hiller Cove, was closed to shellfishing on April 28, 2003 due to the oil spill and re-opened on October 13, 2003. The transplant site is classified as "APPROVED" for the direct harvest of shellfish year-round. Kathy Massey does not believe the area currently supports a productive recreational shellfishery due to limited natural productivity. The locale was historically a popular recreational area; however Ms. Massey has observed a decline in effort in the area in recent years due to its poor productivity. The shellfish department has not performed any propagation activity in this area for decades. During the survey, 128 ft^2 quadrats were dug and 14 quahogs were found (0 .11 quahogs/ft^2). The area was closed for 1 year.

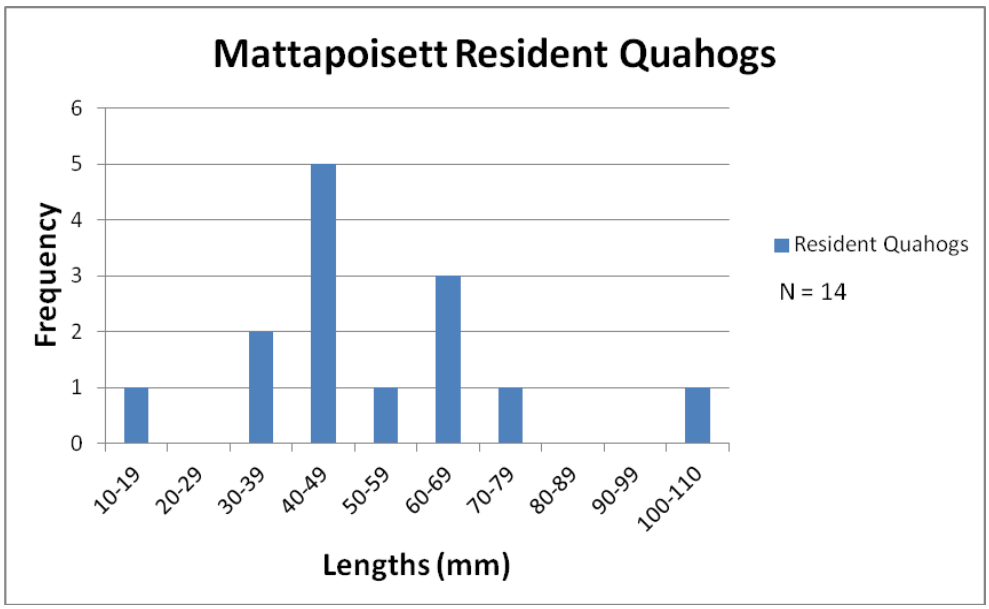


Figure 2. Resident Quahog Length Frequencies at Mattapoisett B-120 Site.

New Bedford – Clarks Cove, Woodlawn Street

In consultation with *DMF* personnel, the New Bedford Shellfish Constable Tom Ringuette, selected the area along the northeastern shoreline of Clark's Cove from the jetty at Woodlawn Street to the red post designating the boundary between the "Conditionally Approved" and "Prohibited" areas for a quahog transplant in 2015 based on the substrate suitability, access and its history as a recreational harvest area in past years. The shoreline extends for approximately 1,600'. The on street parking on Rodney French Boulevard provides parking and access points for this area. Under its authority at G.L. 130 sec 52 the city has designated the site as a recreational shellfishing only area.

All of New Bedford, including Clark Cove, was closed to shellfishing on April 28, 2003 due to the oil spill and re-opened on October 13, 2003. The transplant area is classified as "CONDITIONALLY APPROVED" based on rainfall and meets NSSP standards for direct shellfish harvest when open to shellfishing. Tom Ringuette did not believe the area supported a recreational shellfishery due to limited natural productivity. Mr. Ringuette has previously observed recreational shellfishermen work for nearly two hours for a peck of quahogs. During the survey, 82 ft^2 quadrats were sampled and 78 quahogs were found (0.95 quahogs/ft^2). The city has not performed any propagation activity in this area for decades. This area was closed for 1 year.

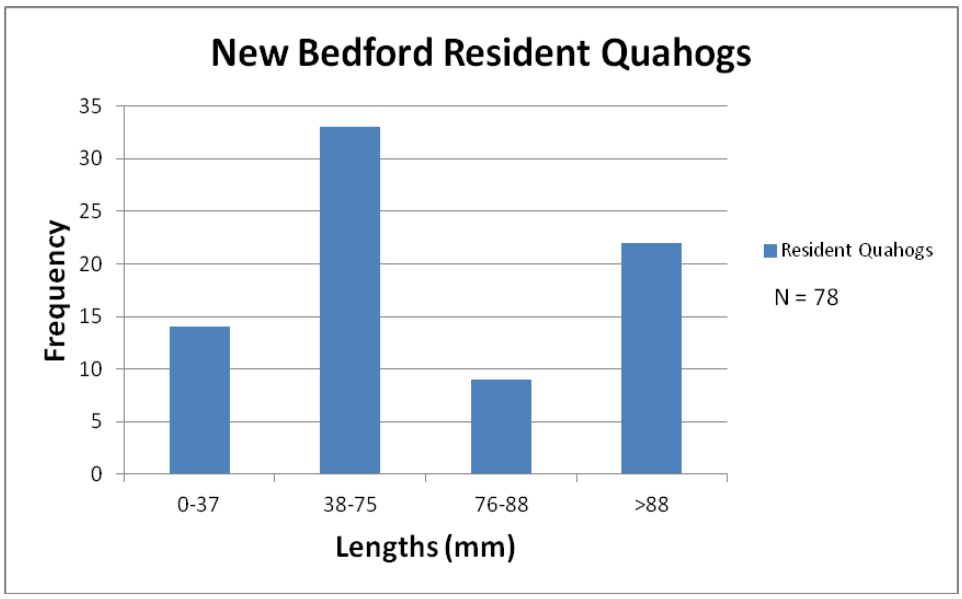


Figure 3. Resident Quahog Length Frequencies at New Bedford B-120 Site. For this survey, size classes were grouped together as seed (0-37mm), necks (38-75mm), cherrystones (76-88), and chowders (>88mm).

Westport – Westport River, The Let-Southeast section

In consultation with *DMF* personnel, the Westport Shellfish Constable Gary Sherman, chose the southeastern portion of "The Let", in the East Branch of the Westport River, for a quahog transplant during 2015. He stated that the near shore area is very favorable substrate for quahogs. The habitat of the "deeper" waters can become less suitable, therefore the transplants would occur within approximately 125' of the shoreline. The shoreline extends for approximately 1,200' from Emma Tripp Landing to the East. Emma Tripp Landing is located at the southern end of the Let and provides adequate parking and access to this shellfishing area. Additional parking is provided on Beach Road. Recreational fishermen can also access the area by boat. There were no other access points with suitable habitat identified in Westport. Under its authority at G.L. 130 sec 52 the town has designated "The Let" as a recreational shellfishing only area.

All of Westport, including The Let, was closed to shellfishing on April 28, 2003 due to the oil spill and re-opened on May 22, 2003. The area is classified as "APPROVED" and Meets NSSP standards for direct harvest of shellfish year-around. Due to the lack of shellfishermen utilizing the site, Gary Sherman did not believe there were many quahogs in this area. The town has not recently conducted any propagation activities in the eastern portion of The Let. During the survey, 180 ft^2 quadrats were dug and 9 quahogs were found (0.05 quahogs/ft^2). This area was closed for 3 years.

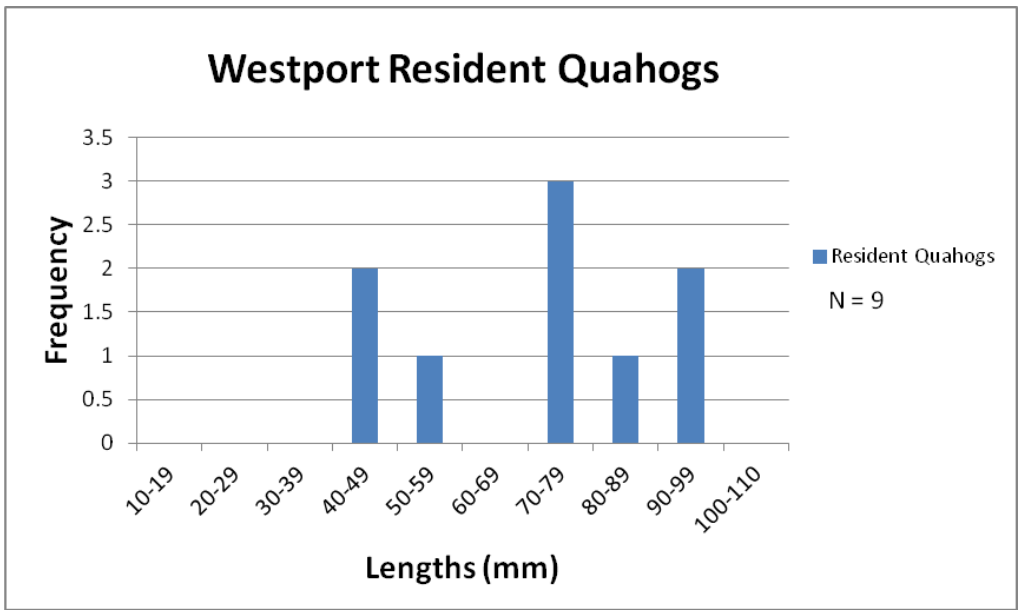


Figure 4. Resident Quahog Length Frequencies at Westport B-120 Site.

2016 Sites

Bourne – Tahanto Flats

In consultation with *DMF* personnel, the Bourne Shellfish Constable Tim Mullen, chose a portion of Phinney's Harbor known as 'Tahanto', for the 2016 quahog transplant due to the suitability of the substrate and access. All of Bourne, including Tahanto, was closed to shellfishing on April 28, 2003 due to the oil spill and re-opened on May 22, 2003.

The transplant site is in DSGA BB: 46, which is classified as "APPROVED" and meets NSSP standards for direct harvest of shellfish throughout the year. Tim Mullen stated this four acre area would benefit greatly from a transplant because it is very favorable habitat for quahogs and has been utilized recreationally in the past. A closure of this site would also benefit the soft shell clam (*Mya Arenaria*) fishery by reducing pressure and allowing the remaining clams to serve as brood stock. The parking lot at Monk's Park as well as street parking in Tahanto provides public parking and access points. Under its authority at G.L. 130 sec 52 the town has designated the site as a recreational shellfishing only area.

On August 14, 2015, a pre-transplant shellfish survey was conducted by *DMF* staff members and town shellfish officials. Survey results indicate a sand and mud substrate, with no submerged aquatic vegetation (SAV) coverage. Water depth at Tahanto Flats ranges between 0-1.5 ft. below MLW. A total of twelve transects were sampled within the site. Eighteen quahogs were found within 324 ft^2 of quadrats surveyed. Mean quahog density at this site is estimated to be 0.5 quahogs/ft^2. The area was closed for two years and is expected to reopen to recreational shellfishing in November 2018.

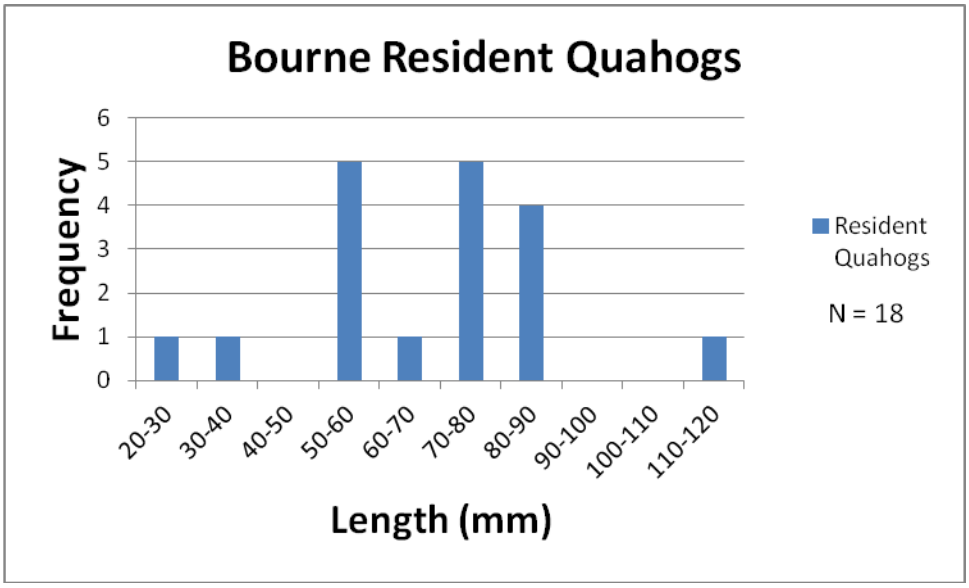


Figure 5. Resident Quahog Length Frequencies at Bourne B-120 Site.

Dartmouth – Apponagansett Bay

In consultation with *DMF* personnel, the Dartmouth Shellfish Constable Steve Mello, chose the area northwest of the town landing pier, to the northern end of the park area for 2016 quahog transplants. All of Dartmouth waters, including Apponagansett Bay, was closed to shellfishing on April 28, 2003 due to the oil spill and re-opened on October 13, 2003. The transplant site is in DSGA BB: 12, which is classified as "CONDITIONALLY APPROVED" and meets NSSP standards for direct harvest of shellfish during the time period it is open status. Steve Mello states that this 1-acre area has favorable habitat for quahogs. He does not believe the area currently supports a recreational shellfishery due to the lack of sufficient quahog resource. However in the 1980s and 1990s, this area was used as a transplant site due to ease of access and suitable habitat. The large parking lot at the town landing is the access point for the transplant area. As with all quahog transplant locations resultant from B-120 funding, the town has designated the site for recreational shellfishing only.

On August 14, 2015, a pre-transplant site shellfish survey was conducted by three *DMF* staff members and the Shellfish Constable. Survey results indicate a sand and mud substrate, with no SAV coverage. Water depth of the Apponagansett Bay site ranges between 0.5 ft. and 1.5 ft. below MLW. A total of eight transects were sampled within the site. Twenty six quahogs were found within 88 ft^2 quadrats. Mean quahog density at the site is estimated to be 0.3 quahogs/ft^2. The site was closed for one year and reopened to recreational shellfishing on November 1, 2017

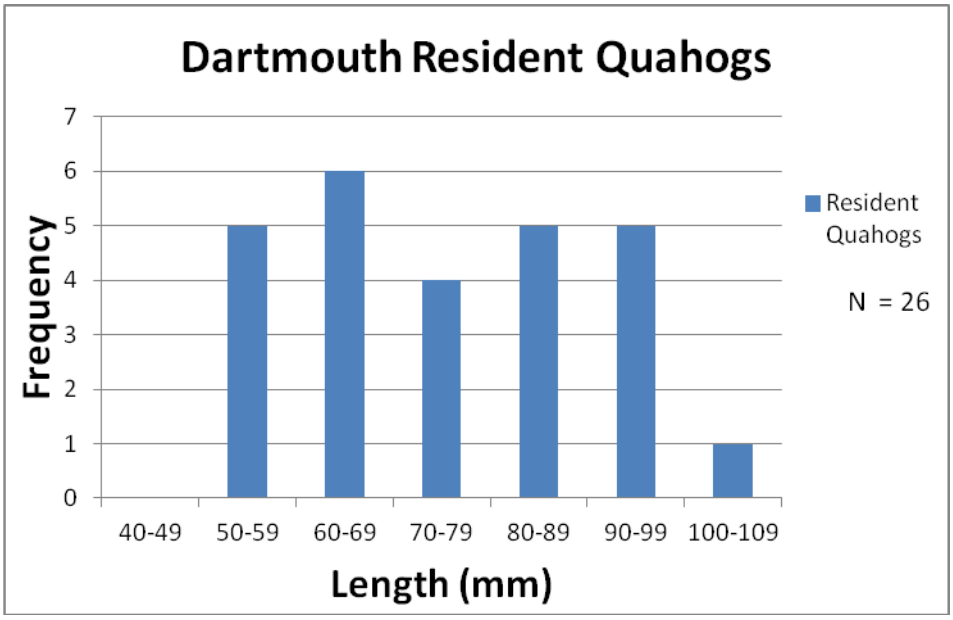


Figure 6. Quahog Length Frequencies at Dartmouth B-120 Site.

Fairhaven – West Island North, Jack's Cove

In consultation with *DMF* personnel, the Fairhaven Shellfish Constable Tim Cox, selected waters in the vicinity of West Island North known as Jack's Cove, for 2016 transplants. All of Fairhaven waters, including Jack's Cove, was closed to shellfishing on April 28, 2003 due to the oil spill and re-opened on October 13, 2003. The transplant site is in DSGA BB: 18, which is classified as "APPROVED" and meets NSSP standards for the direct harvest of shellfish throughout the year.

The shellfish constable stated that this 3-acre area is very favorable habitat for quahogs and has been utilized recreationally in the past. The parking lot along the western shore and the town parking lot across the street provide parking and access points for this area which the town has designated for recreational shellfishing only. This area had been used as a transplant site many years ago but no propagation activity has been performed by the town recently. After receiving quahogs through the 2016 Trustee-approved B-120 restoration plan, the site remained closed for one year to allow quahog growth and recruitment.

On August 13, 2015, a pre-transplant shellfish survey was conducted by *DMF* staff and the Shellfish Constable. Survey results indicate a sand and mud substrate, with no SAV coverage. ater depth at the Jack's Cove site ranges between 0–2 ft. below MLW. A total of twelve transects were sampled within the site. Eighteen quahogs were found within 246 ft^2 of quadrats. Mean quahog density at the site was estimated to be 0.07 quahogs/ft^2. The site was closed for one year and reopened to recreational shellfishing on September 13, 2017.

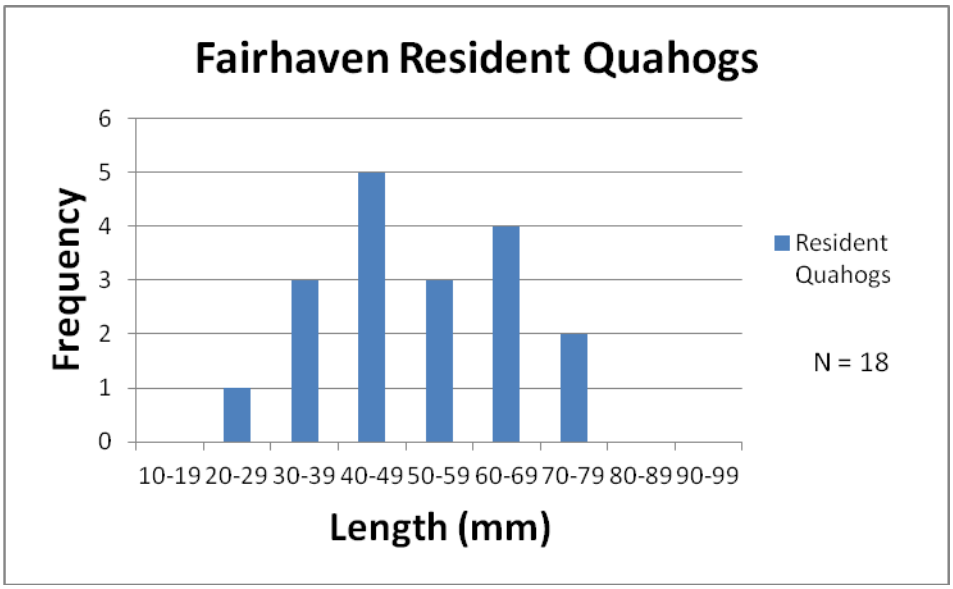


Figure 3. Quahog Length Frequencies at Fairhaven B-120 Site.

Gosnold – Nashawena, The Neck

In consultation with *DMF* personnel, Seth Garfield on behalf of the Gosnold Shellfish Constable Asa Lombard chose the North Western waters off "The Neck" on Nashawena Island as the 2016 relay transplant site. This 5-acre location is adjacent to Farm House Road and resides North West of the island caretaker's house. All of Gosnold was closed to shellfishing on April 28, 2003 due to the oil spill and re-opened on May 22, 2003. The transplant site off Nashawena is within Designated Shellfish Growing Area (DSGA) E:4 which is classified as "APPROVED" and meets NSSP requirements for direct harvest of shellfish throughout the year. Seth Garfield does not believe the area currently supports a recreational shellfishery due to the limited quahog resource, and no propagation work has been done in this area for decades.

On October 3, 2016, a pre-transplant site shellfish survey was conducted by *DMF* staff members. The survey was conducted utilizing basket rakes aboard a *DMF* vessel. Survey results indicate a primarily sand sediment substrate. Water depth of the Nashawena site ranges between 0-3 ft below MLW. Two transects were sampled within the area. One quahog was found within 25 ft^2 of sampled quadrats. Mean quahog density at the site is estimated to be 0.04 quahogs/ft^2. The area was closed for 20 months and will reopen to recreational shellfishing on July 26, 2018.

Marion – Planting Island Cove

In consultation with *DMF* personnel, Marion Shellfish Department staff (Isaac Perry, Harbormaster and Adam Murphy, Shellfish Constable) selected a portion of Planting Island Cove for a quahog transplant in 2016. They stated that the 1.5-acre area adjacent to the western shoreline is very favorable habitat for quahogs. The area has also received quahog transplants in the past. The parking lots along the western shore provide parking and access points for this area, and the town has designated the area as restricted to recreationally shellfishing. All of Marion waters, including Planting Island Cove, was closed to shellfishing on April 28, 2003 due to the oil spill and re-opened on November 12, 2003. The transplant

site is in DSGA BB:32, which is classified as "APPROVED" meets NSSP standards for direct harvest of shellfish throughout the year. Isaac Perry does not believe the area currently supports a recreational shellfishery due to the limited quahog resource. Mr. Perry has previously observed fewer and fewer shellfishermen utilize the area each year. The shellfish department has not performed any propagation activity in this area for years.

On August 10, 2015, a pre-transplant site shellfish survey was conducted by *DMF* staff members and the Shellfish Constable. Survey results indicate a sand and mud substrate, with no SAV coverage. Water depths of the Planting Island Cove site range between 1ft. below and 2.5 ft. above MLW. A total of six transects were sampled within the site, and two quahogs were found within the 84 ft^2 of quadrats. Mean quahog density at the site is estimated to be 0.02 quahogs/ft^2. The site was closed to shellfishing for one year and reopened to recreational shellfishing on October 4, 2017.

Mattapoisett - Brandt Island Cove

In consultation with *DMF* personnel, the Mattapoisett Shellfish Constable, Kathy Massey, chose Brandt Island Cove just north of Leisure Shores Marina, for the quahog transplant in 2016. All of Mattapoisett waters, including Brandt Island Cove, was closed to shellfishing on April 28, 2003 due to the oil spill and was re-opened on October 13, 2003. The 1.5-acre transplant site is located within DSGA BB: 23, which is classified as "APPROVED" meets NSSP standards for direct harvest throughout the year. The marina provides parking and access to the location. The area currently does not support a recreational shellfishery due to the limited quahog resource. The shellfish department has not performed any propagation activity in this area for decades. The shellfish constable stated that the area has very favorable habitat for quahogs and was once productive for recreational harvesters.

On June 2, 2016, a pre-transplant shellfish survey was conducted by *DMF* staff members and the Shellfish Constable. Water depths of the Brandt Island site ranges between 2.7–4.2 ft. below MLW. One-hundred-twenty quadrats were sampled along four 600 ft^2 belt transects. Survey results indicate a sand and mud substrate. Twenty-three quahogs were found within 120 ft^2 of quadrats. Mean quahog density at the site is estimated to be 0.19 quahogs/ft^2. The site was closed for one year and reopened to recreational shellfishing on October 20, 2017.

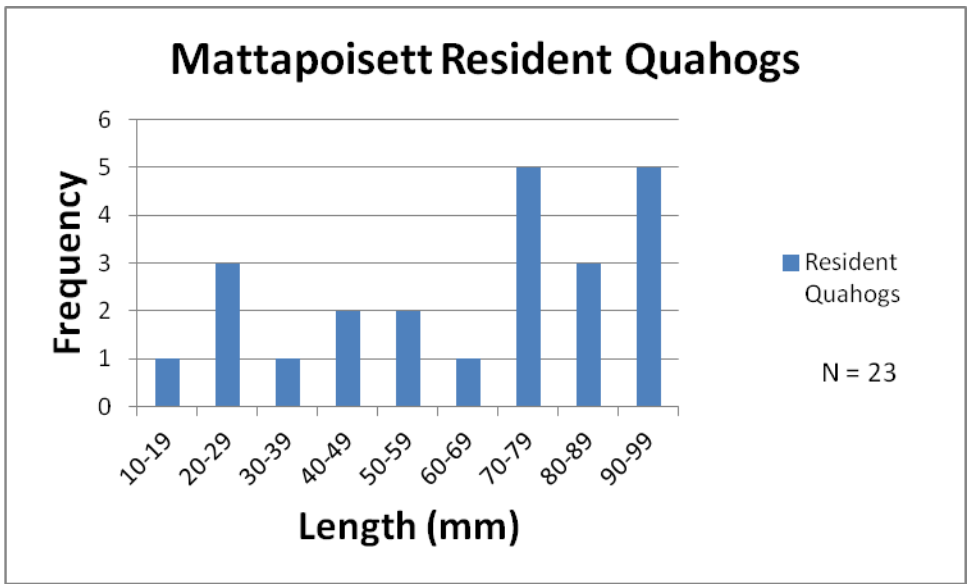


Figure 8. Quahog Length Frequencies at Mattapoisett B-120 Relay Site.

New Bedford – Clark's Cove, Dudley Street

In consultation with *DMF* personnel, the New Bedford Shellfish Constable Tom Ringuette, chose a 1-acre area along the eastern shoreline of Clark's Cove, extending between the jetties at Woodlawn and Dudley Streets, for B-120 quahog transplants in 2016. All of New Bedford waters, including Clark's Cove, was closed to shellfishing on April 28, 2003 due to the oil spill and re-opened on October 13, 2003. The transplant site is in DSGA BB:13, which is classified as "CONDITIONALLY APPROVED" based on rainfall and meets NSSP standards when the area is open to shellfishing. The site supports favorable habitat for quahogs and has been utilized recreationally in the past. However, the site does not currently support a recreational shellfishery due to a limited quahog resource and the lack of City funds for shellfish propagation. The large parking lot at the town landing and off-street parking at Rodney French Boulevard provide ample access points this area. The City has designated this site for recreational shellfishing only.

On June 27, 2016, a shellfish dive survey was conducted by *DMF* staff with the assistance of the New Bedford Shellfish Constable. The dive survey results indicate a bottom substrate consisting y of a mixture of primarily sand at greater depth and mud closer to shore. Water depth at the site ranges between 0.75 – 9.75 ft. below mean low water. Fifty-six quahogs were found within 154 ft^2 of quadrats along ten transects. Mean quahog density at the site is estimated to be 0.36 quahogs/ft^2. The site was closed for 21 months and reopened to recreational shellfishing on July 6, 2018.

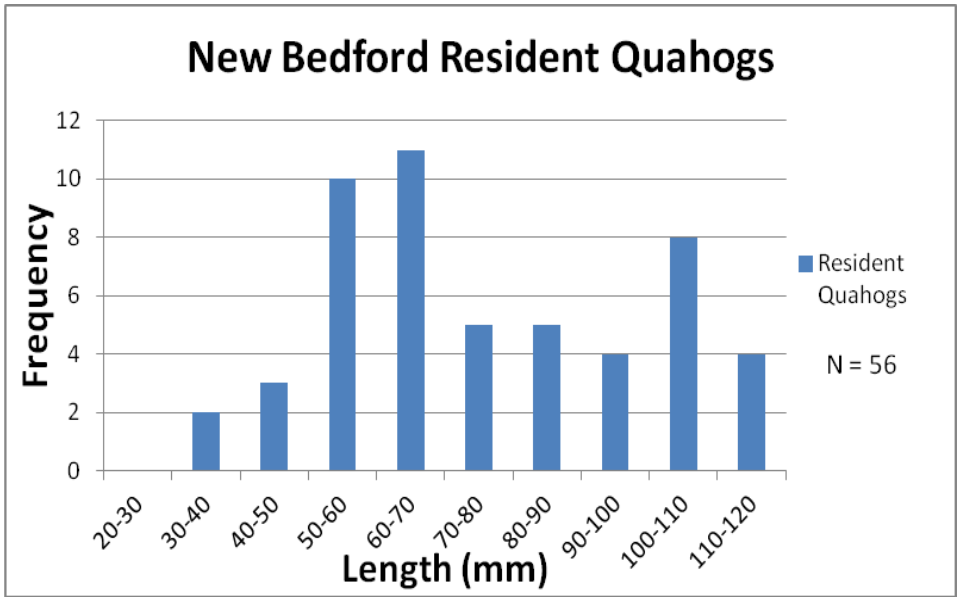


Figure 9. Quahog Length Frequencies at New Bedford B-120 Relay Site.

Wareham – Sunset Cove

In consultation with *DMF* personnel, the Wareham Shellfish Constable Garry Buckminster, selected a portion of Sunset Cove for 2016 quahog transplants. The constable states that the 2-acre area has favorable habitat for quahogs and has not had any propagation efforts for several years. The

Gladstone Road right-of-way provides an access point for this area. All of Wareham waters, including Sunset Cove, was closed to shellfishing on April 28, 2003 due to the oil spill and re-opened on May 22, 2003. The transplant site is in DSGA BB: 41 and is classified as "CONDITIONALLY APPROVED", meeting NSSP standards for direct harvest of shellfish when open to shellfishing. Garry Buckminster does not believe the area currently supports a recreational shellfishery due to the limited quahog resource. Under its authority at G.L. 130 sec 52, the town has designated the site as a recreational shellfishing only area.

On August 12, 2015, a pre-transplant site shellfish survey was conducted by three *DMF* staff members and the Shellfish Constable. Survey results indicate a sand and mud substrate, with no SAV coverage. Water depth at the Sunset Cove site ranges between 0–2.5 ft. below MLW. A total of twelve transects were sampled within the site. Twenty-nine quahogs were found within 192 ft^2 of quadrats. Mean quahog density at the site is estimated to be 0.15 quahogs/ft^2. The site will remain closed to recreational shellfishing for 3 years.

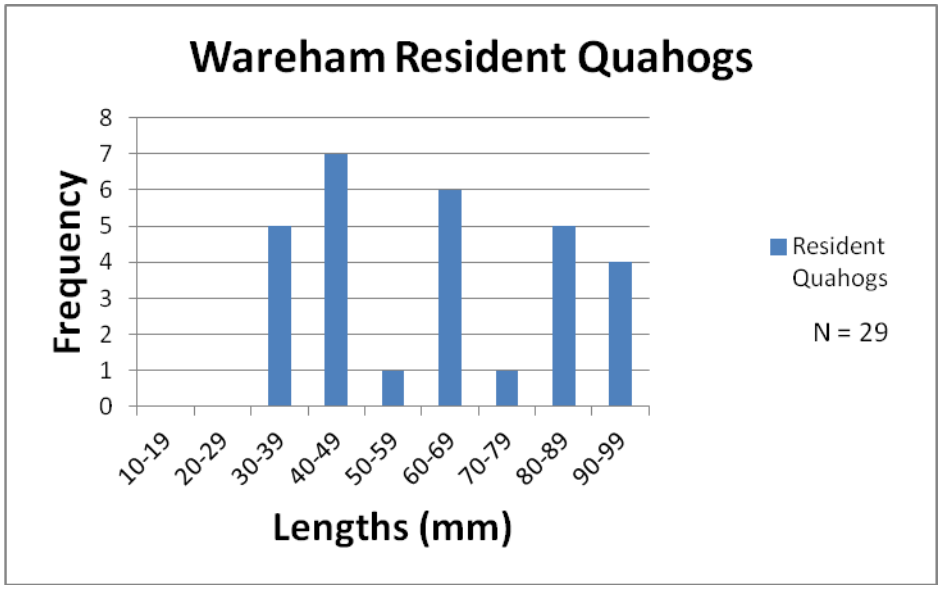


Figure 10. Quahog Length Frequencies at Wareham B-120 Site.

Westport – Westport River-The Let, Northeast section

In consultation with *DMF* personnel, the Westport Shellfish Constable Chris Leonard chose an 8-acre site on the southeastern portion of the Let in the East Branch of the Westport River (North of "East Beach Road") for a quahog transplant in 2016. The constable states that the nearshore area is very favorable habitat for quahogs. All of Westport waters, including The Let, was closed to shellfishing on April 28, 2003 due to the oil spill and re-opened on May 22, 2003. The transplant site is in DSGA BB: 4.0, which is classified as "APPROVED", and meets NSSP standards for direct harvest of shellfish year round. There are very few quahogs in this area due to poor recruitment and the lack of propagation efforts in the eastern portion of the Let. The near shore portions of this area support very favorable habitat for quahogs, while the "deeper" offshore waters are muddy and less suitable. Therefore, relayed quahogs were planted within 125 ft. of the shoreline. Emma Tripp Landing is located at the southern end of The Let and provides adequate parking (additional parking is provided on Beach Road for a total of 12

spaces) and both walking access and boat access to this shellfishing area. (Recreational fishermen often access the area by shallow-draft boat.) For years, the town has designated The Let as a recreational only shellfishing area.

On September 22, 2016, a pre-transplant site shellfish survey was conducted by *DMF* staff members and the Shellfish Constable Chris Leonard. The survey was conducted from a boat with the use of bull rakes, sampling 30 quadrats along 5 transects. The proposed transplant area consisted primarily of mud and sand sediment which is favorable habitat for quahogs. Water depth of the Let site ranges between 0.5–1.5 ft below MLW. Sixteen quahogs were found within 150 ft^2 of quadrats. Mean quahog density at the site is estimated to be 0.10 quahogs/ft^2. The site was closed for 22 months and will reopen to recreational shellfishing in August 2018.

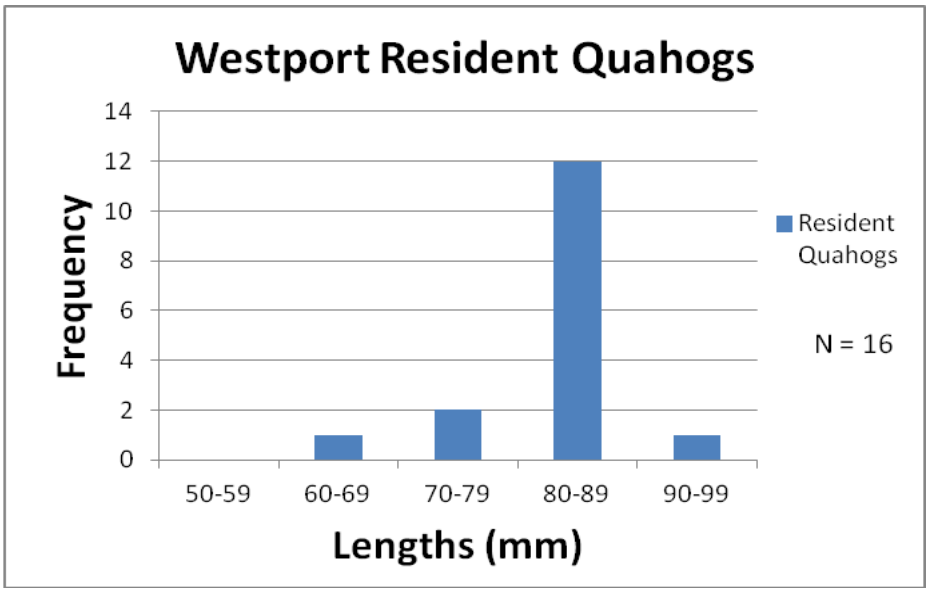


Figure 11. Quahog Length Frequencies at Westport B-120 Site.

2015 and 2016 Quahog Transplants Methods

With the assistance of Shellfish Department staff in each town, *DMF* biologists sampled quahogs from the Taunton River donor site as they were being loaded into boats for planting at the B-120 sites. Random quahog subsamples of a known volume (1 peck basket) were collected from the 800+ bushels of transplanted quahogs prior to planting in each municipality, and all individuals were counted and measured for shell length. Sample size at each site ranged between 5 and 12 pecks, and varied depending on availability of personnel. These measurements were used to estimate the total number and size frequency of transplanted quahogs within each B-120 site. Following sampling, quahogs were planted by boat/barge across the designated area. In 2015, all quahog transplant activities were conducted in October. In 2016 all transplant activities were conducted between July and November.

Site Marking and Closure Period

Prior to commencement of the transplants, *DMF* prepared and distributed closure notices for each B-120 contaminated quahog relay site to local and state law enforcement agencies, US Food and Drug Admiistration (FDA), MA Department of Public Health (DPH) and The MA Department of Environmental Protection (DEP). The notices specify geographic boundaries for each area and prohibit shellfishing or attempting to shellfish in the area during the specified closure period. The four sites in 2015 and nine sites in 2016 were marked with posted signs on the shoreline and/or buoys for outer boundary markings prior to and during the closure period, and regular enforcement patrols are routinely carried out by municipal shellfish department personnel.

In order to maximize quahog spawning and recruitment within and around the B-120 transplant sites, *DMF* worked with the municipalities to keep B-120 quahog relay sites closed for as long as possible. The amount of available suitable quahog habitat within Approved or Conditionally Approved shellfish growing areas varies by town. As a result, municipalities with limited area available for recreational shellfishing closed the B-120 transplant sites for one year, while others closed their sites for two or three years. In 2015, Gosnold, Mattapoisett, and New Bedford were closed for 1 year (reopened fall 2016) and Westport was closed for 3 years (reopening in summer 2018). In 2016, Bourne, Gosnold, New Bedford, Wareham and Westport closed the B-120 quahog transplant sites for a minimum of two years. The remaining sites in Dartmouth, Fairhaven, Marion and Mattapoisett were closed to recreational shellfishing for one year.

Prior to allowing any harvest from the B-120 quahog transplant site within the municipalities, *DMF* collected shellfish and water samples for bacteriological analysis to determine if health standards were met for direct harvest and human consumption. For sites where results are within acceptable values, DMF lifted the contaminated area closure and municipal shellfish departments generated management opening notices allowing recreational shellfishing in those areas. All four 2015 sites were tested, met NSSP standards, and have been re-opened for harvest (Westport in July 2018 and the other three municipalities in 2016). All 2016 sites, except one in Wareham, have been tested and met NSSP standards, and five of these sites have already been opened to shellfishing (Dartmouth, Fairhaven, Marion, and Mattapoisett opened in fall 2017, Westport opened in July 2018). The remaining four sites (Bourne, Gosnold, New Bedford, and Wareham) will open in fall 2018 or spring 2019. Refer to Appendix III for all completed bacteriological screening results for 2015 and 2016 sites.

Quahog Transplants Results

A summary of estimated number, size range, and planting density of quahogs at each 2015 and 2016 B-120 site is presented in Table 2. Length frequencies of transplanted quahogs within each B-120 site are provided in Figures 12 through 19.

Town	Site Name	Year Planted	# Bushels Relayed	Estimated # Quahogs	Size Range (mm)	Mean Size (mm)	Area Planted (acres)	Area Planted (ft^2)	Quahog Density (#/ft^2)
GOSNOLD	West End-Cuttyhunk Pond	2015	70	16,369	55-104	77.7	0.5	21,780	0.8
MATTAPOISETT	Hiller Cove	2015	810	168,480	45-104	81.9	1.5	65,340	2.6
NEW BEDFORD	Oaklawn Street - Clark's Cove	2015	810	187,920	55-104	77.7	0.9	39,204	4.8
WESTPORT	The Let - Westport River, SE Section	2015	810	176,094	51-101	80.3	1.6	69,696	2.5
2015 TOTALS			2500	548,863			4.5		
BOURNE	Tahanto Flats	2016	800	149,871	40 - 110	84.55	4	174,240	0.86
DARTMOUTH	Apponagansett Bay	2016	884	169,905	61 - 110	80.88	1	43,560	3.90
FAIRHAVEN	West Island North, Jack's Cove	2016	800	139,200	59 - 110	81.24	3	130,680	1.07
GOSNOLD	Nashawena	2016	70	14,840	68 - 102	83.8	0.3	13,068	1.14
MARION	Planting Island Cove	2016	800	190,720	50 - 103	79.1	1.5	65,340	2.92
MATTAPOISETT	Brandt Island Cove	2016	806	137,278	62 - 111	86.8	2.7	117,612	1.17
NEW BEDFORD	Dudley St. Clark's Cove	2016	800	169,920	60 - 104	80.7	1	43,560	3.90
WAREHAM	Sunset Cove	2016	884	151,164	41 - 110	86.0	2	87,120	1.74
WESTPORT*	The Let - Westport River, NE Section	2016	801	155,873	55 - 108	82.9	8	348,480	0.45
2016 TOTALS			6645	1,278,771			23.5		

Table 2. 2015 & 2016 B-120 Quahog Transplant Summary. *Note Westport quahogs were sampled for market size instead of a measurement (mm), so averages for density, mean, minimum, and maximum length (mm) from all other deliveries were used.

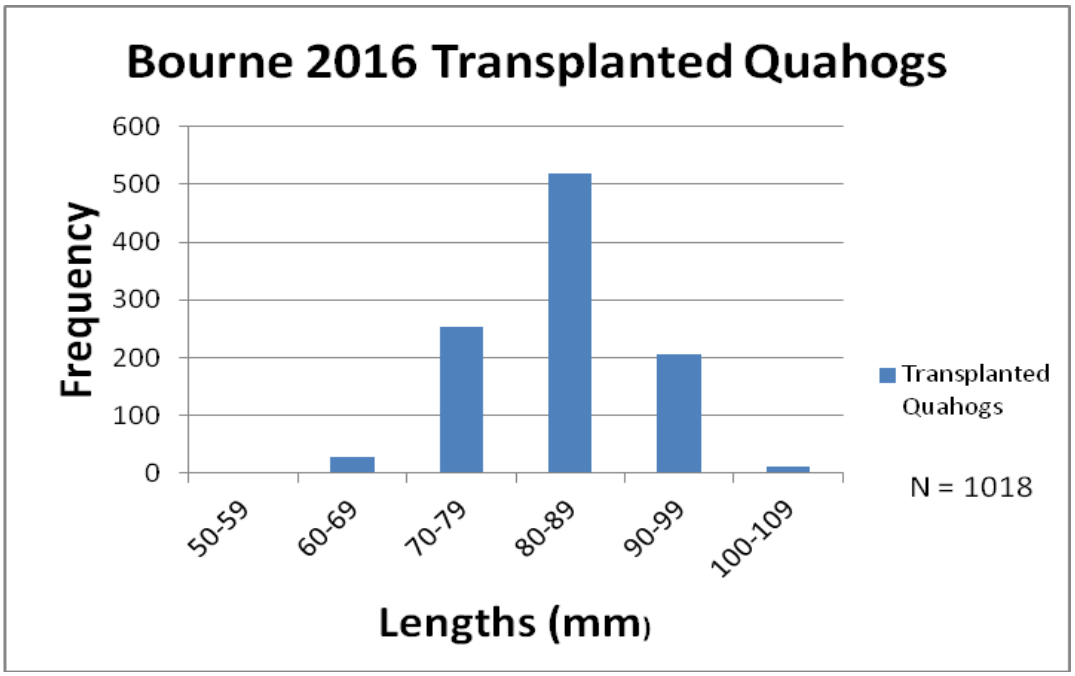


Figure 12. Transplanted Quahog Length Frequencies at Bourne B-120 Site.

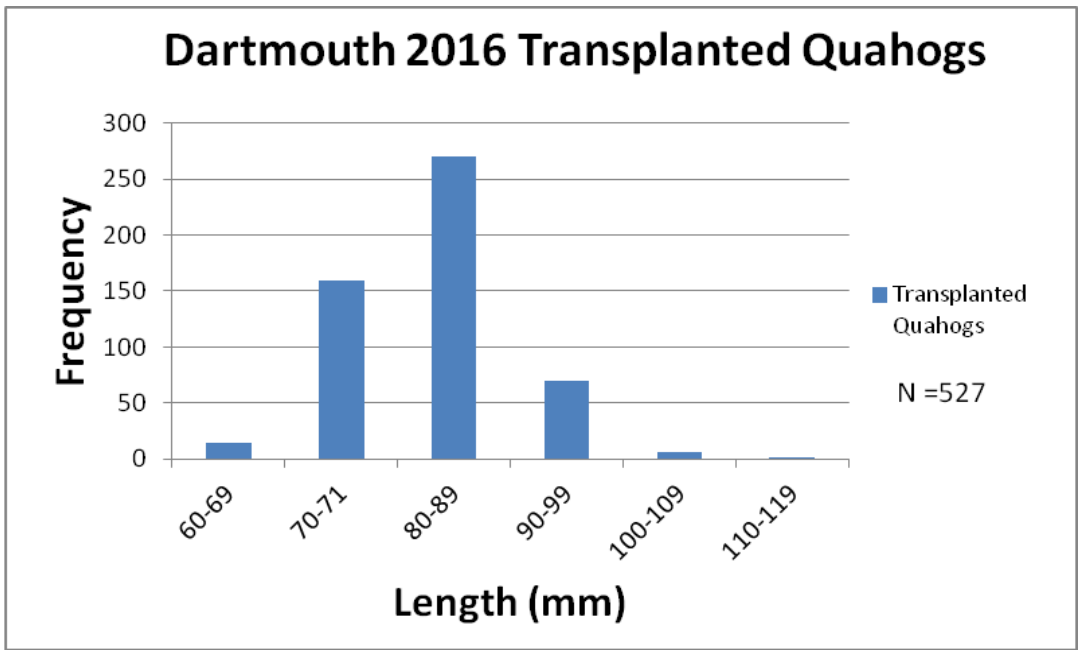


Figure 13. Transplanted Quahog Length Frequencies at Dartmouth B-120 Site.

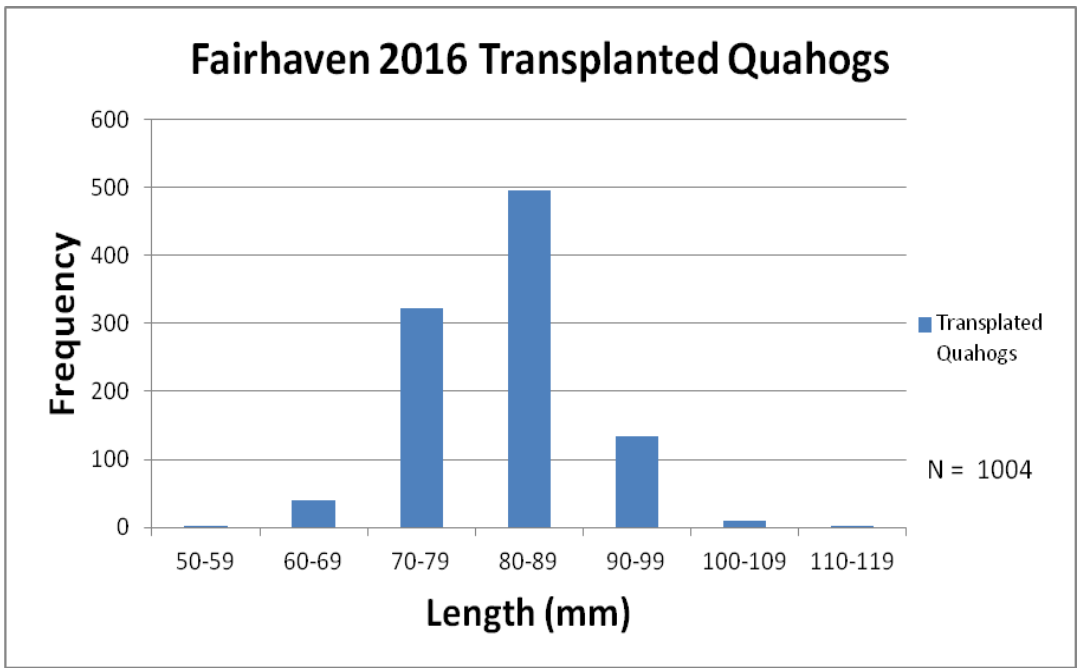


Figure 14. Transplanted Quahog Length Frequencies at Fairhaven B-120 Site.

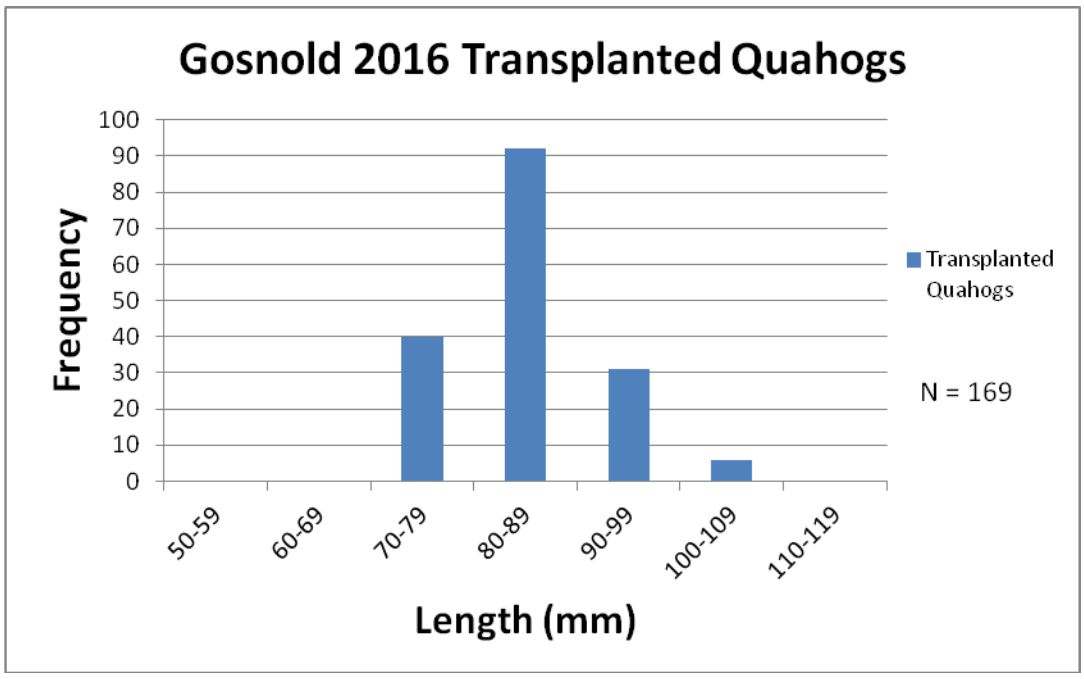


Figure 15. Transplanted Quahog Length Frequencies at Gosnold B-120 Site.

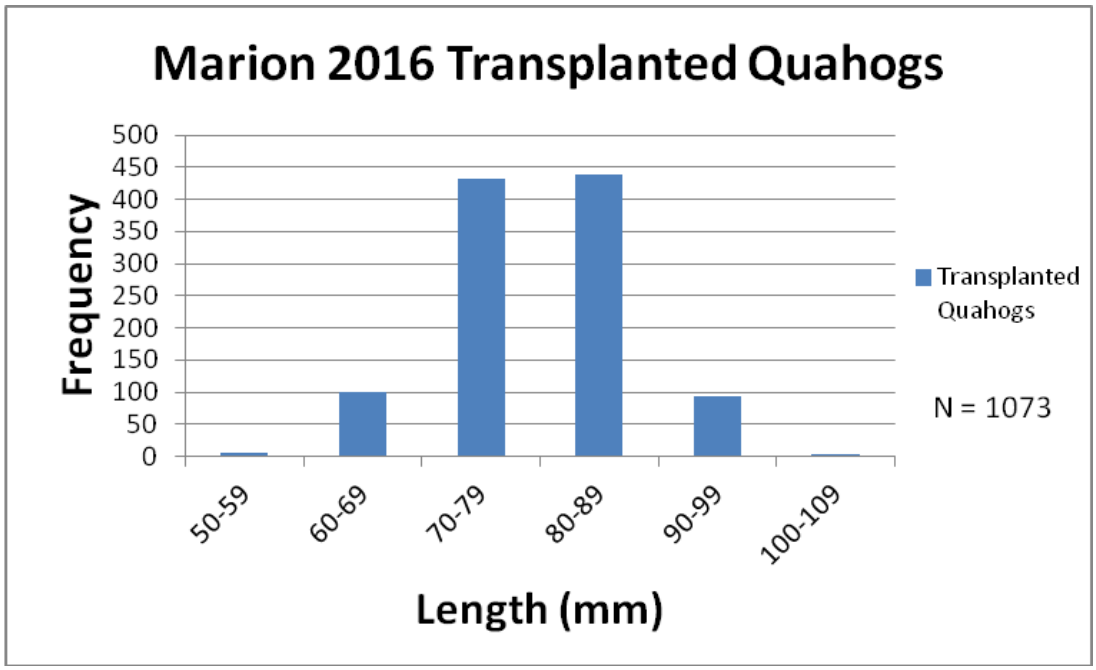


Figure 16. Transplanted Quahog Length Frequencies at Marion B-120 Site.

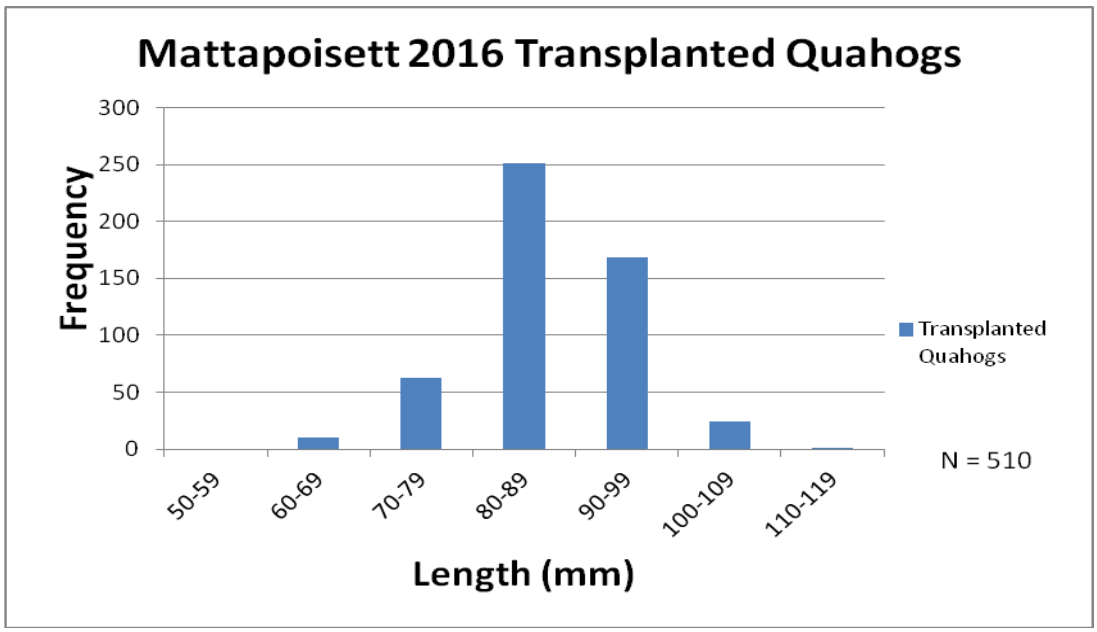


Figure 17. Transplanted Quahog Length Frequencies at Mattapoisett B-120 Site.

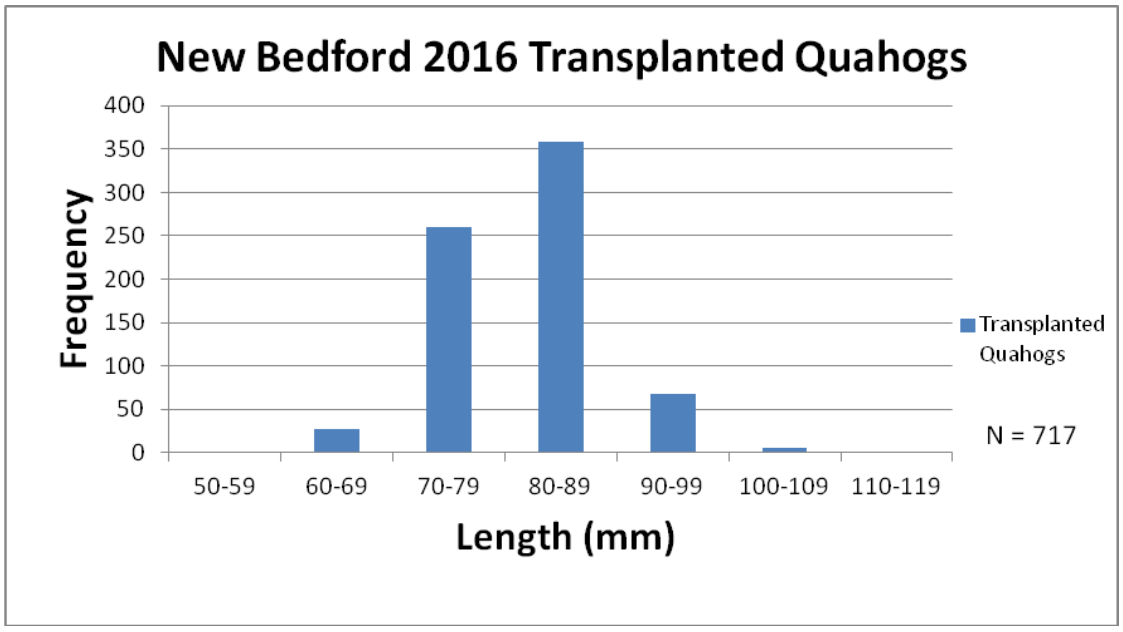


Figure 18. Transplanted Quahog Length Frequencies at New Bedford B-120 Site.

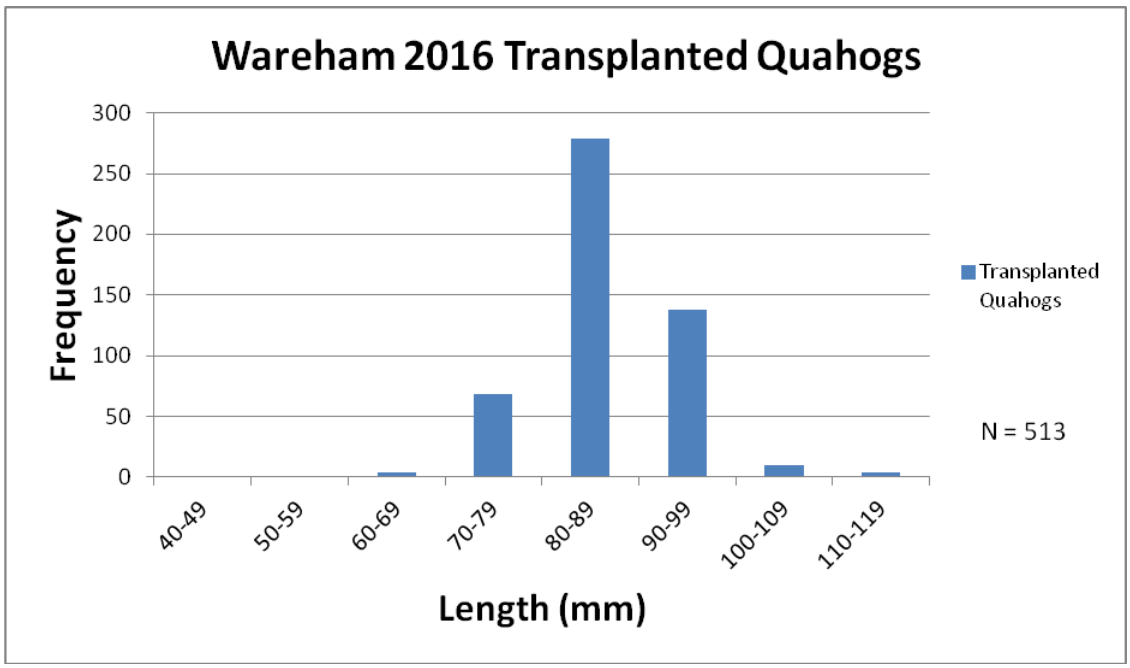


Figure 19. Transplanted Quahog Length Frequencies at Wareham B-120 Site.

Post-Transplant Monitoring Methods

Due to a shortage of personnel, only the 2015 transplant site in Westport was surveyed prior to reopening the area to recreational shellfishing. Post planting surveys were conducted at all 2016 quahog transplant sites. Survey results are described in the following section.

During 2017 DMF and, in some cases, municipal Shellfish Department staff, conducted post-planting surveys at B-120 sites in all nine participating Buzzards Bay municipalities in order to document survival and growth of the quahogs that were transplanted during 2015 and 2016. Survey methods consisted of standard belt transects or random collection of samples throughout the individual B-120 transplant sites. Survey methods within each town depended partially on the availability of shellfish department staff to assist with field work. When employing the standard belt transect method, the number, spacing, and length of each transect and number of sampled quadrats was determined by the transplant site area. For each transect, 1-ft^2 quadrats were dug using basket rakes to excavate the sediment to a depth of 8-12 inches. The number of quadrats collected at each site varied. All commercially important bivalve shellfish within quadrats were enumerated and the shell length measured. Within each quadrat, the substrate type, genus, and species of organisms, and percent cover of attached submerged aquatic vegetation was documented. A summary of post-planting survey results are presented below.

Post-Transplant Monitoring Results – 2015

Westport, The Let – Westport River, SE section

On August 29th, 2017, a post-planting shellfish survey was conducted by two *DMF* staff and the Westport Deputy Harbormaster. A boat was necessary and a bull rake (18-inch width) was utilized to dig 11 quadrats, each approximately 1 ft^2, at random locations within the planting area. GPS waypoints were

recorded at each quadrat for subsequent mapping. A total of 40 quahogs were found within the 11 quadrats for a density of 3.64 quahogs/ft^2. Substrate consisted of primarily soft mud and sand. Results of the survey are summarized in Table 3, and the length frequency of quahogs within the site is presented in Figure 20.

Mean (mm)	75.28
Min (mm)	70
Max (mm)	97
Total #	40
# Quadrats	11
Density/sq.ft	3.64

Table 3. Transplanted Quahog Summary Data Post-Planting at the 2015 Westport B-120 Site.

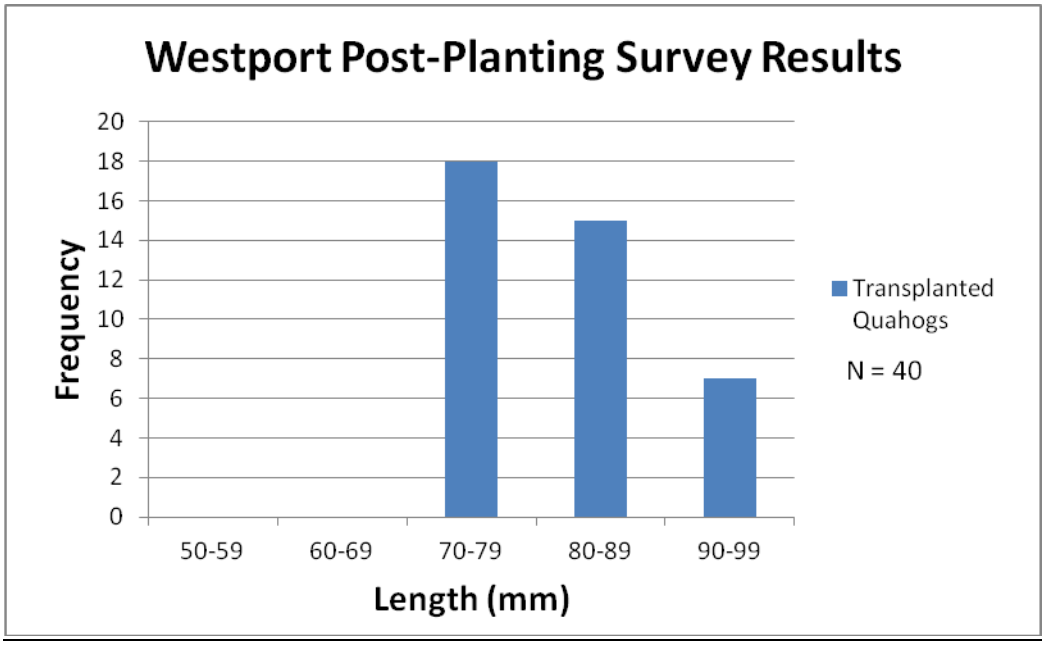


Figure 20. Transplanted Quahog Length Frequencies Post-Planting at the 2015 Westport B-120 Site.

Post-Transplant Monitoring Results – 2016

Bourne, Tahanto Flats

On May 22nd, 2017, a post-planting shellfish survey was conducted by three DMF and two Bourne Department of Natural Resources staff. The flat was composed of a sand and mud substrate, with sparse submerged aquatic vegetation (SAV) coverage consisting of *Laminaria* sp., *Enteromorpha* sp., and filamentous red algae (sp. unknown). Water depth at the site ranged between 0 to 1.5 ft. below the MLW mark. A total of six transects were sampled within the site and quadrats were dug using bull rakes. 164 quahogs were found within 102 1 ft^2 quadrats. Average quahog density at the site was estimated to be 1.6 quahogs/ft^2. Results of the survey are summarized in Table 4, and the length frequency of quahogs within the site is presented in Figure 21.

Mean (mm)	79.88
Min (mm)	18
Max (mm)	102
Total #	164
# Quadrats	102
Density/sq.ft	1.61

Table 4. Transplanted Quahog Summary Data Post-Planting at the Bourne B-120 Site.

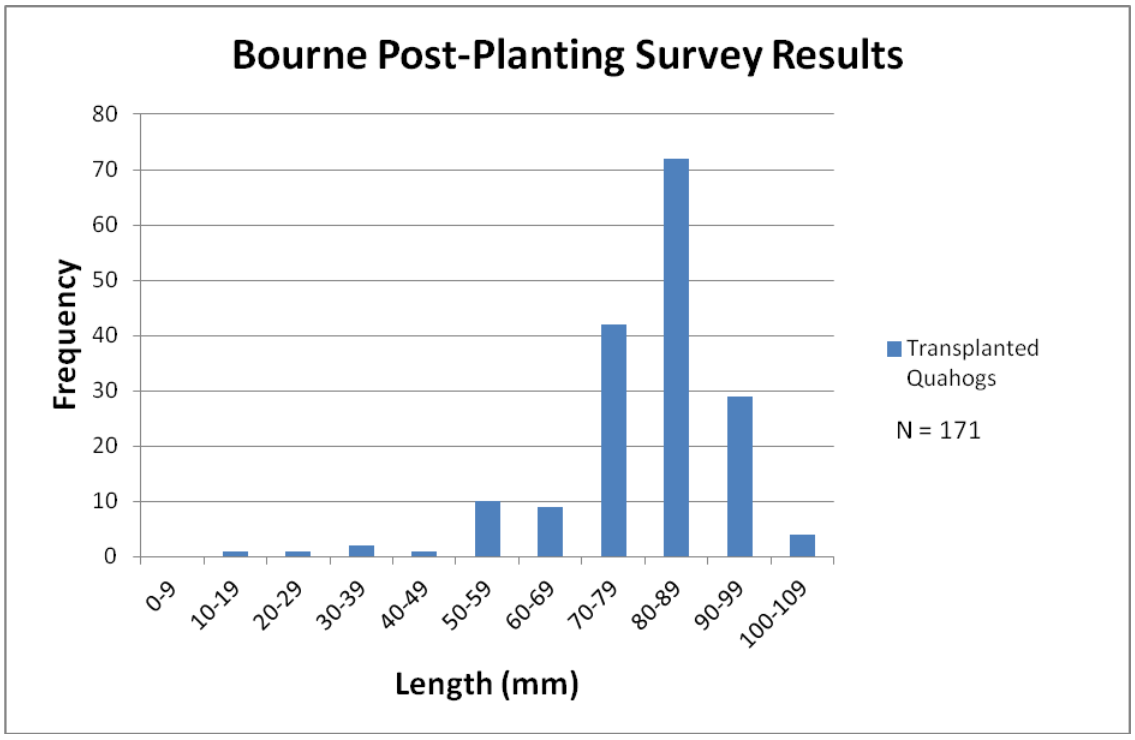


Figure 21. Transplanted Quahog Length Frequencies Post-Planting at the Bourne B-120 Site.

Dartmouth – Apponagansett Bay

On October 16th, 2017, two *DMF* staff conducted a survey of the 2016 B-120 quahog transplant site for the town of Dartmouth located off the north shore of Apponagansett Point Park. Water depth of the Apponagansett Bay site ranged between 0.5 ft. below and 1.5 ft. below the MLW mark. Sediment closest to shore was a firm mixture of gravel and sand. The intertidal zone had high densities of oysters and wild-set, resident quahogs (resident quahogs are lighter-colored, different than the transplanted quahogs from the Taunton River that are generally stained black from the dark-colored mud of the donor site). Sediment near shore was rocky, transitioning to a silt-mud mixture with large rocks interspersed throughout at depth. Vegetation observed was sporadic and included species of *Gracilaria, Codium*, and *Ascophyllum* (rockweed). A total of five transects were sampled within the site. Forty four quahogs were found within 25 ft^2 quadrats. Average quahog density at the site is estimated to be 1.76 quahogs/ft^2. Results of the survey are summarized in Table 5 and the length frequency of quahogs within the site is presented in Figure 22.

Mean (mm)	65.38
Min (mm)	13.4
Max (mm)	89.3
Total #	44
# Quadrats	25
Density/sq.ft	1.76

Table 5. Transplanted Quahog Summary Data Post-Planting at the Dartmouth B-120 Site.

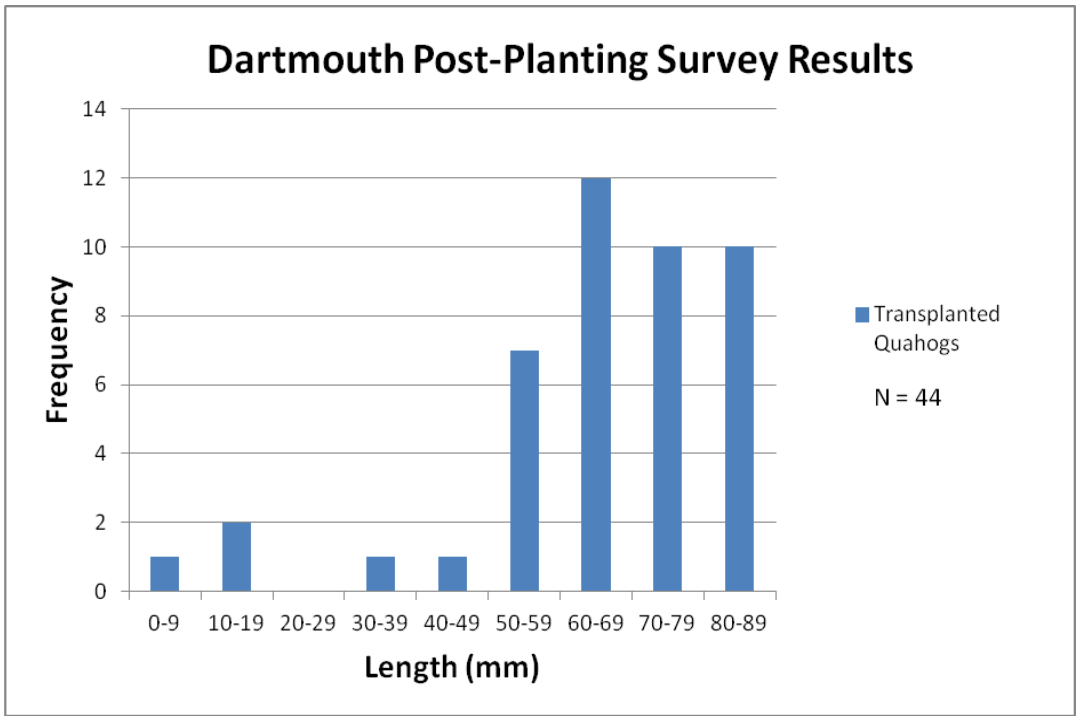


Figure 22. Transplanted Quahog Length Frequencies Post-Planting at the Dartmouth B-120 Site.

Fairhaven, Jacks Cove

A survey of the quahog restoration site in Jacks Cove was conducted by DMF and Fairhaven Shellfish Department staff on July 6th and July 7th, 2017. The substrate throughout the sampled area was a mixture of mud, sand, and gravel. On the first day, three transects were run perpendicular from shore on the western side of the cove. Eight 1-ft² quadrats, spaced 10 ft. apart, were sampled along each transect using basket rakes. A total of 78 quahogs were found within the 24 quadrats. On the second day, the survey team ran three similar transects on the eastern side of Jacks Cove. A total of 42 quahogs were found within 19 quadrats. When combining the sample results from both days, 120 quahogs were found in 43 quadrats. The density of quahogs within the transplant area is estimated to be 2.79 quahogs /ft². Results of the survey are summarized in Table 6 and the length frequency of quahogs within the site is presented in Figure 23.

Mean (mm)	70.63
Min (mm)	44.6
Max (mm)	99.7
Total #	120
# Quadrats	43
Density/sq.ft	2.79

Table 6. Transplanted Quahog Summary Data Post-Planting at the Fairhaven B-120 Site.

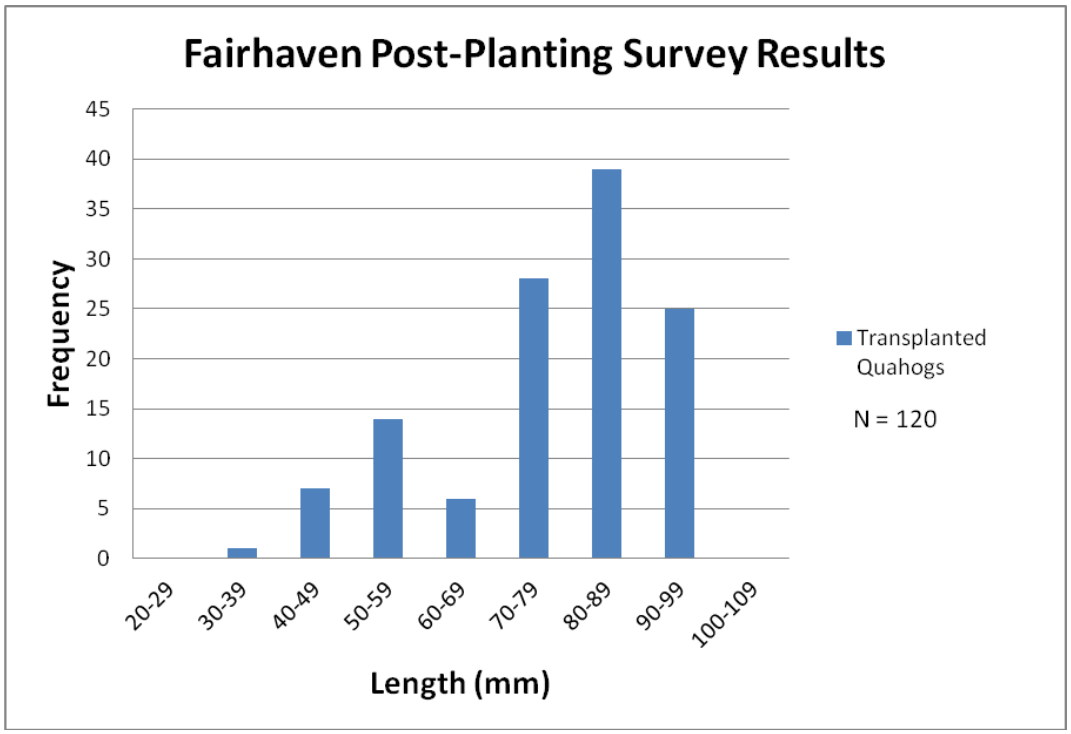


Figure 23. Transplanted Quahog Length Frequencies Post-Planting at the Fairhaven B-120 Site.

Gosnold, Nashawena Island

A survey of the quahog restoration site on Nashawena Island in Gosnold was conducted on August 28th, 2017 by three *DMF* staff. Quahogs were planted at water depths between 0 and 3 ft. below the MLW mark. Substrate was a mixture of firm sand, gravel, and mud. Two transects were walked parallel to the shoreline. Eleven 1-ft² quadrats, spaced 10 ft apart, were sampled along each transect using basket rakes. A total of 43 quahogs were found in 22 quadrats. Quahog density within the transplant area is estimated to be 1.95 quahogs /ft². Results of the survey are summarized in Table 7 and the length frequency of quahogs within the site is presented in Figure 24.

Mean (mm)	83.8
Min (mm)	38.5
Max (mm)	97.9
Total #	43
# Quadrats	22
Density/sq.ft	1.95

Table 7. Transplanted Quahog Summary Data Post-Planting at the Gosnold B-120 Site.

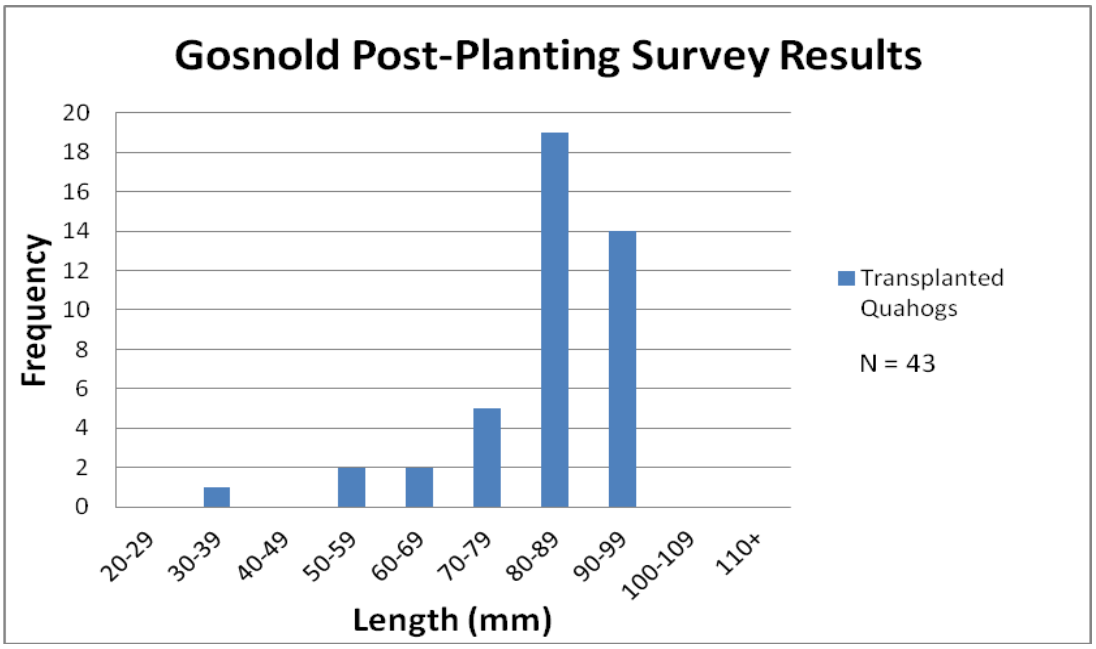


Figure 24. Transplanted Quahog Length Frequencies Post-Planting at the Gosnold B-120 Site.

Marion, Planting Island Cove

A survey of the quahog restoration site at Planting Island Cove in Marion was conducted on August 31st, 2017 by one DMF staff person and three Marion Shellfish Department staff. Quahogs were planted at water depths between 1 ft. below and 2.5 ft. above the MLW mark. The western section of the survey area contained a firm sand and gravel substrate. Moving east, this substrate transitioned to softer mud. Vegetation consisted primarily of patchy *Gracilaria* and filamentous red algae. Oysters and juvenile flounder were also observed during the survey.

Five equally spaced transects were run perpendicular to shore. Ten 1-ft² quadrats, spaced 10 ft apart, were sampled along each transect. A total of 162 quahogs were collected within the 50 quadrats. Quahog density within the transplant area is estimated to be 3.24 quahogs/ft². Results of the survey are summarized in Table 8 and the length frequency of quahogs within the site is presented in Figure 25.

Mean (mm)	78.2
Min (mm)	52
Max (mm)	104
Total #	162
# Quadrats	50
Density/sq.ft	3.24

Table 8. Transplanted Quahog Summary Data Post-Planting at the Marion B-120 Site.

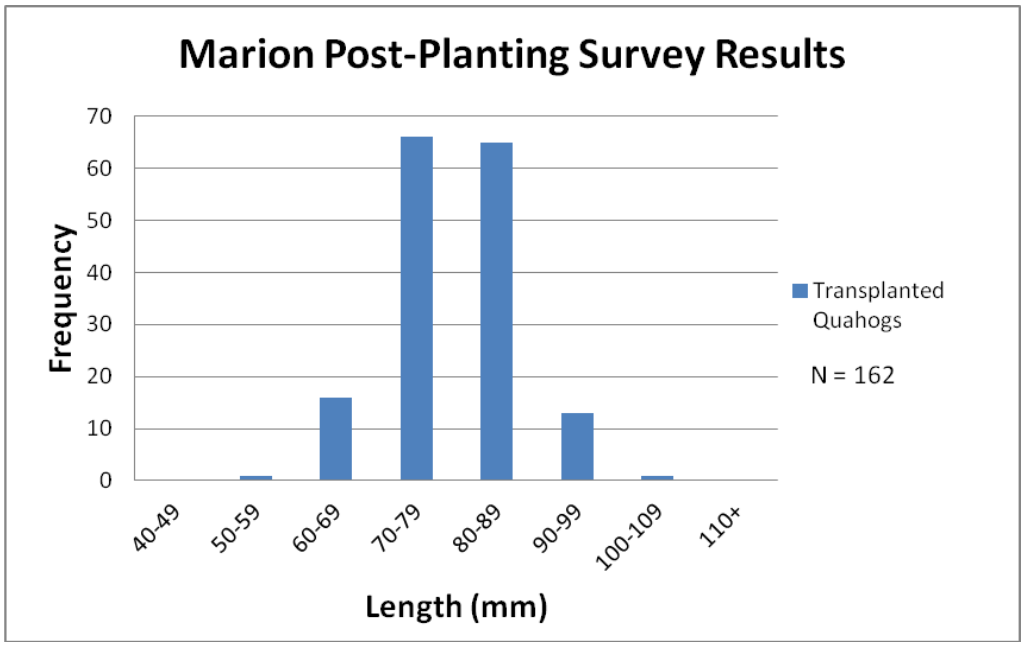


Figure 25. Transplanted Quahog Length Frequencies Post-Planting at the Marion B-120 Site.

Mattapoisett – Brandt Island Cove

A survey of the quahog restoration site at Brandt Island Cove in Mattapoisett was conducted on October 17th, 2017 by two *DMF* staff and two Mattapoisett Shellfish Department staff. Quahogs were planted within this 2.7-acre site at water depths between 2.7 and 2.4 ft. below the MLW mark. The western section of the survey area along the shore contained a firm sand and gravel substrate that transitioned to softer mud on the eastern side of the site. Vegetation consisted mostly of patchy *Gracilaria* and filamentous red algae. Oysters were also observed during the survey.

Six equally spaced transects were run perpendicular to shore. Five 1-ft² quadrats, spaced 10 ft apart, were sampled along each transect using hand rakes. A total of 162 quahogs were collected within the 50 quadrats. A total of 127 quahogs were collected within the 30 quadrats. Quahog density within the transplant area is estimated to be 4.23 quahogs/ft². Results of the survey are summarized in Table 9 and the size frequency of quahogs within the site is presented in Figure 26.

Mean (mm)	81.9
Min (mm)	26
Max (mm)	100
Total #	127
# Quadrats	30
Density/sq.ft	4.23

Table 9. Transplanted Quahog Summary Data Post-Planting at the Mattapoisett B-120 Site.

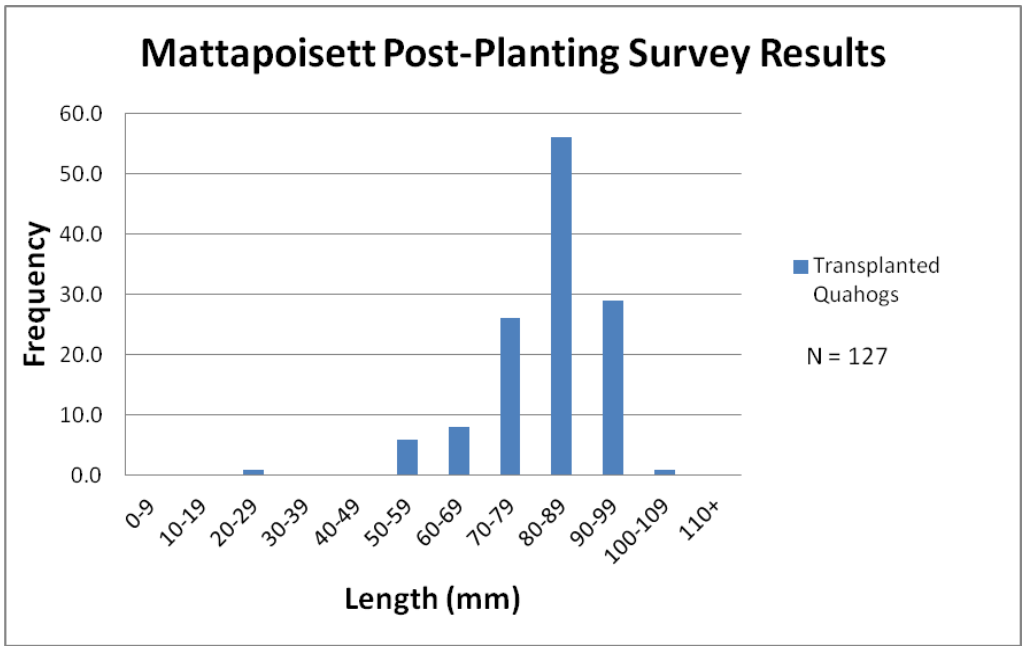


Figure 26. Transplanted Quahog Length Frequencies Post-Planting at the Mattapoisett B-120 Site.

New Bedford – Dudley Street, Clarks Cove

A survey of the quahog restoration site at the Dudley Street site in Clarks Cove, New Bedford was conducted on October 5th, 2017 by three *DMF* staff. Quahogs were planted within this 1-acre site at water depths between 0.8 and 10 ft. below the MLW mark. The bottom substrate consisted of a mixture of firmer rocky sand with gravel closer to shore, and transitioned to a silty mud at depth.

Six equally spaced transects were run perpendicular to shore. Twenty-four 1-ft² quadrats, spaced 15 ft. apart, were sampled along each transect using hand rakes. A total of 109 quahogs were collected within the 24 quadrats. Quahog density within the transplant area is estimated to be 4.5 quahogs /ft². Results of the survey are summarized in Table 10 and the size frequency of quahogs within the site is presented in Figure 27.

Mean (mm)	79.16
Min (mm)	45
Max (mm)	102
Total #	109
# Quadrats	24
Density/sq.ft	4.54

Table 10. Transplanted Quahog Summary Data Post-Planting at the New Bedford B-120 Site.

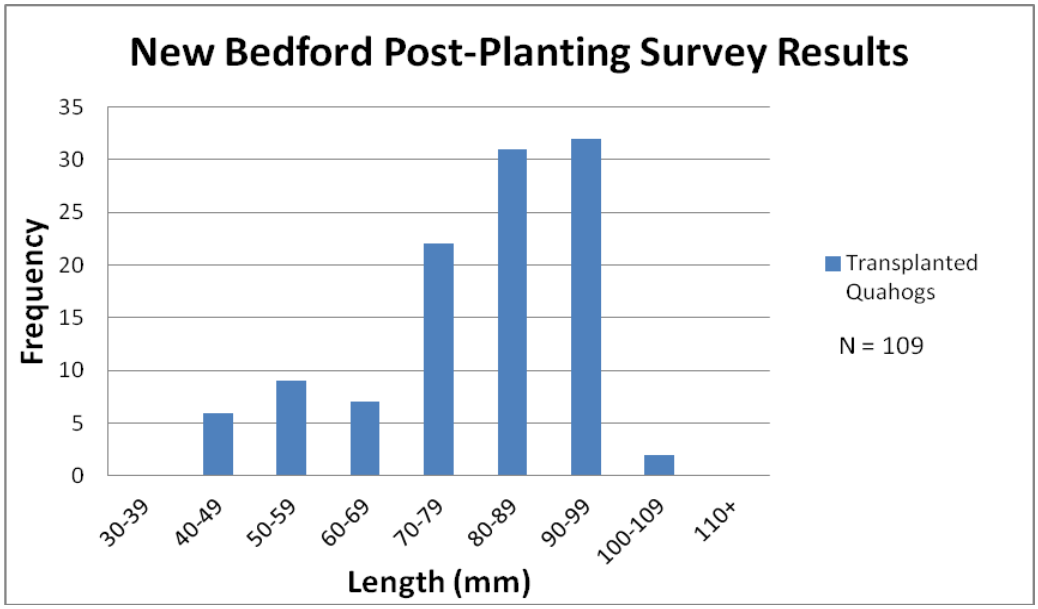


Figure 27. Transplanted Quahog Length Frequencies Post-Planting at the New Bedford B-120 Site.

Wareham – Sunset Cove

A survey of the 2016 B-120 quahog transplant site in Sunset Cove, was conducted on June 7th, 2018 by two *DMF* staff. An estimated 151,164 quahogs (884 bushels) were planted across 2 acres during the fall of 2016. Water depth at this site ranges from 0-2.5 ft. below the MLW mark. Substrate within the shallower areas along shore and on a shoal on the northeastern portion of the site consisted of firm sand and gravel. Deeper areas within the site consisted of soft mud/silt with some rocks and seaweed.

Following reconnaissance of the site and discussions with local residents that were present when the quahogs were planted in November 2016, the survey team determined that the quahogs were planted in a narrow 30-50 ft. band running parallel to shore in deeper water. The survey team randomly sampled 36 1-ft^2 quadrats throughout the redefined area using basket rakes. A total of 70 quahogs were collected within the 36 quadrats. Quahog density within the transplant area is estimated to be 1.94 quahogs/ft^2. Results of the survey are summarized in Table 11 and the size frequency of quahogs within the site is presented in Figure 28.

Mean (mm)	84.22
Min (mm)	51.3
Max (mm)	105.2
Total #	70
# Quadrats	36
Density	1.94

Table 11. Transplanted Quahog Summary Data Post-Planting at the Wareham B-120 Site.

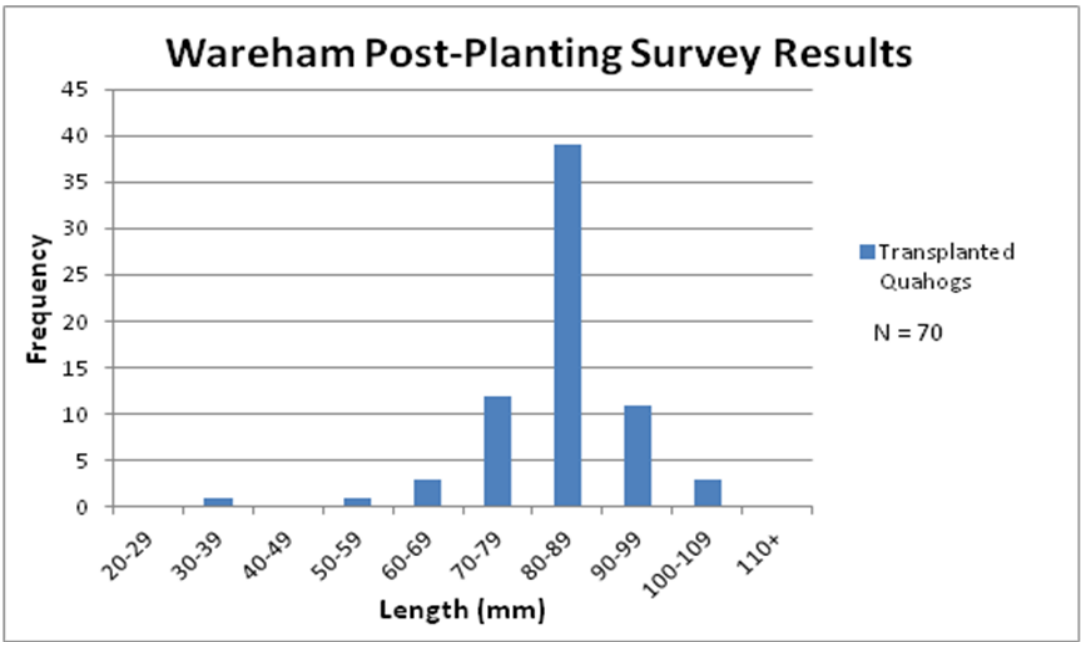


Figure 28. Transplanted Quahog Length Frequencies Post-Planting at the Wareham B-120 Site.

Westport – The Let, East Branch of Westport River

A survey of the 2016 B-120 quahog transplant site in Sunset Cove, was conducted on May 14th, 2018 by one *DMF* staff member and the Westport Shellfish Constable. An estimated 155,873 quahogs (801 bushels) were planted across approximately 8 acres during the fall of 2016. Water depth at this site ranges from 0.5 and 1.5 ft. below the MLW mark.

Sampling was conducted from the Shellfish Department's boat using an 18-inch wide bullrake. Twenty randomly placed 1.3 ft^2 quadrats were dug throughout the planted area. A total of 34 quahogs were collected within the 20 quadrats. Quahog density within the transplant area is estimated to be 1.7 quahogs/ft^2. Results of the survey are summarized in Table 12 and the size frequency of quahogs within the site is presented in Figure 29.

Mean (mm)	68.55
Min (mm)	62
Max (mm)	110
Total #	34
# Quadrats	20
Density/sq.ft	1.7

Table 12. Transplanted Quahog Summary Data Post-Planting at the Westport B-120 Site.

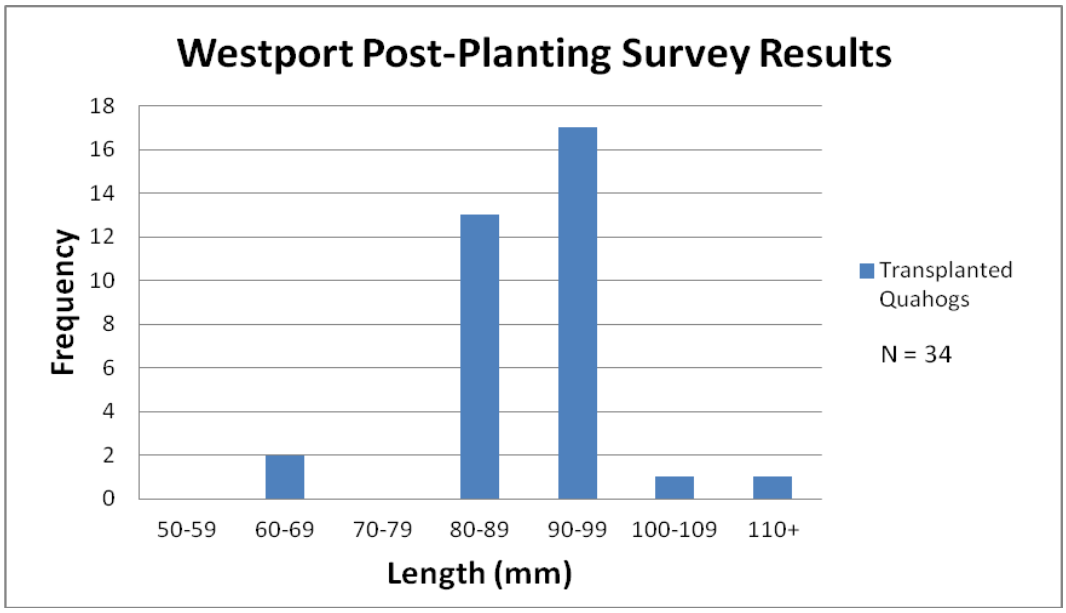


Figure 29. Transplanted Quahog Length Frequencies Post-Planting at the Westport B-120 Site.

Below is a table of summary data (Table 13) from the resident quahog populations at B-120 sites prior to transplanting and the results of the post-planting surveys 1-2 years following the transplants. As expected, mean densities at all sites increased following the quahog transplants. Mean quahog length increased at six of the ten B-120 transplant sites where post-planting surveys were conducted (one 2015 site and nine 2016 sites). Mean quahog length decreased at the four sites in Dartmouth, Marion, New Bedford and Westport. The observed difference in mean length is most likely related to the different size range of quahogs planted at these sites. Transplanted quahog size ranged widely between 50 mm and 108mm at these sites. Post-transplant survey teams may have inadvertently sampled a higher number of smaller quahogs than were sampled during the transplant. Additionally, the observed variations in mean length may also be attributed to the fact that DMF did not distinguish between resident and transplanted quahogs when conducting field surveys. In sites containing an abundance of smaller resident quahogs, mean lengths of resident and transplanted quahogs may be skewed as a result.

Town	Site Name	Year Planted	Post-Planting Survey Date	Pre-Planting Density	Post-Planting Density	Pre-Planting Mean Length (mm)	Post-Planting Mean Length (mm)
GOSNOLD	West End-Cuttyhunk Pond	2015	n/a	0.26	n/a	71.39	n/a
MATTAPOISETT	Hiller Cove	2015	n/a	0.11	n/a	53.79	n/a
NEW BEDFORD	Oaklawn Street - Clark's Cove	2015	n/a	0.95	n/a	n/a	n/a
WESTPORT	The Let - Westport River, SE Section	2015	7/29/2017	0.05	3.64	71.2	75.28
BOURNE	Tahanto Flats	2016	5/22/2017	0.5	1.61	66.06	79.88
DARTMOUTH	Apponagansett Bay	2016	10/16/2017	0.3	1.76	80.43	65.38
FAIRHAVEN	West Island North, Jack's Cove	2016	7/6/2017	0.07	2.79	51.78	70.93
GOSNOLD	Nashawena	2016	8/21/2017	0.04	1.95	75.2	83.8
MARION	Planting Island Cove	2016	8/31/2017	0.02	3.24	108	78.2
MATTAPOISETT	Brandt Island Cove	2016	10/17/2017	0.19	4.23	65.85	81.9
NEW BEDFORD	Dudley St. Clark's Cove	2016	10/5/2017	0.36	4.54	80.43	79.16
WAREHAM	Sunset Cove	2016	6/7/2018	0.15	1.94	65.64	84.22
WESTPORT	The Let - Westport River, NE Section	2016	5/14/2018	0.1	1.7	82.18	68.55

Table 13. Summary data for the pre-transplant and post-transplant quahog populations at each 2015 and 2016 B-120 site.

Condition Index Methods and Results

In 2016 and 2017, *DMF* collected samples of transplanted quahogs from the B-120 study sites in Marion, Fairhaven, and Bourne for the determination of Condition Index (CI). The 2016 sample was taken at the time of harvest from the Taunton River and the 2017 sample was taken during the fall, one year post-transplant. Although condition index is not a direct indication of the reproductive potential of an organism, it is a good indicator of its general condition, gonadal development, and health (Marroquin-Mora and Rice, 2008). Twenty quahogs were collected from each site for lab processing and in determining the CI. At the *DMF* New Bedford Lab, staff used the procedures and formula of Crosby and Gale (1990) to determine the CI of the collected quahogs:

CI = [dry soft tissue wt. (g) X 1,000/total weight g) – shell weight (g)

All weights were estimated to the nearest 0.1 g. During August 2016, quahogs were collected upon delivery to each of three B-120 quahog relay sites. Approximately one year after transplanting, in September and October 2017, another sample of twenty quahogs was collected from each site to determine CI and assess any changes in quahog health across the year. The CI results from both years are presented in Table 14. Due to a malfunction of the drying oven, 2016 CI results for quahogs destined for Sippican Harbor in Marion were compromised, and therefore, not presented.

Town	Site	Sampling Period	Mean Length (mm)	CI Range	Mean CI	SD (n=20)	CI Category
Bourne	Tahanto Flats	Aug. 2016	81.6	50.74 - 85.47	67.6	12.85	Good
Bourne	Tahanto Flats	Oct. 2017	89.5	59.89 - 91.04	76.56	7.96	Good
Fairhaven	Jack's Cove	Aug. 2016	90.8	37.8 - 94.05	71.12	15.94	Good
Fairhaven	Jack's Cove	Sept. 2017	62.5	62.06 - 107.09	80.58	11.39	Good
Marion	Planting Island Cove	Aug. 2016	84.4	n/a	n/a	n/a	n/a
Marion	Planting Island Cove	Sept. 2017	89.6	32.99 - 79.86	55.99	11.32	Fair

Table 14. 2016-2017 B-120 Condition Index Summary.

Condition index values of the quahogs relayed to Bourne and Fairhaven in 2016 were similar to those reported by Marroquin-Mora and Rice (2008) in Narragansett Bay during August. These values both increased during the year, either indicating an improvement in health and reproductive potential or reflecting the seasonality and presence of spawning activity around these times. It has been demonstrated that CI values often increase before spawning periods, followed by a decrease post-spawning (Marroquin-Mora and Rice 2008). Condition index for quahogs in Marion is much lower, although we do not have the comparison between years for this site. Decreased mean quahog lengths in Fairhaven between 2016 and 2017 was most likely an effect of sampling, as fishing was not a factor; there could have been greater numbers of resident quahogs in the later sampling which are often smaller than the transplanted individuals, and would thus decrease the mean size.

It is believed that CI in the range of computed values of upper 60s to 70s indicates generally good condition, with documented values for quahogs ranging from below 60 to over 100 (Marroquin-Mora and Rice 2008). *DMF* will continue to monitor CI at future B-120 quahog relay sites, and will strive to maintain consistent timing in seasonal sampling in order to accurately compare CI values across years.

II. Quahog Upwellers and Out-Planting

Methods and Results

During 2016, DMF oversaw a program whereby the towns of Wareham, Dartmouth, and Fairhaven purchased upwellers for growing out small quahog seed for restoration of recreational fishing areas in 2017. *DMF* supervised the purchase of three upwellers for use in quahog seed grow-out. The towns were responsible for all costs associated with operation of the upwellers, including electricity and routine maintenance. Each town operated and maintained the upweller facilities to produce larger-sized quahog seed for placing into priority shellfish sites managed for sustainable recreational shellfisheries. Quahog seed from a commercial hatchery was grown-out in the upwellers for eventual outplanting at selected sites in 2017. The three town Shellfish Departments plan on continued use of the upwellers purchased with B-120 funds as part of their ongoing annual municipal shellfish restoration programs. These upwellers will be utilized by Dartmouth, Fairhaven and Wareham well after B-120 funds have expired. Pictures of the systems are presented below in Figures 30-32.

The towns of Dartmouth, Fairhaven and Wareham purchased the flupsy-style upwellers from Atlantic Aquaculture Supply during the winter of 2016. Staff from the three towns and DMF constructed three upwellers. Dartmouth and Fairhaven constructed 8 ft. x 20 ft. wooden docks and installed eight 2 ft. x

2ft fiberglass silos affixed to a 2 ft. x 8 ft. trough for each system. Using additional town funds, Wareham built a larger 8 ft. x 40 ft. dock that contains 14 silos. During the spring 2017, the upwellers were transported via trailer to locations within their respective towns surveyed by *DMF* for suitability and compliance with all applicable regulations and guidelines. Each municipality received 185,000 (5-8 mm) seed from Bill Avery's Quality Bay Clams LLC, and began grow-out during July 2017. Fairhaven and Wareham out-planted the quahogs under predator-control nets, and Dartmouth free broadcasted the quahog seed at the grow-out site.

Figure 30. Photo of Upwellers at the Dartmouth B-120 Site.

Figure 31. Photo of Upwellers at the Fairhaven B-120 Site.

Figure 32. Photos of Silos and Quahog Seed at the Town of Wareham B-120 Upweller.

Fairhaven

During the summer and fall 2017, *DMF* staff collected data on upweller quahog growth prior to out-planting at selected restoration sites in Wareham, Fairhaven and Dartmouth. In August, the three towns each received 185,000 quahog seed ranging from 5 to 8 mm in length. Following delivery, *DMF* staff carried out approximately bi-weekly checks on the upweller, monitoring the operation of the unit and taking random subsamples of quahogs for length measurements. In order to establish a growth rate for the seed, DMF employees randomly selected a representative sample of quahogs for analysis. Each silo was sampled and aggregated, such that a minimum of 50 individuals were measured to the nearest 0.1 mm using calipers.

Fairhaven started and finished with their quahogs in 6 silos. Due to how the FLUPSYs were constructed, they were unable to attach the 7th and 8th silos that would have allowed them to reduce the density of clams in the primary 6 silos as the clams grew. The quahogs were counted on November 14th, 2017 prior to being planted on November 14th and 15th. At the time of planting, the quahogs averaged 9.9 mm in length, ranging from 7.1 to 13.5 mm. Fairhaven successfully planted 155,376 animals for an upweller survival rate of 84.0%. As shown in Figure 33, variability in size measurements increased over the sampling period and quahog lengths plateaued in October and November. Based on the apparent

reduction in mean length during the same period, we expect the observed mortality was primarily associated with larger quahogs. The town has increased their upweller capacity for the 2018 season and it is expected that the ability to reduce the density of individual silos as the quahogs grow will increase growth and survival rates in later months. Sampling results are presented in Figure 33 below.

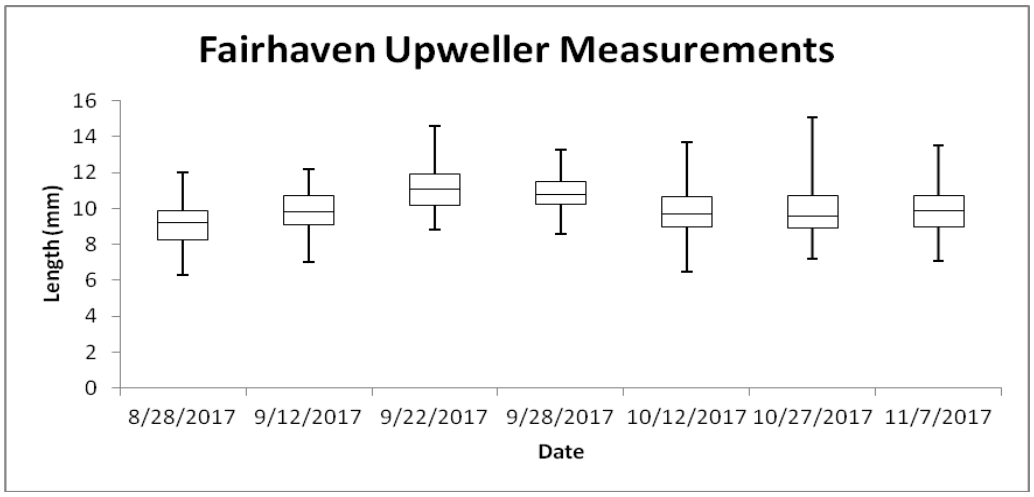


Figure 33. Length Measurements from Upweller Quahogs at the Fairhaven B-120 Site.

Pre-Planting Site Surveys – Round Cove, Nasketucket Bay, Fairhaven

On November 13th, 2017, *DMF* and Fairhaven harbormaster personnel conducted a survey of the potential planting site to determine habitat suitability and compliance with the goals of the B-120 trustee's restoration plan. The quahog site is located on the northern shore of Round Cove, a protected cove on the Western side of West Island (DSGA:BB18), classified as approved. The cove can be accessed by the public via Dogwood Street, and both Round Cove and Senior Cove to the north are popular recreational shellfishing areas.

Seven transects of five quadrats were sampled, yielding a total of 38 quahogs. Density is estimated to be 1.1 quahogs /ft² within the area surveyed. Substrate within the site consisted of equal amounts of sand and mud, with sand and gravel dominating closer to shore. Water clarity was good. A map of the quahog planting area is presented in Figure 34 and the pre-planting survey results are presented in Table 15.

Figure 33. Map of the Pre-Planting Survey Area at the Fairhaven B-120 Site.

Mean (mm)	47.7
Min (mm)	20.2
Max (mm)	79.8
Total #	38
# Quadrats	35
Density/sq.ft	1.1

Table 15. Resident Quahog Summary Data Pre-Planting at the Fairhaven B-120 Site.

Quahog Seed Planting

Prior to outplanting, total number of quahogs within the upwellers in Wareham, Fairhaven and Dartmouth were estimated using volumetric calculations. Upweller silos were washed down and dead animals were culled and discarded. Triplicate samples of quahogs from all silos were randomly collected and utilized to determine how many wet packed animals were held within a 100 ml volume. The total volume of quahogs (L) within all silos was measured, and this volume was used to approximate the total number of quahogs within the upweller system.

Fairhaven and Wareham each broadcast-planted quahogs from the upwellers under 14 ft. x 30 ft. predator exclusion nets (Figure 34). Target planting density was 40-50/ft^2. Nets were constructed using shade cloth which is typically used by commercial greenhouses. Prior to planting the quahogs, the footprint of each net was raked using standard garden rakes in order to remove potential predators, including crabs and conch. Small gill nets were attached to the bottom of the nets in order to float the nets off the bottom, and ten-foot pieces of rolled steel rod (A36 ¼ inch) were fastened to the perimeter of the nets using cable ties to secure the edges. Ten-inch staples, constructed of the same rolled steel stock were used to anchor the perimeter of each net to the substrate. Prior to planting, quahogs destined for each net were counted using the volumetric method and placed in numbered nylon meshed bags.

Figure 34. Photos of Predator-Exclusion Net Deployment at the Wareham B-120 Site. Similar methods were used at the Fairhaven B-120 site.

Out-planting - Round Cove, Nasketucket Bay, Fairhaven

On November 14th and 15th, 2017, approximately 155,376 seed quahogs were planted under seven predator exclusion nets at the Round Cove restoration site in Fairhaven by a small crew of DMF and Shellfish Department staff. Due to the time constraints of a marginal low tide and small crew size, only 4

nets were seeded with quahogs on November 14th. Overnight, the remaining quahogs were held in a walk-in refrigerator and were planted the following morning

The estimated area where quahogs were planted under the nets in Round Cove was 0.15 acres (Figure 35). This is smaller than the 0.31-acre area that was surveyed November 13th 2017.

Figure 35. Map of the Planting Area at the Fairhaven B-120 Site.

Wareham

Quahog Upweller Monitoring

Wareham started their quahogs in 4 silos, and over the course of the season reduced silo density until the quahogs were spread among 13 silos. Unlike Fairhaven and Dartmouth, Wareham already had 2 FLUPSYs in operation, and utilized this to their advantage. The quahogs were counted on November 6th, 2017, prior to being planted. At the time of planting, the quahogs averaged 12.7 mm in length, ranging from 9.3 to 17.4 mm. Wareham successfully planted 87,685 animals for an upweller survival rate of 47.4%. Wareham achieved the best growth rate across the three participating towns, but the survival rate was significantly lower than the other towns. This is likely due to a severe storm that impacted the area on October 29th through the 30th, and which resulted in the displacement of three to four silos. The town maintained a detailed record of the timing and frequency with which they cleaned their upweller, as well as took their own length measurements to supplement DMF data. Sampling results are presented in Figure 35 below.

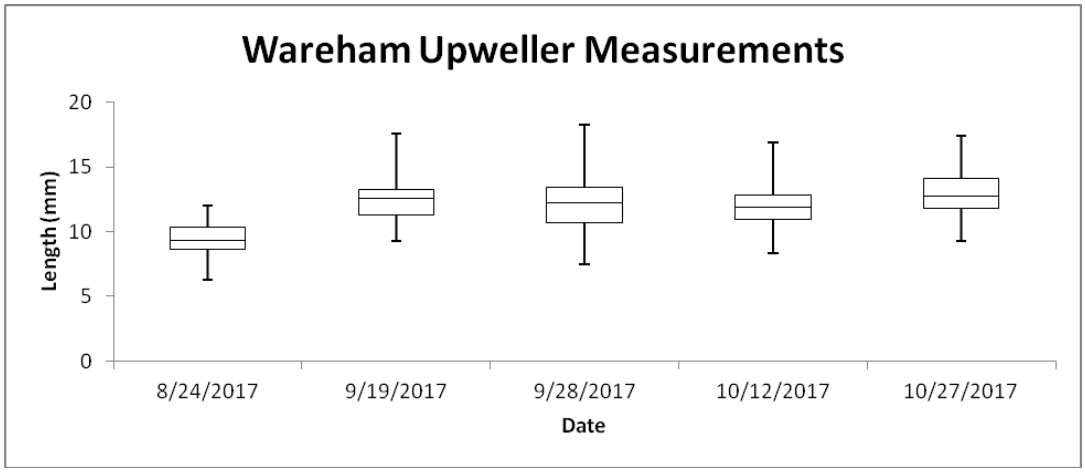


Figure 35. Length Measurements from Upweller Quahogs at the Wareham B-120 Site.

Pre-Planting Site Surveys – Lydia's Island, Onset Bay, Wareham

On November 1st, 2017 *DMF* and Wareham harbormaster personnel conducted a survey of the potential planting sites to determine habitat suitability and compliance with the goals of the B-120 trustee's restoration plan. The quahog site is located on the northern shore of a peninsula called Lydia's Island, south of Wickett's Island within Onset Bay (DSGA:40), classified as approved (Figure 37). Land abutting the site is owned by the Buzzards Bay Coalition and designated as a conservation area. The coalition also owns Wickett's island north of the site. Currently there is no public access agreement through the upland BBC-owned property and the site can only be accessed by boat at this time. The site will be closed to harvest for 2-3 years and the town is evaluating the potential to secure site access.

Ten transects of five quadrats were dug, yielding a total of 44 quahogs. Density is estimated to be 0.88 quahogs /ft² within the area surveyed. Substrate within the site consisted mostly of fine sand with little rocks and vegetation. Water clarity was > 5'. Survey results are presented in Table 16.

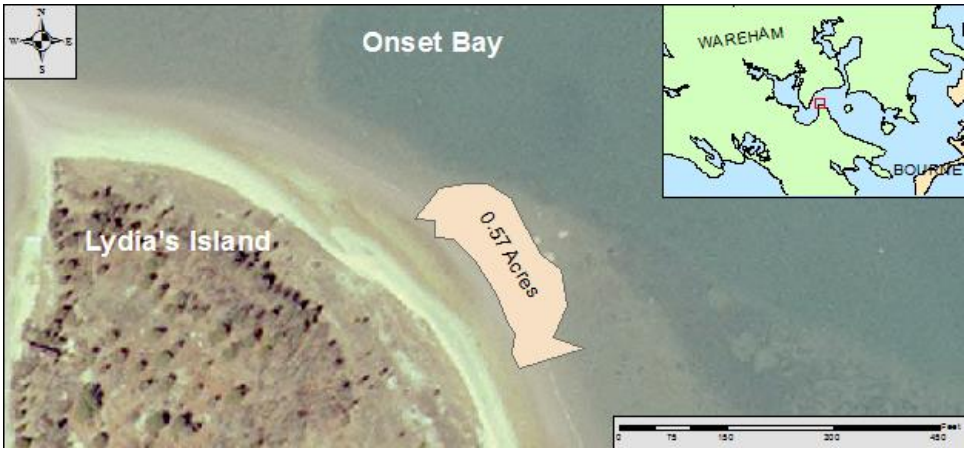


Figure 37. Map of the Pre-Planting Survey Area at the Wareham B-120 Site.

Mean (mm)	68.2
Min (mm)	35
Max (mm)	109
Total #	44
# Quadrats	50
Density/sq.ft	0.88

Table 16. Resident Quahog Summary Data Pre-Planting at the Wareham B-120 Site.

Out-planting – Lydia's Island, Wareham

On November 6th, 2017, approximately 87,685 seed quahogs were planted under five predator exclusion nets at the Lydia's Island restoration site in Wareham. An estimated 3-4 silos worth of quahogs were lost and deposited under the upweller during a record breaking storm on October 29th – 30th. The field crew consisted of three Shellfish Department staff, three *MarineFisheries* staff and seven volunteers from the Buzzards Bay Coalition. Town boats were used to ferry the field crew and equipment to the site from the Harbormaster's office on Onset Pier.

Staff and volunteers were split into two groups. One group began assembling nets while a second team measured out the plots, marked the four corners of each net footprint using 5 ft. lengths of PVC, and began to rake the footprints clean. Upon completion of the raking this team assisted the first team in completing the nets. Once all nets were assembled, plots were cleaned and quahogs were seeded, each net was placed over its plot individually and stapled in place. The actual estimated area where quahogs were planted under the nets was 0.08 acres (Figure 38).

Figure 38. Map of the Quahog Seed Planting Area at the Wareham B-120 Site.

Dartmouth

Quahog Upweller Seed Monitoring

Dartmouth started and finished with their quahogs in 6 silos. Due to how the FLUPSYs were constructed, the town was unable to attach the 7th and 8th silos that would have allowed them to

reduce the density of clams in the primary 6 silos as they grew. The quahogs were counted on November 9th 2017, prior to being planted. At the time of planting, the quahogs averaged 8.4 mm in length, ranging from 5.3 to 13.4 mm. Dartmouth successfully planted 49,948 animals for a survival rate of 27.0%. The town did not maintain a record of when or how often they cleaned the upweller. Over the course of the season, it became apparent that staffing issues in Dartmouth were taking their toll on the project. Despite the best efforts of the Harbormaster and a part-time assistant, thick fouling consistently built up on the undersides of the silos, most likely preventing food from being drawn in. The quahogs were also kept in bags, hung from the center pipe, two per silo with the exception of one silo with four bags. Dead shell was frequently observed during the routine check-ups. Dartmouth has made arrangements for the 2018 season to partner with the Community Boating Center (CBC), a local, non-profit organization. CBC staff and students assist with upweller maintenance as part of the CBC's new aquaculture education program. The increased capacity that CBC brings will hopefully result in better maintenance and higher growth and survival rates in future years.

Sampling results are presented in Figure 39 below.

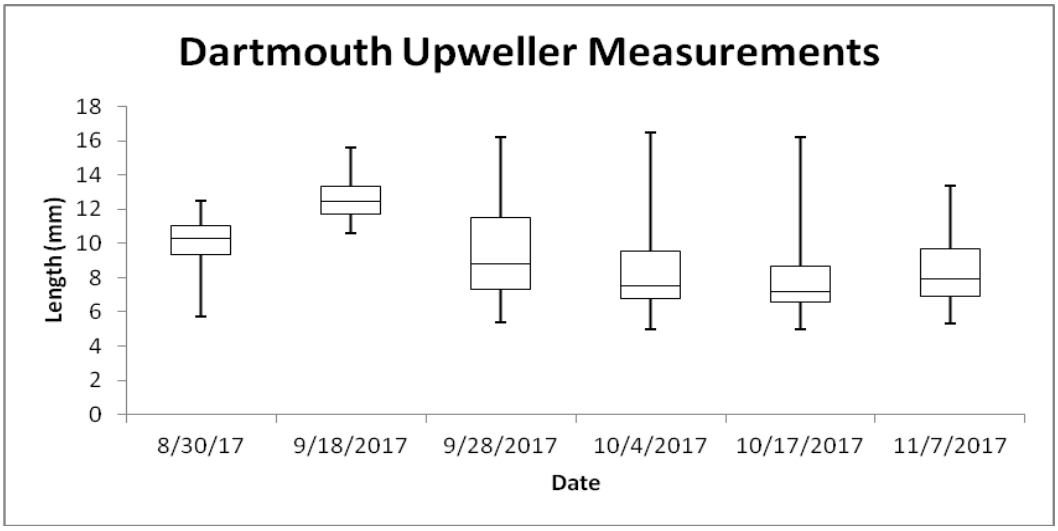


Figure 39. Length Measurements from Town of Dartmouth Upweller Quahog Seed.

Pre-Planting Site Surveys – Bush Point, Apponagansett Bay, Dartmouth

On October 31st, 2017, a pre-planting survey was conducted in order to determine the suitability of potential planting sites. The survey was conducted by DMF shellfish personnel with assistance from Dartmouth Shellfish Constable Steve Melo and a volunteer.

The proposed site was located at Bush Point (BB:12.5) within Apponagansett Bay (Figure 40). Thirty-six one-square- ft^2 quadrats were raked along ten transects. Habitat varied between more gravelly substrate close to shore and along the northern portion of the site to a mixture of sand and silt in the southern and middle sections of the site. A total of 50 quahogs were observed and density was estimated at 1.39 quahogs/ ft^2.

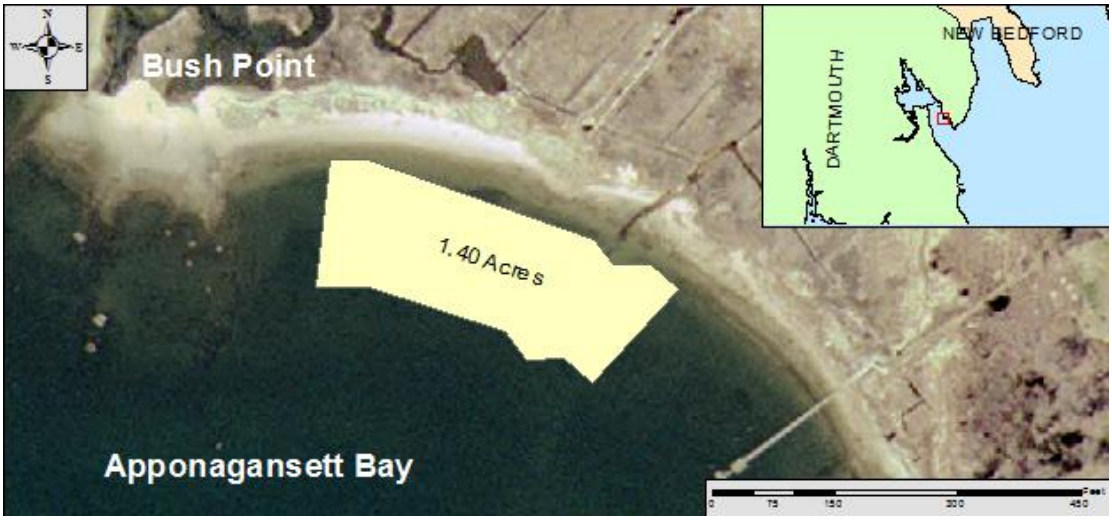


Figure 40. Map of the Pre-Planting Survey Area at the Dartmouth B-120 Site.

Mean (mm)	57.8
Min (mm)	13
Max (mm)	88
Total #	50
# Quadrats	36
Density/sq.ft	1.39

Table 17. Resident Quahog Summary Data Pre-Planting at the Dartmouth B-120 Site.

Out-planting – Bush Point, Apponagansett Bay, Dartmouth

Dartmouth did not use predator exclusion nets. Shellfish Department and DMF staff free broadcasted the quahog seed at the B-120 restoration site (Figure 41) from a town owned boat.

On November 9th, 2017, DMF and Dartmouth Shellfish Department staff planted approximately 49,948 upweller reared quahogs at the Bush Point restoration site in Apponagansett Bay. Using a portable GPS, the crew marked the four corners of a small area within the restoration site that was previously surveyed on October 31st, 2017. The quahogs were broadcasted from the rear of a town-owned 18 ft. skiff which ran multiple transects within the marked area totaling an estimated 6572 $ft.^2$ (0.14 acres). It is estimated that quahogs were planted at a density of approximately 7.6 quahogs per ft^2.

Figure 41. Map of the Planting Area at the Dartmouth B-120 Site.

Post-Planting Survey Methods and Results

DMF and town Shellfish Department staff conducted post-planting surveys of out-planted, upweller-reared quahogs in Wareham and Fairhaven in May and June 2018. The predator-exclusion nets that were still present at each site were removed at the time of the survey. However, many of these nets had been damaged or lost during winter storms. A survey of the Dartmouth out-planting site is scheduled for summer/fall 2018.

Fairhaven Post-Planting Survey

On June 13th, 2018, two *DMF* staff and the Fairhaven Shellfish Constable conducted a post-planting survey of the quahog out-planting site in Round Cove, Fairhaven. Two predator-exclusion nets were still present at the time of the survey, so these were removed and the other previously-netted planting locations were located using GPS coordinates. Four transects were sampled across the area with ten 1-ft^2 quadrats excavated at 10-foot intervals along each transect using a mesh-lined basket rake. GPS coordinates were taken at the start and end of each transect for subsequent mapping. A total of 281 planted quahogs were found across the 40 quadrats, for a density of 7.03 quahogs/ft^2. Additionally, twenty adult, resident quahogs were observed and recorded.

Mean (mm)	10.3
Min (mm)	7.1
Max (mm)	16.3
Total #	281
# Quadrats	40
Density/sq.ft	7.03

Table 18. Planted Quahog Seed Summary Data Post-Planting at the Fairhaven B-120 Site.

Wareham Post-Planting Survey

On May 29th, 2018, two DMF staff and two Wareham Shellfish Department staff conducted a survey of the quahog seed planting site in Sunset Cove, Wareham. Three predator-exclusion nets were still present at the site but they were bunched up and may have moved around a bit due to heavy storms. These nets

were removed and the original netted planting areas were located by the landmarks that the Deputy Shellfish Constable used at the time of planting. Eight quadrats were randomly excavated across the estimated netting locations using mesh-lined basket rakes. A total of 24 1-ft^2 quadrats were sampled and 115 planted quahogs were found, for a density of 7.19 quahogs/ft^2.

Mean (mm)	12.95
Min (mm)	9.6
Max (mm)	17.7
Total #	115
# Quadrats	24
Density/sq.ft	4.79

Table 19. Planted Quahog Seed Summary Data Post-Planting at the Wareham B-120 Site.

Considerations for Baseline and Performance Monitoring in 2018

Quahog growth rates within the upwellers varied widely between the three towns (Figure 42), and seemed to be directly correlated with the availability of staff allocated to maintaining the upwellers and sort quahogs within each town. The average length of the quahogs at the time of planting was 8.4 mm in Dartmouth, 9.9 mm in Fairhaven, and 12.7 mm in Wareham. Lower quahog growth rates in the Dartmouth and Fairhaven FLUPSY's may be partially attributed to the fewer number of silos (6) compared to Wareham, which used up to 13 silos by the end of the growing season.

Estimated survival of the quahogs within the upwellers also varied between the three towns (27% in Dartmouth, 47% in Wareham and 84% in Fairhaven). It should be noted that a severe two-day storm in Buzzards Bay at the end of October directly hit Wareham's FLUPSY at Onset Pier and significantly reduced their overall survival rates. The town estimates that approximately 3-4 upwellers worth of quahogs were displaced, either through broken and sunken silos or washed over the top of the silos. Fairhaven was able to move their FLUPSY to protected waters before the storm hit.

Proper shellfish husbandry practices include routine cleaning of the upwellers to reduce the buildup of pseudofeces and to control biofouling. Routine cleaning and culling of the seed quahogs is critically important as well. Fast growing, larger quahogs need to be routinely sorted and separated from smaller individuals and placed in different silos. If the two sizes are not separated, the larger quahogs will out-compete the runts and greater uniform growth rates will not likely be obtained within a seasonal grow-out period. To address these needs, DMF has coordianted with all three towns that will be receiving quahog seed to ensure they have appropriate staff and resources to manage the project. While Wareham and Fairhaven have similar personnel to last year, which is adequate, Dartmouth has brought on new personnel dedicated to raising shellfish seed and maintaining the upwellers. DMF staff will regularly check in with the towns and visit the upwellers to confirm the projects are running well.

DMF has also increased staff time dedicated to the project for the 2018 season in order to enable us to work closely with town Shellfish Departments to provide guidance regarding proper shellfish husbandry practices. DMF staff will regularly check in with the towns and visit the upwellers to confirm the projects are running well. DMF staff will also ensure the municipalities use a standard set of methods to follow when independently collecting data for the project. The use of standard datasheets for biweekly length measurements as well as standard forms to record all upweller/cage maintenance activities will be

provided to towns prior to arrival of seed quahogs. Additionally, DMF personnel will be present at sampling events to the extent possible, particularly early in the season and in communities that have limited staffing or previous issues with project upkeep and reporting.

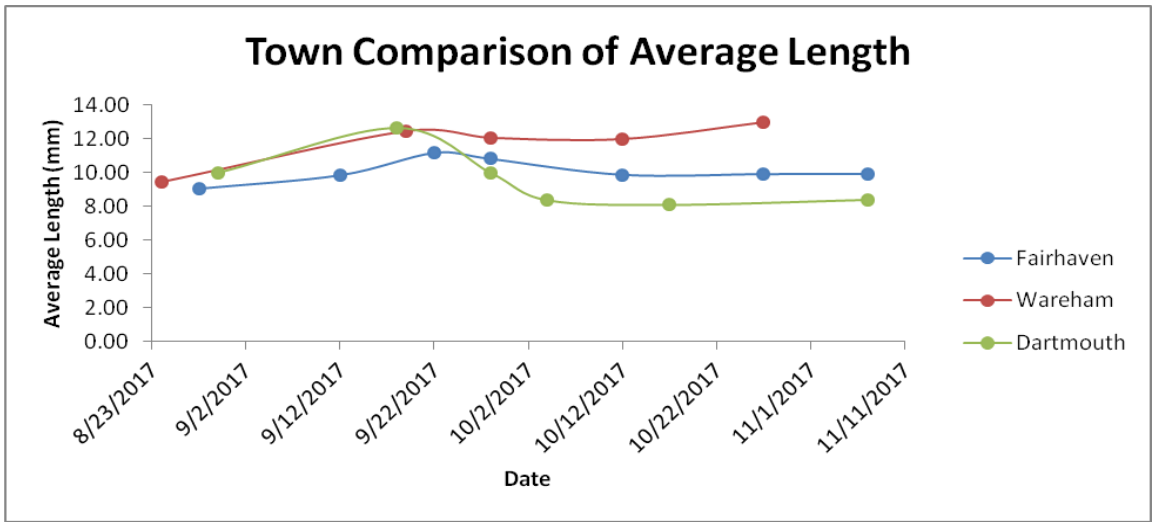


Figure 42. Comparison of Upweller Quahog Seed Growth Across All Three B-120 Sites.

III. *Single Oyster Purchase and Out-Planting*

Methods

Oyster Seed Purchases

The B-120 oyster project began in 2017 in Bourne, Marion, and Wareham. Each town committed to planting oysters at one site per year for two years (2017 and 2018), amounting to a total of 6 planted sites within municipally-managed waters of Buzzards Bay. Each year, the participating three towns pool their resources to purchase hatchery oyster seed at the best available price. Prior to procuring oyster seed, the participating towns work collaboratively with *DMF* to determine the size and quantity of oyster seed best suited to meet town needs. Municipalities provide *DMF* with information detailing the locations and characteristics of the proposed planting sites, anticipated planting densities, information on the availability of upweller space, and alternative nursery systems (i.e. floating bags). Generally, each municipality purchases small oyster seed to be placed in upwellers as well as larger field-plant sized oysters. Based on hatchery availability, the towns receive small seed first and the larger seed later in the season, allowing them to maximize their grow-out resources and distribute the work load.

The participating towns and *DMF* work closely together to ensure these efforts support the B-120 goal to create and maintain sustainable recreationally-available oyster resources at each of the oyster planting sites. Through monitoring of the oyster seed within the upwellers, and monitoring the growth, survival, and density of out-planted oysters, we intend to continuously refine these efforts.

Pre-Planting Surveys and Post-Planting Surveys

Surveys of the proposed 2017 oyster restoration sites were conducted prior to out-planting. *DMF* personnel collaborated with town staff to conduct these surveys. Surveys consisted of running multiple transects across each site and sampling one-square-foot quadrats a 10-foot intervals along the transect. The exact length of individual transects and number of quadrats varied based on site dimensions. Quadrats were excavated with basket rakes to a depth of 8-12 inches, and all observed shellfish were recorded as well as any observed vegetation, substrate type, and water depth. Post-planting surveys were conducted within 2 months following out-planting using the same method as the pre-planting surveys.

Results

Oyster Seed Purchase and Grow-out

In 2017, Bourne, Marion, and Wareham purchased varying numbers and sizes of juvenile oysters with B-120 funds (Table 15). On June 28th, 2017, Wareham and Marion received 1.4 million ≥2 mm oysters from Muscongus Bay Aquaculture in Maine for placement into town-owned upwellers for eventual out-planting within B-120 restoration sites. On July 14th, 2017, both towns received a total of 476,160 larger seed oysters (9-13mm) from Muscongus Bay Aquaculture's Bourne facility. These oysters were placed in floating bags and maintained on a regular basis before out-planting (Figure 43).

On June 23rd, 2017, Bourne directly out-planted approximately 84,360 41-78mm oysters into their B-120 restoration site in Cohasset Narrows. These oysters were received from the town of Falmouth's Little Pond Aquaculture Demonstration Project. All purchased oysters were certified as disease-free by DMF-approved shellfish pathology laboratories prior to receipt by the towns.

Figure 43. Photo of the Floating Oyster Cage Grow-out System at the Marion B-120 Site.

Town	Destination	Size Range	Quantity	Source	Outplanting Site
Bourne	Immediate Field Plant	41 - 78 mm	84,360	Town of Falmouth	Cohasset Narrows South
Marion	Upweller	≥ 2 mm	400,000	Muscongus Bay	Black Point
Marion	Floating Cages	9 - 13 mm	326,160	Muscongus Bay	Black Point
Wareham	Upweller	≥ 2 mm	1,000,000	Muscongus Bay	Lydia's Island West
Wareham	Floating Cages	13 - 22 mm	150,000	Muscongus Bay	Onset Island Reefs

Table 20. Summary of B-120 Single Oyster Purchases by Towns of Bourne, Marion, and Wareham.

Bourne

Pre-Planting Survey

On May 2nd, 2017 *DMF* personnel, Town of Bourne personnel, and a member of TNC conducted a pre-planting survey of the proposed oyster restoration site located south of Cohasset Narrows, behind Mass. Maritime Academy's Beachmoor building. See Figure 44 for survey area (green). A total of 8 transects were run perpendicular to shore and 1-ft^2 quadrats were sampled every 10 ft. along each transect. A total of 60 quadrats were sampled and 14 quahogs and 2 oysters were collected for a final density of 0.23 and 0.03 animals/ft^2 respectively. The flat consisted of sand and mud substrate, with sparse vegetation coverage consisting of *Laminaria* sp., *Enteromorpha* sp. and filamentous red algae (sp. unknown). Water depth at the site at low tide ranged between -2 to + 3 ft. below the MLW mark.

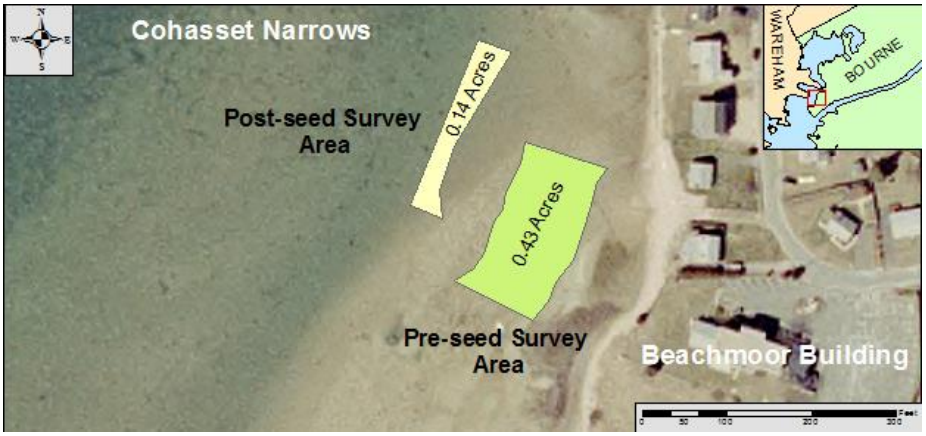


Figure 44. Map of Pre and Post-Planting Survey Areas at the Bourne B-120 Site.

Out-Planting – Cohasset Narrows, Bourne

Oysters were harvested from Falmouth's Little Pond Aquaculture Demonstration Project, relayed to a conditionally approved area in Bourne's Pond in Falmouth and harvested again after the status was changed to "Closed to Shellfishing". As a result, the oyster transfer to Bourne had to be permitted using a Contaminated Shellfish Relay Permit that was issued June 21st, 2017. Once pathology screening was conducted and the samples met the required health standard, the Falmouth Shellfish Department delivered the oysters to Taylor Point Marina, which is near the B-120 restoration site. On June 23rd, Bourne staff loaded the oysters in 80 lb. totes onto their boat, and the oysters were then transported to the site and broadcast-seeded within the B-120 planting area.

Thirty eight totes of oysters, containing an estimated 84,360 oysters, were broadcast-seeded within the site. Fifty oysters were sampled for shell length by Bourne personnel. The average length of the oysters was 50mm and ranged from 41 to 78mm. The B-120 oyster restoration site was marked and posted with signs closing the area to shellfishing for a minimum of one year.

Post-Planting Survey – Cohasset Narrows, Bourne

Three *DMF* personnel surveyed the B-120 oyster restoration site on November 29th. The team walked the area that was surveyed on May 5th, 2017. The depth range of the surveyed area was between -2 to +3 ft. below the MLW mark. No planted oysters were observed within the surveyed area, but planted oysters were evident outside of the surveyed area in adjacent deeper water. Two transects parallel to shore were walked; one along the nearshore boundary of the planted area and the second approximately 10 feet further out in deeper water. All oysters within 1-ft ^{2} quadrats were collected using basket rakes. Quadrats were spaced evenly by 10 paces (approximately 18-ft. intervals). The shoreline width and shallow edge of the planted area was identified visually and the boundary coordinates recorded using GPS. Visibility was > 5 ft, and oyster clumps were easily identified. The deep water boundary could not be documented by staff in chest waders. GPS coordinates of all quadrat locations were recorded and plotted. Oysters from each quadrat were collected in numbered mesh nylon bags and later sampled for shell length.

On December 11th, 2017, one *DMF* staff member and one Bourne Shellfish Department staff member took a boat out to the oyster planting site to re-survey the planting area. Using the previously observed GPS waypoints and a viewing box, transects were run from south to north (wind direction) to attempt to find the outer edge of the oyster planting site. Oysters tended to be in large clusters, consistent with broadcast planting. The shape of the planting area appeared to follow the natural topography of a deeper trough outside of the originally surveyed area. The new estimated planting area was 0.5 acres. Using the estimated planting density of 2.9 oysters per ft^2, it is estimated that 63,162 oysters are within the planted area. See Table 21 for length measurements and abundance estimates, and See Figure 44 for the location of the pre-planting (green) and post-planting survey areas (yellow).

Mean (mm)	79.2
Min (mm)	53.6
Max (mm)	100.1
Total #	61
# Quadrats	21
Density/sq.ft	2.9
Area Surveyed	0.14 acres
Area Surveyed	6304 sq.ft
Density of area	18,282 oysters

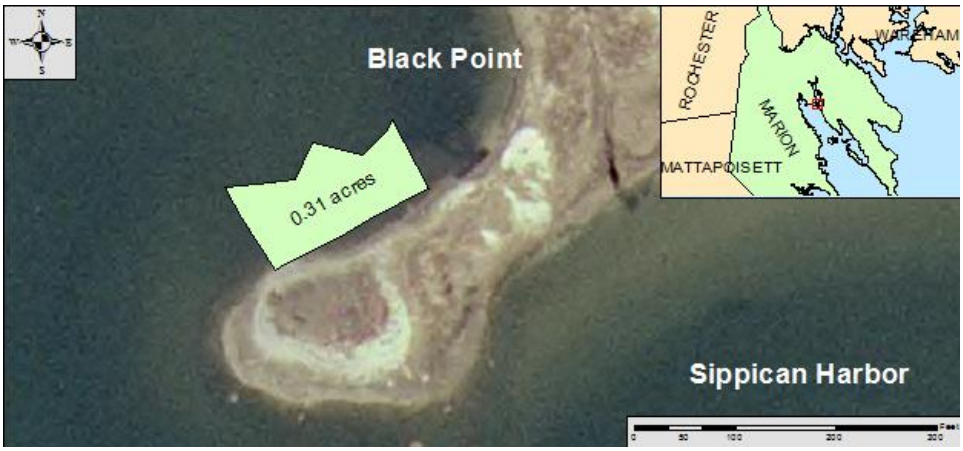
Table 21. Oyster Length and Abundance Summary Data Post-Planting at the Bourne B-120 Site.

Marion

Pre-Planting Survey – Black Point, Sippican Harbor, Marion

On October 3rd, 2017, *DMF* and Marion harbormaster personnel conducted a survey of Black Point (Figure 45) to determine habitat suitability of the area and resident shellfish species density and size

classes. It is the only town-designated area for recreational oyster harvesting, and is open to shellfishing seasonally from November to May. The area had been propagated in the past, and aquaculture operations have been ongoing in the area for years. It is assumed that the existing oyster population is a combination of wild set oysters and past propagation efforts in the area conducted by Marion. Substrate consisted of firm sand and gravel mixture extending from the vegetation line (*Spartina alterniflora*) into the water and eventually becoming much softer mud. The most suitable habitat was the band of firmer sediment extending seaward from the *Spartina* line to about 30 ft. Survey results (Table 22) demonstrate that this area contained a low density of living shellfish. Two large whelks were observed, but no other predator species. Due to bottom type and depth, quadrats per transect varied from 5 to 8, spaced roughly 12 feet apart.



Map 8. Map of the Pre-Planting Survey Area at the Marion B-120 Site.

	Oysters	Quahogs
Mean (mm)	39	60.98
Min (mm)	19.3	39.8
Max (mm)	58.9	81.3
Total #	83	10
# Quadrats	47	47
Density/sq.ft	1.77	0.21

Table 22. Resident Oyster and Quahog Summary Data Pre-Planting at the Marion B-120 Site.

Prior to planting, the town did not maintain a good record of oyster seed maintenance within the upweller or floating cages, nor did they periodically measure shell lengths. Oysters within the upwellers (small) and floating cages (large) were sampled by *DMF* personnel on July 5th and October 3ed (Table 23). On October 3rd, *DMF* found a significant level of mortality amongst larger-sized animals that was most-likely due to poor upweller maintenance. These were disappointing results, and measures to improve town commitment and accountability are described at the end of this section.

Date	Seed Type	Mean Length (mm)	Max Length (mm)	Min Length (mm)	Total #
7/5/2017	Large	15.6	21.7	9.4	44
10/3/2017	Large	21.9	38.1	14.1	72
10/3/2017	Small	18.9	27.3	11.5	48

Table 23. Oyster Seed Summary Data in Grow-Out Cages at the Marion B-120 Site.

Post-Planting Survey – Black Point, Sippican Harbor, Marion

Two *DMF* personnel conducted a post-planting survey of the Black Point oyster restoration site on December 19th, 2017. The survey team walked the perimeter of the planted area using a GPS to mark it for further analysis. The seaward edge was soft sediment several inches thick. The landward edge was more favorable substrate and a substantial wild oyster population still existed. It was noted that B-120 oysters were scattered throughout this area fairly evenly, and were mixed in with the wild oysters (distinguished by their white/streaked-purple coloring).

Once the project perimeter was determined, the team sampled two transects, one along the seaward edge and one along the exposed intertidal edge of the planted area. The shoreline edge is curvilinear and as such the transects were established to approximate the shoreline configuration. Quadrats (1-ft^2) were sampled using basket rakes. Nine quadrats spaced approximately 45 ft. apart were sampled on the seaward transect. There were very few live oysters (11) observed in these quadrats, likely due to the soft nature of the substrate. Six quadrats spaced approximately 75 ft. apart were sampled along the inner transect, due to time constraints. The substrate closer to shore was much firmer, consisting of hard-packed sand, gravel, and shell. Some dead shell of both wild set and B-120 oysters was observed, but the majority of each quadrat consisted of live animals (71). A total of 82 oysters were counted in 15 quadrats, resulting in a density of 5.5 oysters/ft^2. Using this density, the estimated total oyster population within the 0.2-acre site is 47,916. Of the 82 oysters collected in the survey, 58 were observed to be B-120 oysters. The density of B-120 oysters within the Black Point B-120 restoration site is therefore estimated to be 3.9 oysters/ft^2. Using this density, it is estimated that the there are approximately 33,977 oysters within the site. A summary of the measurements recorded can be found in Table 24, along with a map of the area (Figure 46).

Figure 46. Map of the Post-Planting Survey at the Marion B-120 Site.

Mean (mm)	34.5
Min (mm)	17.1
Max (mm)	75.6
Total #	58
# Quadrats	15
Density/sq.ft	3.87
Area (acres)	0.2
Area (sq.ft)	8712
B-120 Pop'n	33,686
Total Pop'n	47,626

Table 24. Oyster Summary Data Post-Planting at the Marion B-120 Site.

Wareham

Pre-Planting Survey – Western Shore of Lydia's Island, Wareham

On November 1st, 2017, a survey was conducted of a potential site for planting the small oyster seed located on the western shore of Lydia's Island (Figure 47, B) within Onset Bay (DSGA:40), classified as approved waters. Land abutting the site is owned privately and may be in ownership transfer to the Massachusetts Audubon Society for conservation. Substrate throughout this site was hard bottom and loose sand mixed with small gravel, becoming more organic, finer sediment at 4 to 6 inches in depth. The Deputy Shellfish Constable reported that the area was a productive bay scallop site in recent months. Oysters, scallops, horseshoe crabs, and winter flounder were present but little vegetation was observed.

A second potential oyster site was located further west from the first (Figure 47, A), in a cove off Shell Lane, to the southeast of Shell Point in Onset. This location was surveyed by DMF staff but consisted of mucky sediment, and only one group of oysters was observed, while a significant quantity of quahogs was present. Public access would be minimal at best, and due to these poor substrate conditions, this site was not selected for planting.

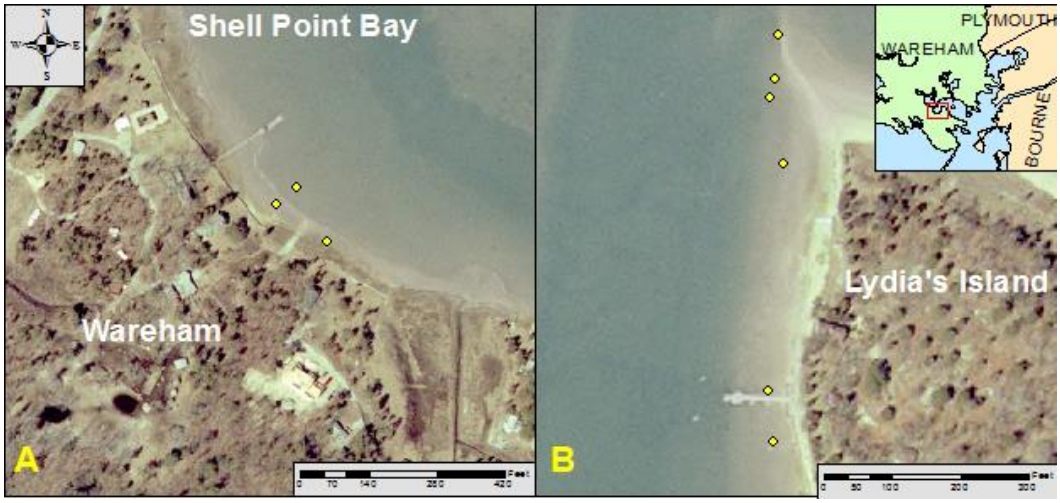


Figure 47. Map of the Pre-Planting Survey Areas at the Wareham B-120 Site.

Oysters in the upwellers (small) and floating cages (large) were sampled by DMFpersonnel periodically (Table 25). The town also maintained a record of activity and periodically graded the larger oysters within the floating cages during the grow-out period. These oysters were planted on two beds off of Onset Island (Figure 48) that have been used for oyster restoration in the past.

Figure 48. Map of the Onset Bay Oyster Planting Areas at the Wareham B-120 Site.

Date	Seed Type	Mean Length (mm):	Min Length (mm):	Max Length (mm):	Total #
7/5/2017	Large	17.8	22	13.3	50
9/6/2017	Large	39.5	50.2	24.2	50
9/6/2017	Small	20.1	25.2	14.7	50
9/19/2017	Small	23	34.6	13.4	50
9/29/2017	Small	22.3	31.4	16.1	54
9/29/2017	Large	39.2	52.1	24	38
10/12/2017	Small	22	34.4	9.8	159

Table 25. Oyster Seed Summary Data from Grow-Out Bags at the Wareham B-120 Site.

Post-Planting Survey: - Onset Island, Wareham

Pre-planting surveys of the two Onset Island oyster beds were not conducted due to known success of the area as an oyster restoration site. Two DMF staff conducted a survey of the two oyster beds planted with the larger seed (Figure 48) on September 29th, 2017. Basket rakes were used to collect a total of 30 1-ft² quadrat samples on the eastern oyster bed at low tide. This larger bed is where Wareham staff planted most of the B-120 oysters. Scallop shell was used as cultch material during the town's previous oyster restoration activities. There was an abundance of blue mussels throughout the site, and 4 quahogs were also observed. Vegetation observed included *Codium* and *Gracilaria*. The substrate consisted of a mixture of hard packed sand and gravel.

The second oyster bed, situated on a sand bar off the west corner of the island had a much higher density of oysters, most of which are assumed to have been planted prior to the start of the B-120 project. Quadrat sampling was not carried out due to time constraints and a rising tide. However, a minimum of 50 oysters were randomly collected and sampled for shell length (Table 26). The majority of the oysters were visibly different in coloring from the B-120 oysters purchased in late June from Muscongus Bay.

A subsample of at least 50 animals was selected from each reef for length measurements (Table 26). The eastern reef had a density of 4.3 oysters/ft^2 and the density for the western reef was not calculated due to time constraints but was observed to be densely populated with oysters.

	East Reef	West Reef
Mean (mm)	51.9 mm	41.3 mm
Min (mm)	29.6	24.5
Max (mm)	70.6	67
Total #	129	181
# Quadrats	30	n/a
Density/sq.ft	4.3	n/a

Table 26. Oyster Summary Data Post-Planting at the Wareham B-120 Site.

Out-planting – Lydia's Island and Onset Island, Wareham

The town of Wareham notified DMF on December 6th, 2017 that they had out-planted the rest of their B-120 oysters – the smaller seed from the upwellers – in three locations. A portion of the oysters were broadcast along the previously surveyed western shore of Lydia's Island (Figure 47, B), while a small amount were broadcast at a similar site on the eastern shore of Lydia's Island (Figure 49), and the rest at the Onset Island beds where the larger seed were planted (Figure 48). According to the Wareham Harbormaster, they had planted a small amount of seed at the second Lydia's Island site because there was good habitat and large boulders present, which could serve as good oyster setting sites. According to town staff, the animals ranged from 1 to 2 inches at the time of planting. Town staff did not count animals, and therefore, an estimate of survival cannot be established.

Figure 49. Map of Two Oyster Planting Areas at Lydia Island Wareham B-120 Site.

Post-Planting Survey – Lydia's Island, Wareham

On December 13th, 2017, DMF and Wareham Natural Resources staff conducted a basic survey of the primary Lydia's Island site (western shore) seeded with B-120 oysters. Difficult weather conditions (wind from the west at >20 mph and temperatures in the mid 20's) allowed only a brief collection of data on size classes in the area seeded (Figure 49). A 1-ft^2 quadrat was sampled from the Lydia's Island West site to obtain an estimate of density from the local area. There were 33 animals in this quadrat, which leads to an estimate of 380,655 total animals planted at this site based on the area of 11,535 ft^2 (Table 27). A total of 85 oysters were sampled for size from the two Lydia's Island locations averaging 36.4 mm (17.3 – 54.3 mm) in length.

	West	East
Mean (mm)	40.3	33.8
Min (mm)	27.2	17.3
Max (mm)	53.8	54.3
Total #	33	52
# Quadrats	1	n/a
Density/sq.ft	33	n/a
Area (sq.ft)	11,535	2,975
Density of area	380,655	n/a

Table 27. Oyster Summary Data, Post-Planting at the Lydia Island Wareham B-120 Site.

Considerations for Baseline and Performance Monitoring in 2018

The primary objectives of the B-120 oyster project were met in 2017 with the acquirement of both small and large oyster seed for all three towns and the subsequent out-planting of these oysters to suitable sites in Buzzards Bay. However, the degree of success in performance monitoring and record-keeping varied between towns. For instance, the town of Marion did not keep a record of sorting, cleaning and other maintenance of the B-120 oysters as requested. Additionally, none of the three towns notified DMF when they were ready to plant the oysters, which lead to some discrepancies between estimated densities of planted oysters, as well as inconsistencies between pre-surveyed planting sites and the actual location where oysters were seeded. This then lead to delays in post-planting surveys and difficulties locating the exact area where plantings occurred.

To increase the overall success of the project moving forward, the issues mentioned above will be addressed in the following ways. First, DMF personnel will strive to be present at the time of seed receipt to meet with all three town shellfish constables and provide them with a standard set of methods to follow for the project. The use of standard data sheets for biweekly length measurements as well as standard forms to record all upweller/cage maintenance activities will be provided to towns at this time. Additionally, *DMF* personnel will be present at sampling events to the extent possible, and particularly in communities that have limited staffing or previous issues with project upkeep and reporting.

Second, towns will be instructed to notify DMF personnel when they are ready to out-plant the oysters, leading to better communication about timing and location of planting sites as well as creating an

opportunity for DMF staff to quantify oyster survival at the time of planting. This will lead to oysters being seeded at the targeted pre-surveyed sites and will improve the timeliness and quality of post-planting surveys. Finally, DMF staff will work with the towns to improve signage at the planting areas, and make sure planting areas remain closed to shellfishing for an appropriate length of time.

Improved communications between towns and DMF personnel as well as an increased presence of DMF staff at oyster monitoring and planting events will increase both the quality and quantity of data collected, while promoting a more collaborative work environment.

IV. TNC Bay Scallop Restoration Project

In 2016, *DMF* assisted TNC with their bay scallop restoration efforts in Bourne. Divers conducted pre-restoration surveys designed to identify and quantify different benthic habitat strata and to estimate average scallop size and abundance by strata type. *DMF* divers also conducted pre-oyster/cultch placement surveys of TNC's proposed 2016 oyster restoration site in Fairhaven.

On April 29, 2016, four *DMF* divers, working in two pairs, conducted belt transect surveys of the various benthic habitat strata as classified by TNC. Habitat type, shellfish species and abundance, and the presence of submerged vegetation and type were documented at 81 locations within Squeteague Harbor (Figure 39). All observations were recorded and reported to TNC.

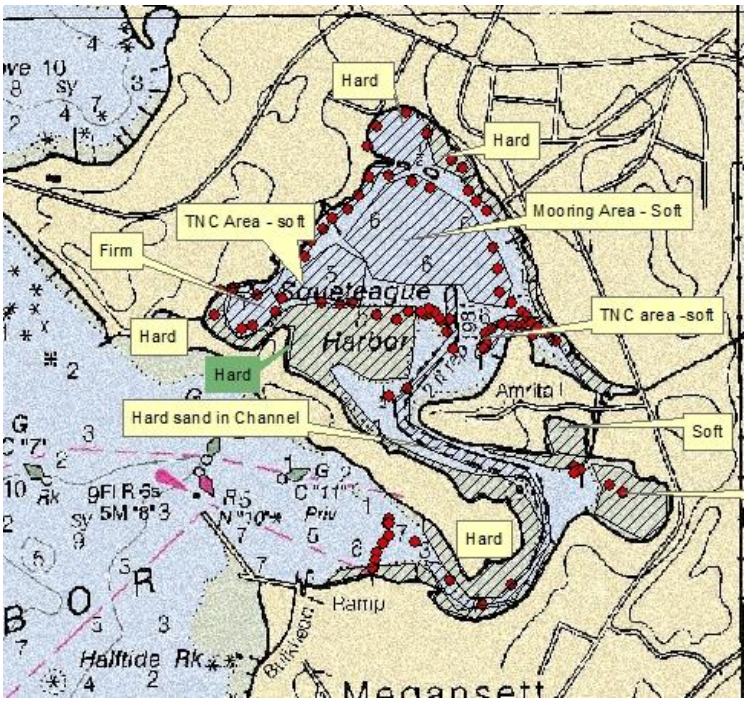


Figure 50. Location of dives conducted to determine habitat type and shellfish abundance within Squeteague Harbor.

On July 18, 2016, three *DMF* personnel conducted a dive survey in Squeteague Harbor. They were accompanied by Steve Kirk of the TNC. The survey was designed to enumerate bay scallopdensity within each habitat type already defined and mapped by the *DMF* and TNC team. Two *DMF* divers conducting

belt transects while being towed behind DMF's 21 ft. vessel. Divers held on to a long metal tow bar. A total of 5-tow bar transect surveys were conducted in this fashion. Most transects were run in and east-west orientation. At the end of each transect, the divers surfaced and reported number of observed live bay scallops, number of other shellfish and any other observed animals, substrate and vegetation type. All observations were recorded by TNC (Figure 40).

Figure 51. Pattern of tow bar paired diver belt surveys.

On July 18th, the *MarineFisheries* divers also completed 3 stand-alone transects making observations and applying the same field protocols as described above (Figure 41). Paired divers swam along a 100- meter lead line, belt transect with each end marked with weighted buoys. Observations were recorded and given to TNC.

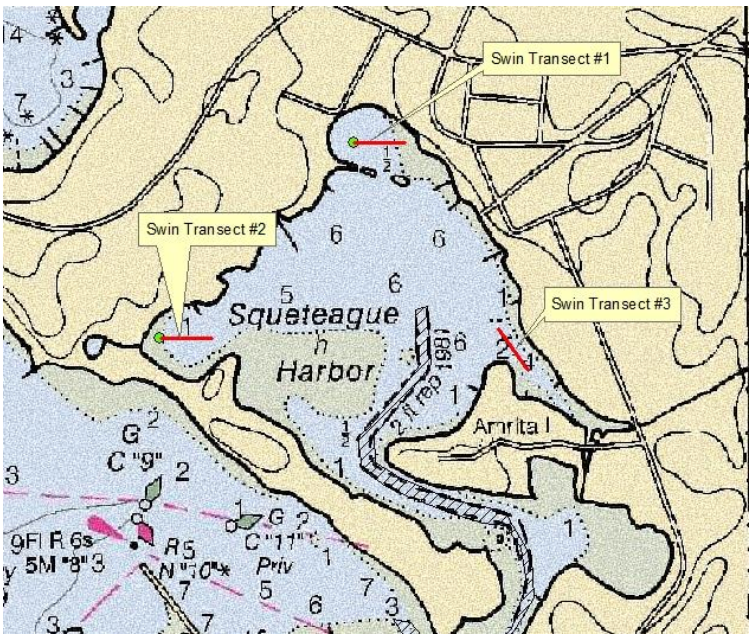


Figure 52. Location of three stand-alone diver transects.

In summary, very few bay scallops were observed. Quahogs were the most abundant shellfish observed in Squeteague Harbor. TNC was given all the collected data for analysis and reporting.

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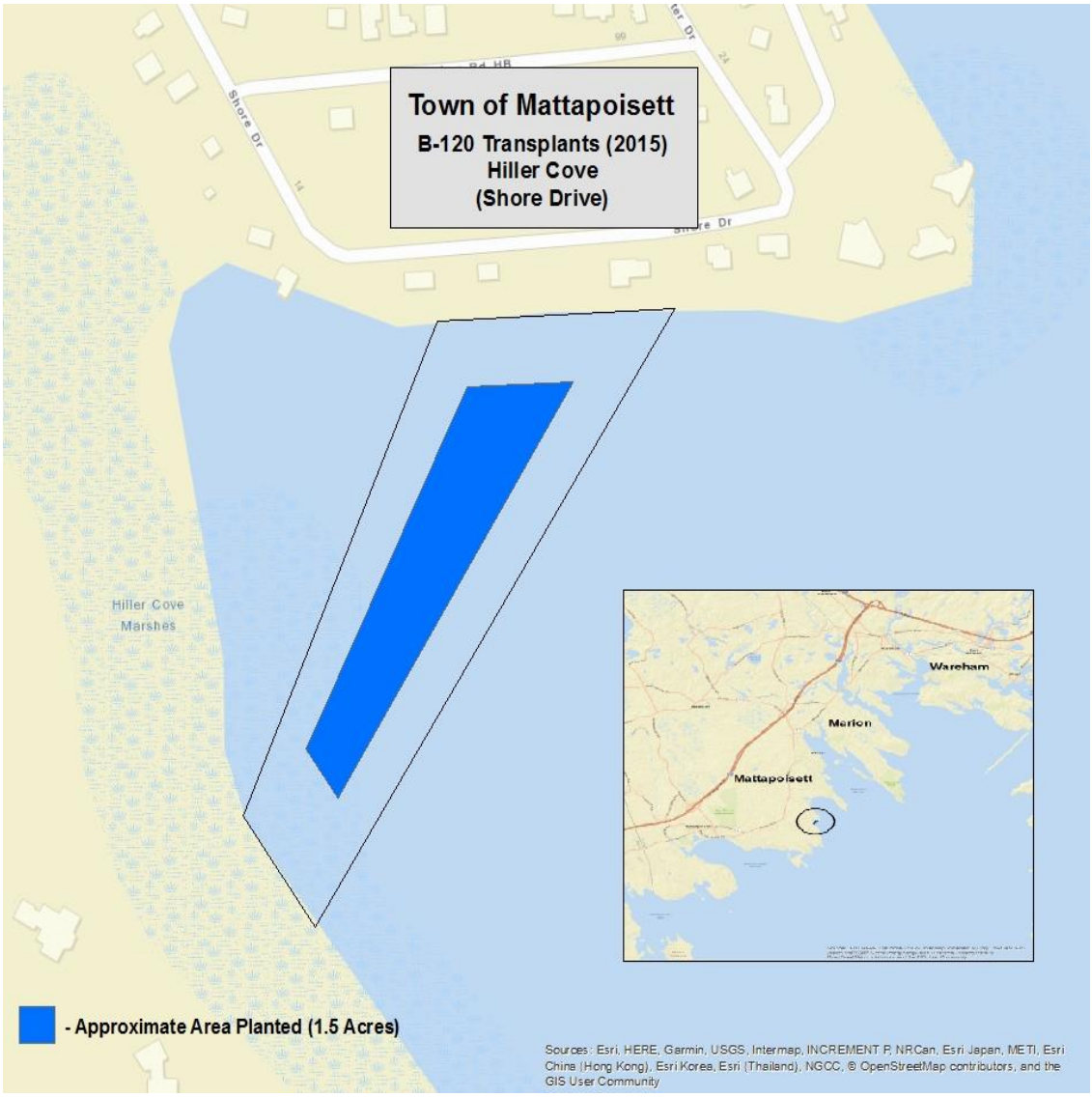
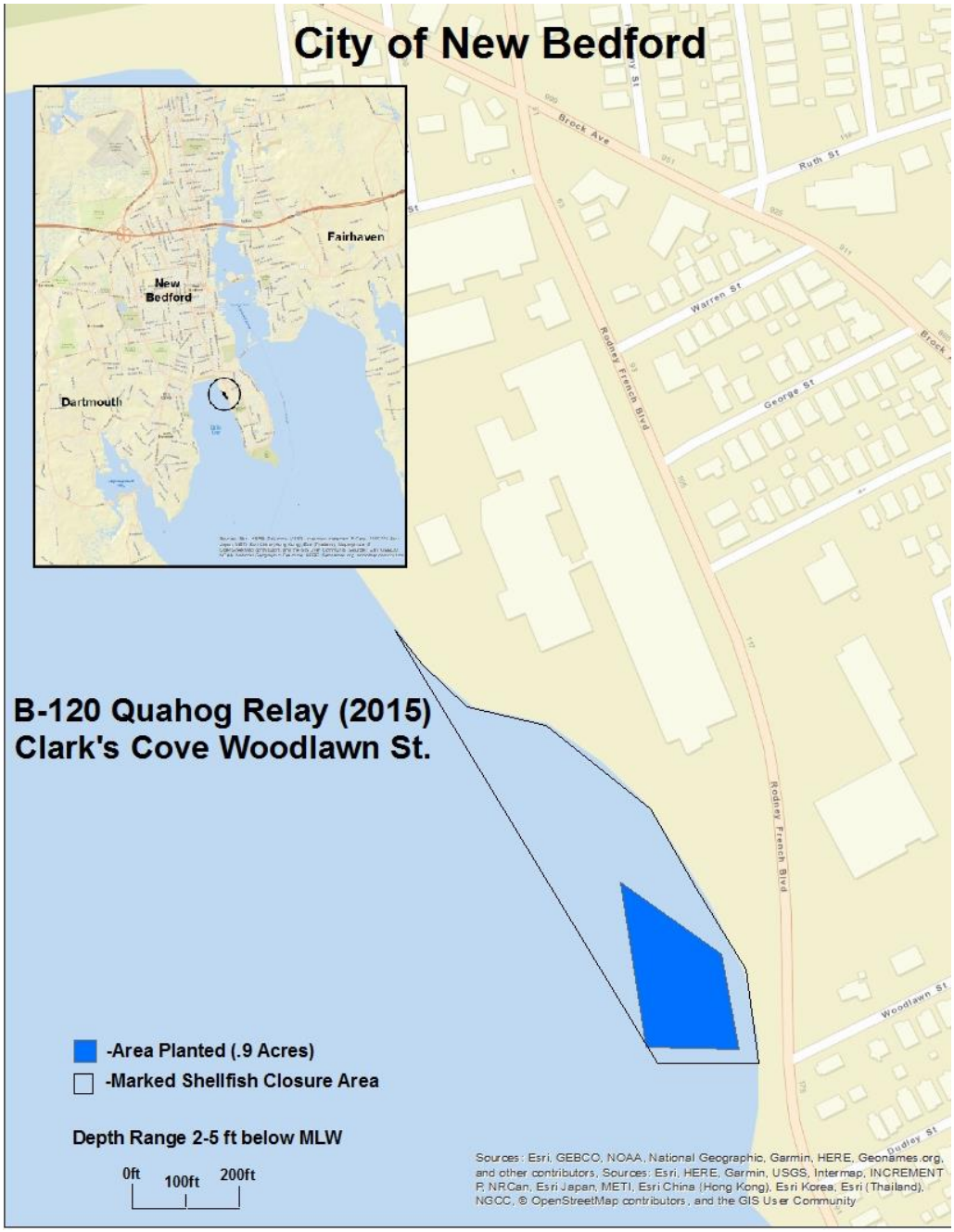
APPENDIX I

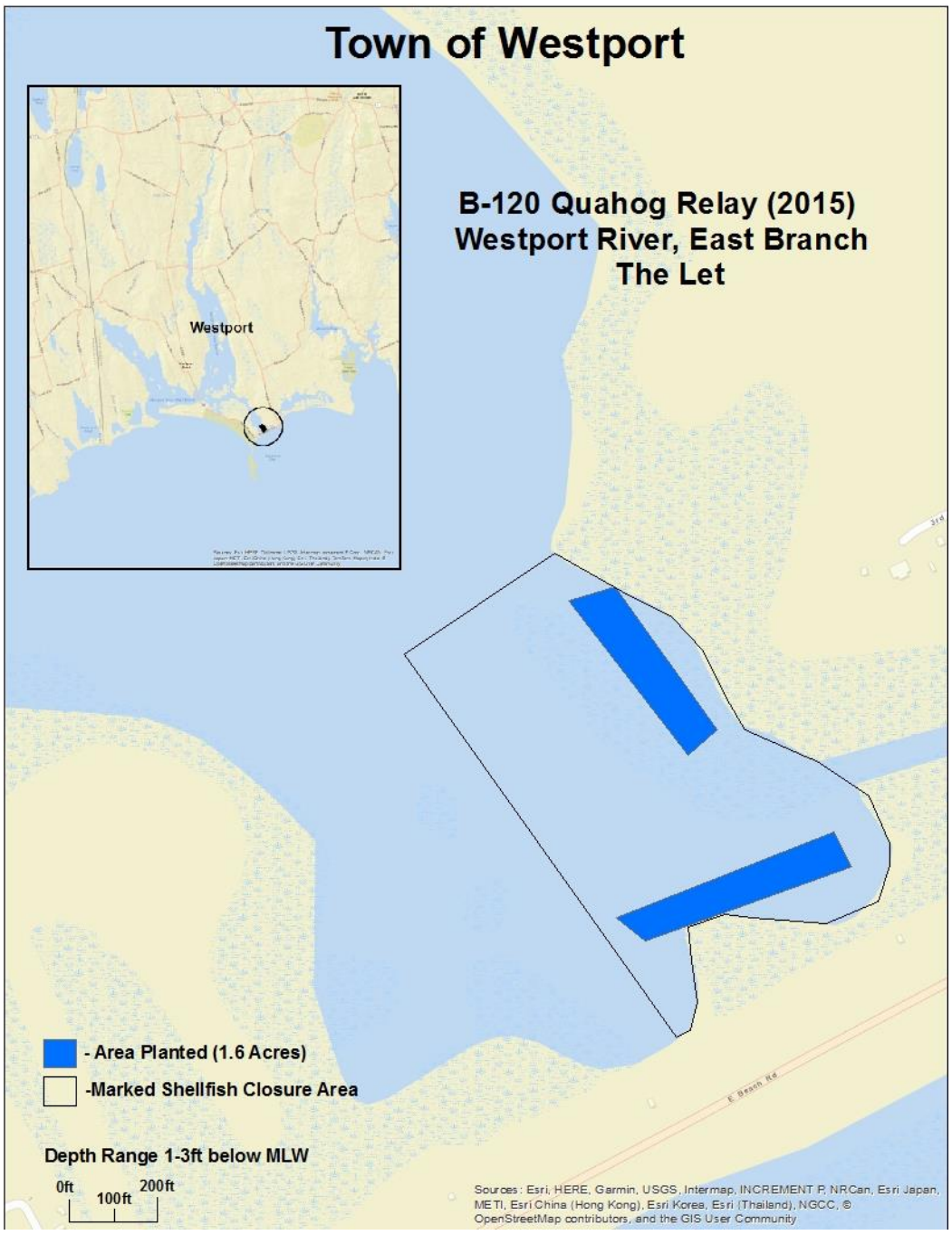
2015 and 2016 B-120 Quahog Transplant Site Maps

2015 Sites

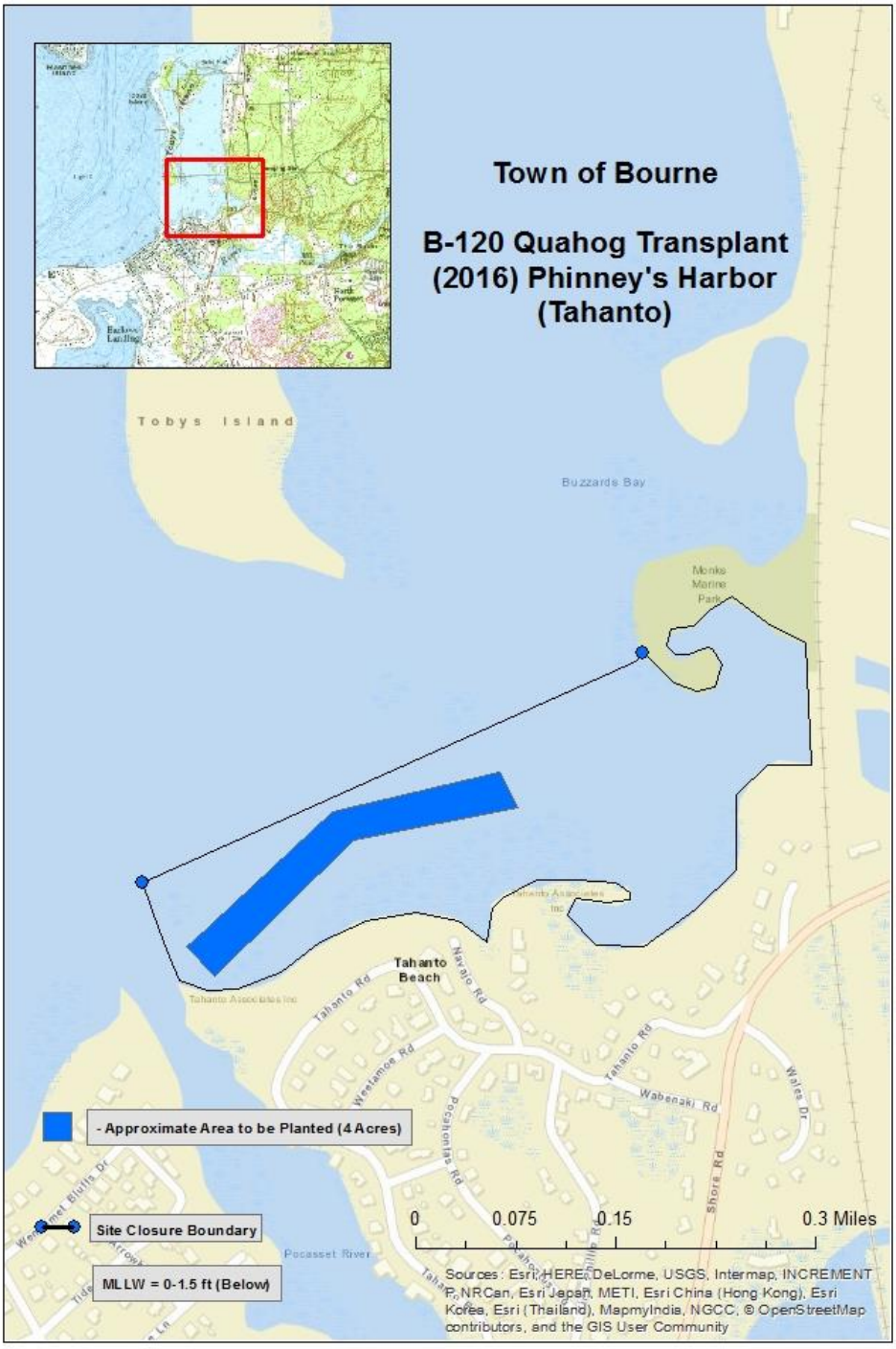

Town of Gosnold
B-120 Quahog Relay (2015)
Cuttyhunk Pond
Cuttyhunk
-Area Planted (.5 Acres)
Depth Range 0.5-4.5 ft below MLW
0
50ft
100ft
Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, © OpenStreetMap contributors, and the GIS User Community

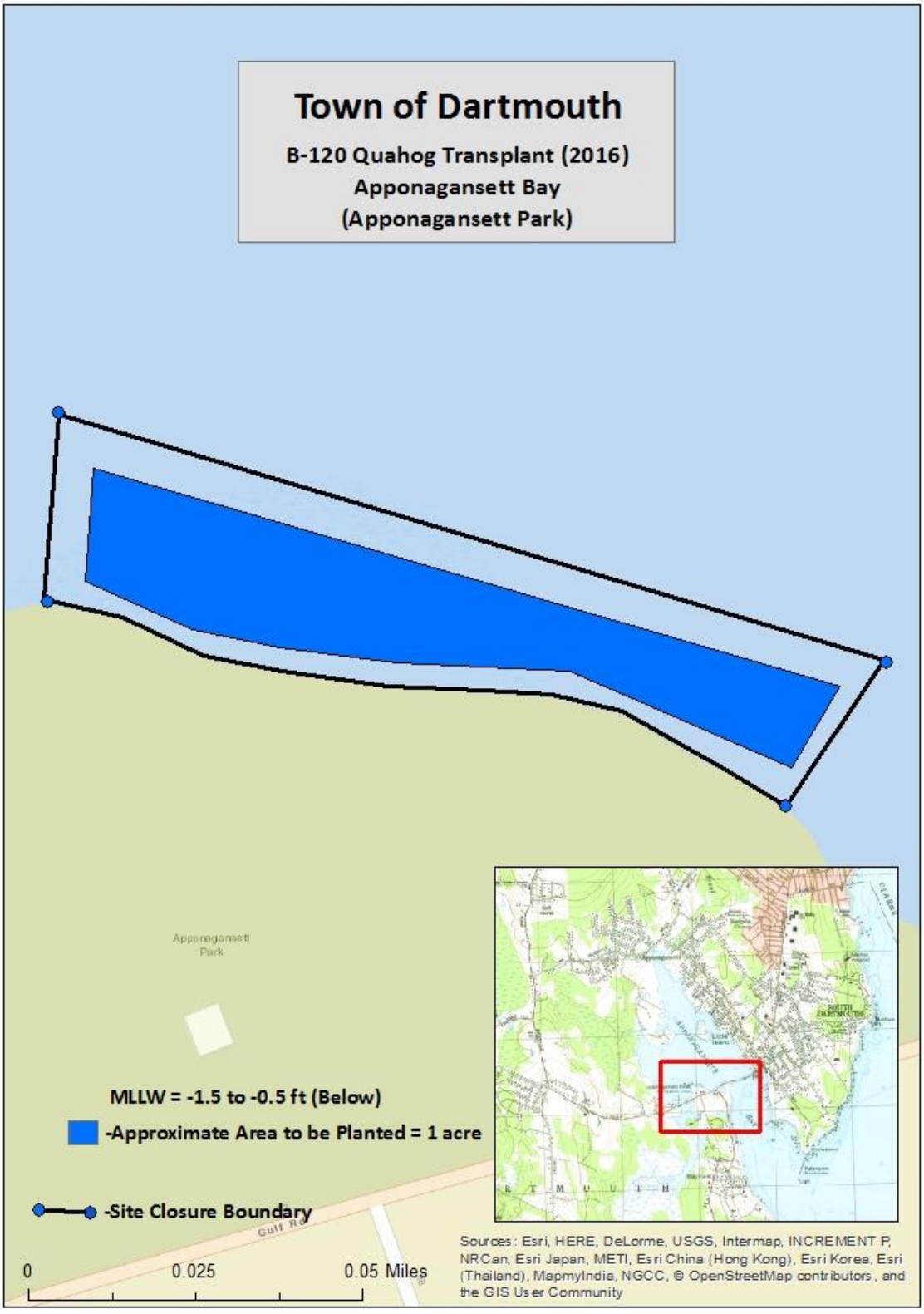

Town of Mattapoisett
B-120 Transplants (2015)
Hiller Cove
(Shore Drive)
Shore Dr
Shore Dr
Hiller Cove
Marshes
Wareham
Marion
Mattapoisett
- Approximate Area Planted (1.5 Acres)
Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, © OpenStreetMap contributors, and the GIS User Community

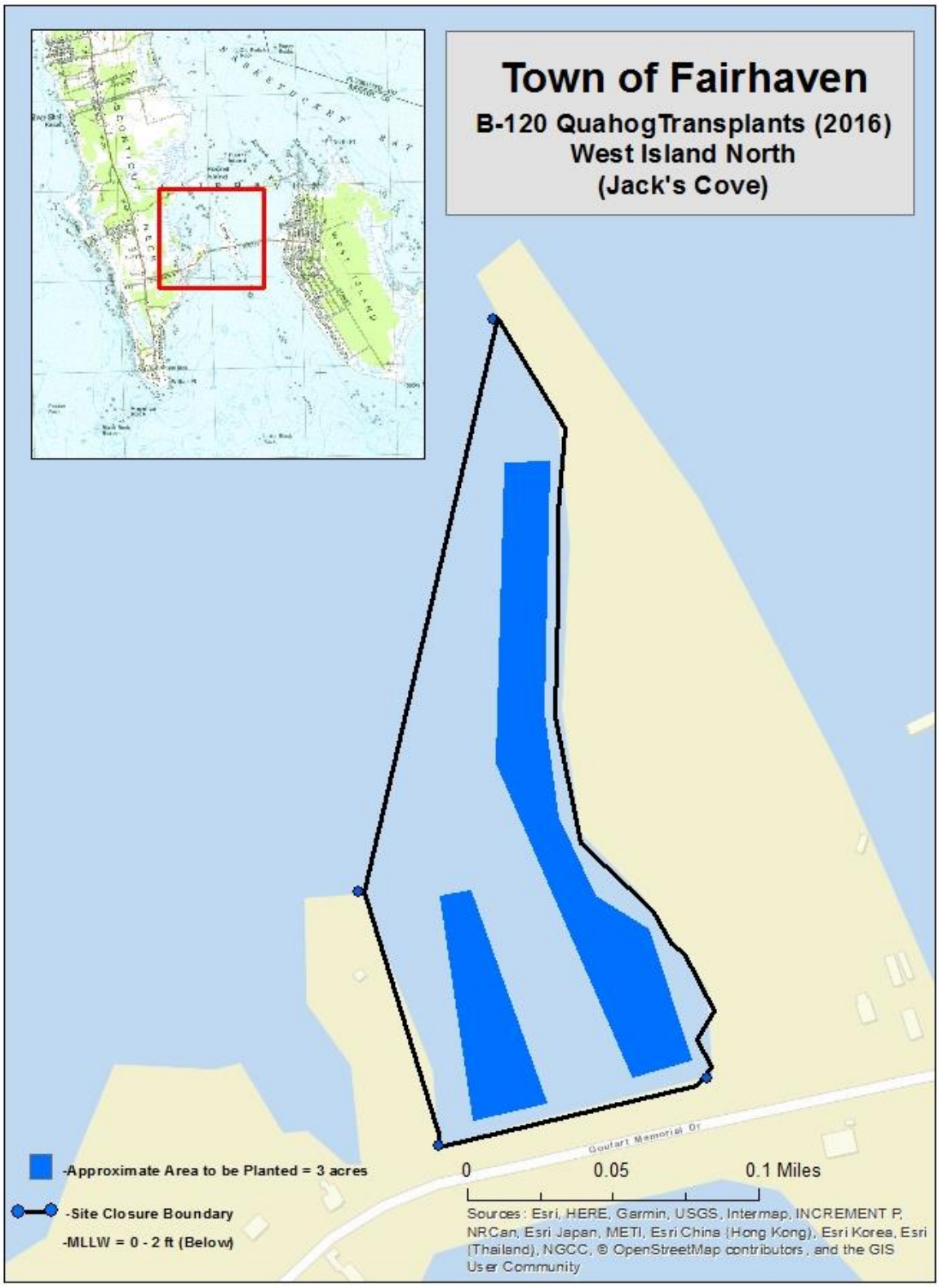

City of New Bedford
Fairhaven
New Bedford
Dartmouth
B-120 Quahog Relay (2015)
Clark's Cove Woodlawn St.
-Area Planted (.9 Acres)
-Marked Shellfish Closure Area
Depth Range 2-5 ft below MLW
0ft
100ft
200ft
Brock Ave
Ruth St
Warren St
George St
Rodney French Blvd
Woodlawn St
Dudley St
Sources: Esri, GEBCO, NOAA, National Geographic, Garmin, HERE, Geonames.org, and other contributors, Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, © OpenStreetMap contributors, and the GIS User Community

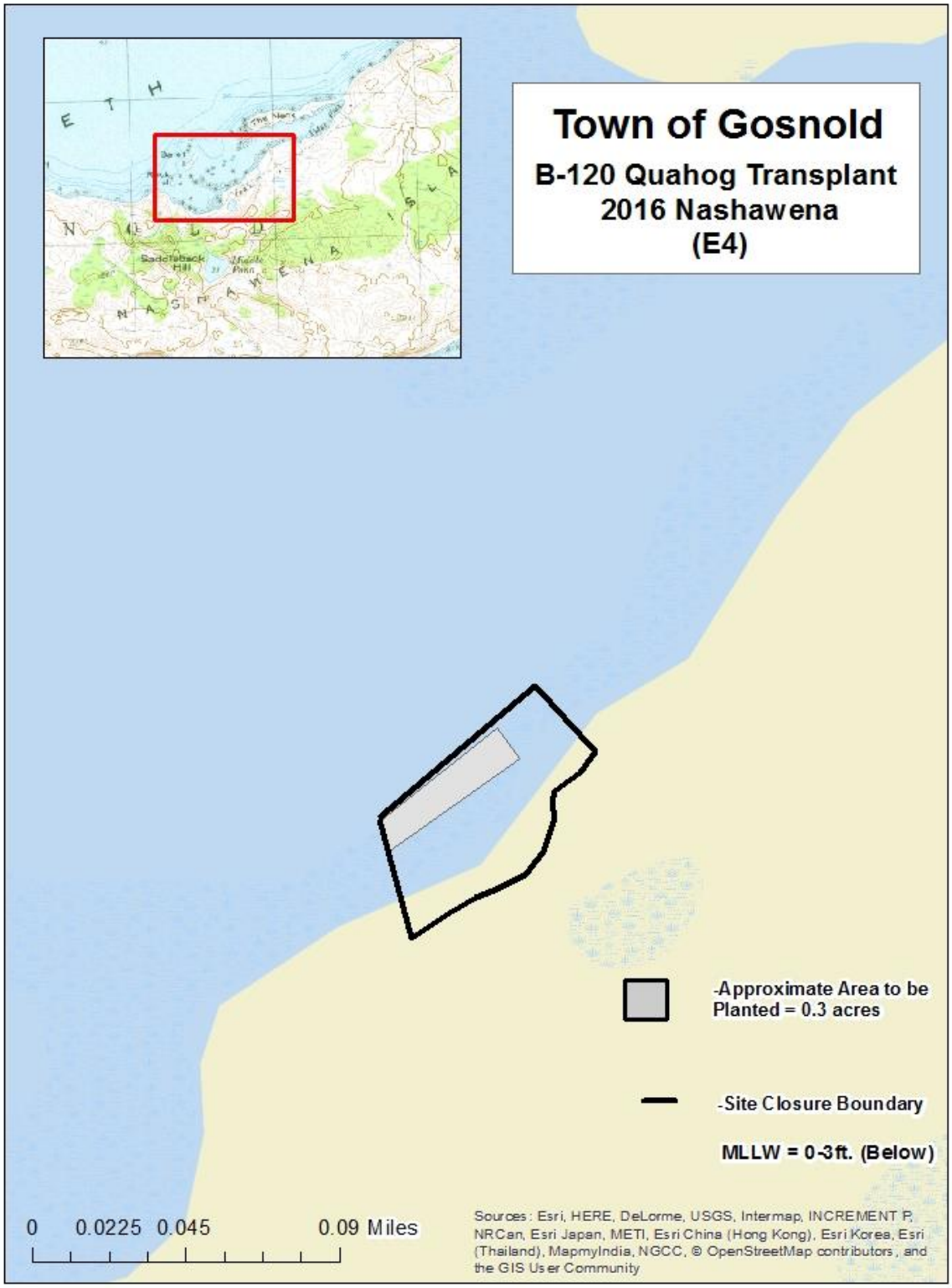

Town of Westport
Westport
B-120 Quahog Relay (2015)
Westport River, East Branch
The Let
- Area Planted (1.6 Acres)
-Marked Shellfish Closure Area
Depth Range 1-3ft below MLW
0ft
100ft
200ft
E Beach Rd
Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, © OpenStreetMap contributors, and the GIS User Community

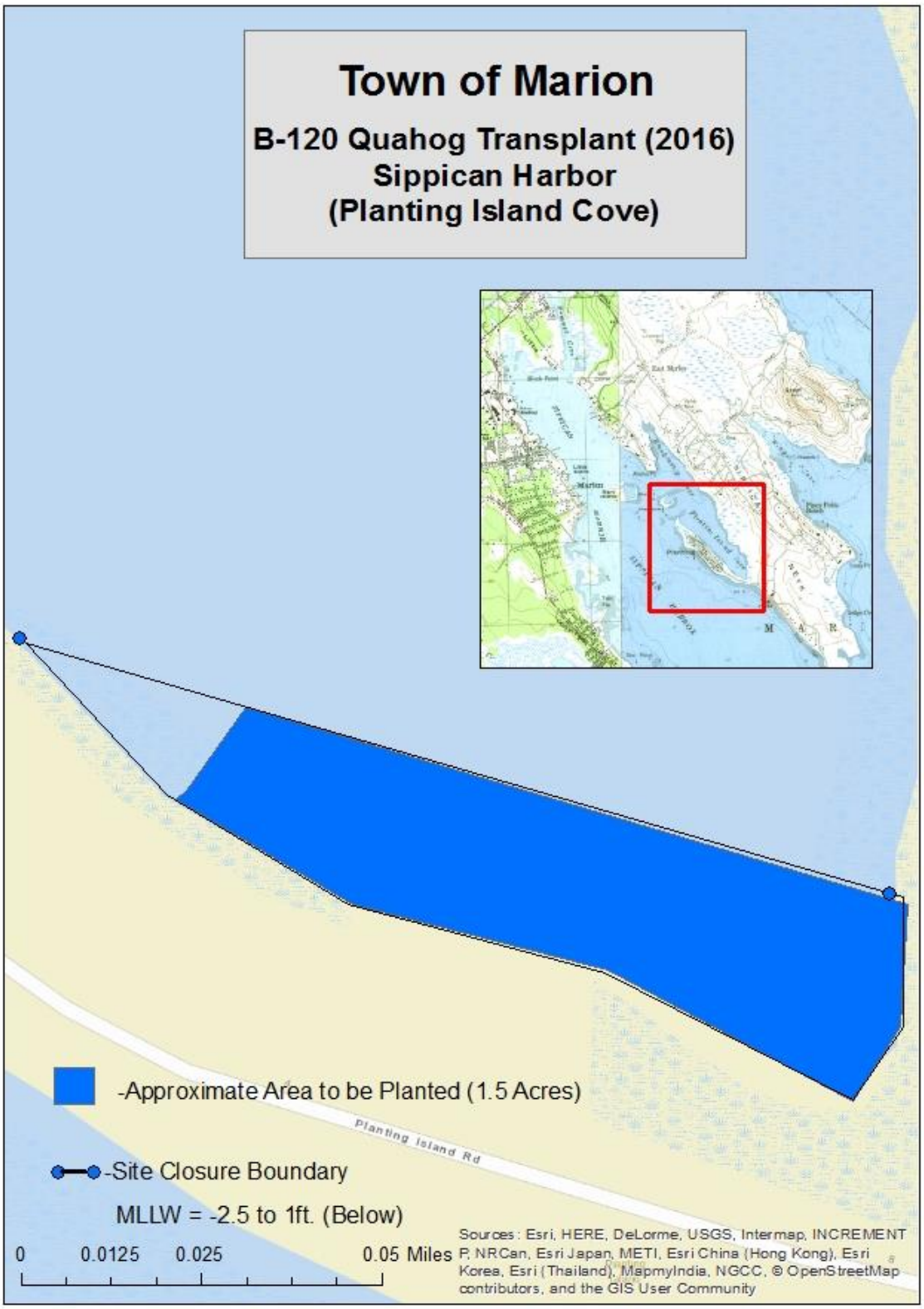
2016 Sites


Town of Bourne
B-120 Quahog Transplant
(2016) Phinney's Harbor
(Tahanto)
Toby s Island
Buzzards Bay
Monks Marine Park
Tahanto Beach
Tahanto Rd
Navajo Rd
Westamoe Rd
Pocahontas Rd
Wabenaki Rd
Wales Dr
Shore Rd
Pocasset River
- Approximate Area to be Planted (4 Acres)
Site Closure Boundary
MLLW = 0-1.5 ft (Below)
0
0.075
0.15
0.3 Miles
Sources: Esri, HERE, DeLorme, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), MapmyIndia, NGCC, © OpenStreetMap contributors, and the GIS User Community


Town of Dartmouth
B-120 Quahog Transplant (2016)
Apponagansett Bay
(Apponagansett Park)
Apponagansett Park
MLLW = -1.5 to -0.5 ft (Below)
-Approximate Area to be Planted = 1 acre
-Site Closure Boundary
Gulf Rd
0
0.025
0.05 Miles
Sources: Esri, HERE, DeLorme, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), MapmyIndia, NGCC, © OpenStreetMap contributors, and the GIS User Community


Town of Fairhaven
B-120 QuahogTransplants (2016)
West Island North
(Jack's Cove)
Goulart Memorial Dr
-Approximate Area to be Planted = 3 acres
-Site Closure Boundary
-MLLW = 0 - 2 ft (Below)
0
0.05
0.1 Miles
Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, © OpenStreetMap contributors, and the GIS User Community

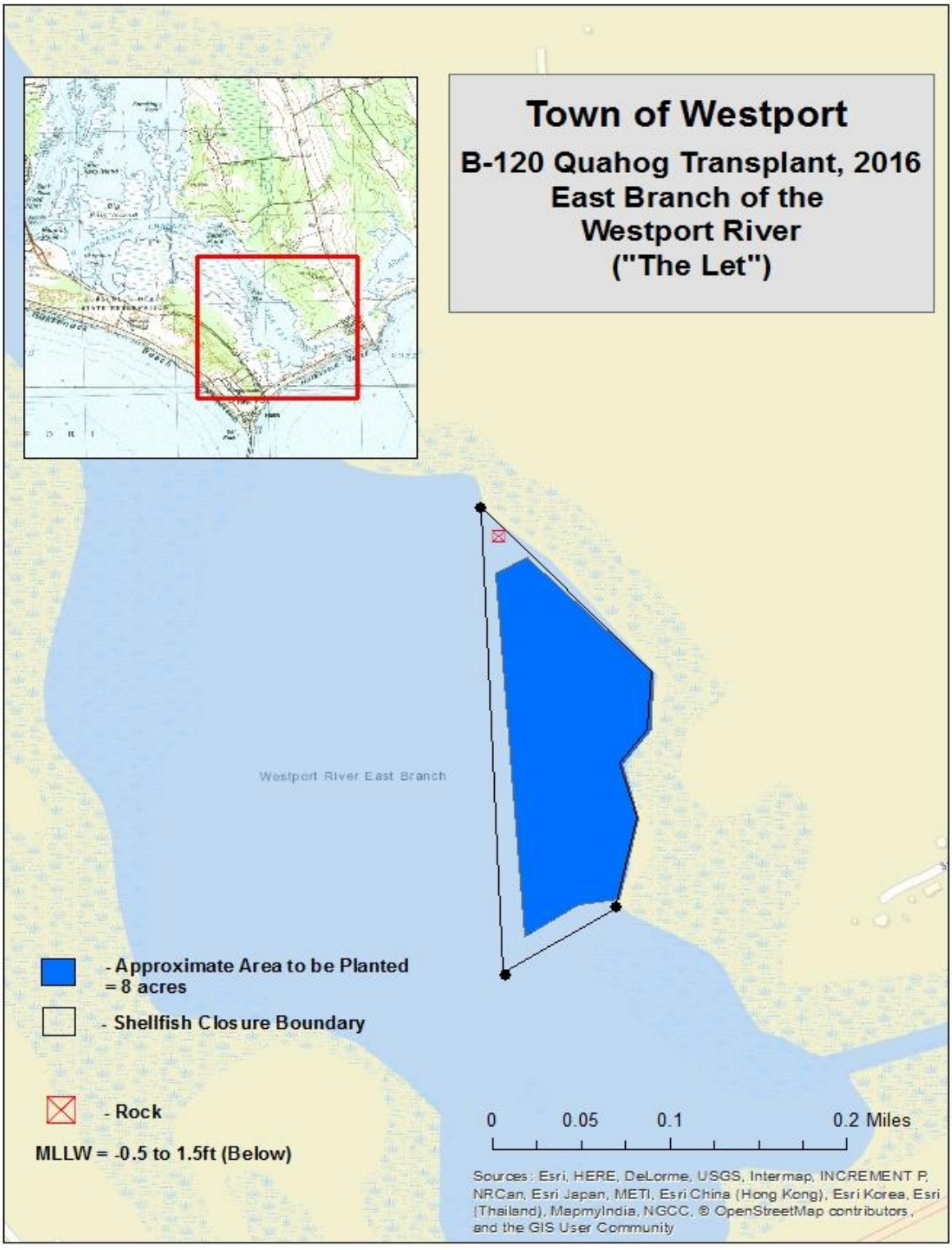

Town of Gosnold
B-120 Quahog Transplant
2016 Nashawena
(E4)
-Approximate Area to be Planted = 0.3 acres
-Site Closure Boundary
MLLW = 0-3ft. (Below)
0 0.0225 0.045 0.09 Miles
Sources: Esri, HERE, DeLorme, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), MapmyIndia, NGCC, © OpenStreetMap contributors, and the GIS User Community


Town of Marion
B-120 Quahog Transplant (2016)
Sippican Harbor
(Planting Island Cove)
-Approximate Area to be Planted (1.5 Acres)
Planting Island Rd
-Site Closure Boundary
MLLW = -2.5 to 1ft. (Below)
0
0.0125
0.025
0.05 Miles
Sources: Esri, HERE, DeLorme, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), MapmyIndia, NGCC, © OpenStreetMap contributors, and the GIS User Community


Town of Mattapoisett
B-120 Quahog Transplant (2016)
Brandt Island Cove
Area to be Planted (1.5 Acres)
Site Closure Boundary
MLLW = 2.7 - 4.2ft (Below)
0
0.0175
0.035
0.07 Miles
Sources: Esri, HERE, DeLorme, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), MapmyIndia, NGCC, © OpenStreetMap contributors, and the GIS User Community


City Of New Bedford
B-120 Quahog Transplant 2016
Clark's Cove (Dudley Street)
Rodney French Blvd
175
-Approximate Area to be Planted (1 Acre)
-Site Closure Boundary
MLLW = 0.75 - 9.75ft (Below)
0
0.01
0.02
0.04 Miles
Sources: Esri, HERE, DeLorme, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), MapmyIndia, NGCC, © OpenStreetMap contributors, and the GIS User Community, Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community, Sources: Esri, GEBCO, NOAA, National Geographic, DeLorme, HERE, Geonames.org, and other contributors


Town of Wareham
B-120 Quahog Transplant (2016)
Sunset Cove
Alfred L Gomez
Baker's Island Rd
Squaw's Path
Flint St
Northport Dr
Central Ave
Atlantic Ave
Franklin St
Gladstone Ave
Arlington Rd
Frankie Ave
Davis Ln
Onset Bay
-Approximate Area to be Planted = 2 acres
-Site Closure Boundary
MLLW = 0 - 2.5ft (Below)
0
0.1
0.2 Miles
Sources: Esri, HERE, DeLorme, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), MapmyIndia, NGCC, © OpenStreetMap contributors, and the GIS User Community


Town of Westport
B-120 Quahog Transplant, 2016
East Branch of the
Westport River
("The Let")
Westport River East Branch
- Approximate Area to be Planted
= 8 acres
- Shellfish Closure Boundary
- Rock
MLLW = -0.5 to 1.5ft (Below)
0
0.05
0.1
0.2 Miles
Sources: Esri, HERE, DeLorme, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), MapmyIndia, NGCC, © OpenStreetMap contributors, and the GIS User Community

APPENDIX II

Pathology Screening Results for Quahogs Within the 2015 and 2016 Taunton River Donor Site

2015 Pathology Results

KENNEBEC RIVER BIOSCIENCES

Shellfish Health Inspection

RECEIVED APR – 7 2015

Company: Massachusetts Division of Marine Fisheries
Address: 30 Emerson Ave.
Gloucester, MA 01930

Site: Winslow Point, Fall River, MA
Species: *Mercenaria mercenaria*
Age:
Size: Avg. 65 mm

Report Date: 06-Apr-15
Receipt Date: 17-Mar-15
Accession: M15031720

Collected By: Greg Sawyer
Date Collected: 16-Mar-15
Witnessed by: James Rossignol

Agent	Common Name	Results	Prevalence	Comments
Perkinsus spp.	Dermo	not detected		
Haplosporidium nelsoni	MSX	n/a		
Haplosporidium costale	SSO	n/a		
n/a	QPX	not detected		
Roseovarius crassostreae	JOD/ROD	n/a		
n/a	Neoplastic cells	not detected		
Bonamia ostreae		n/a		
Bonamia exitiosa		n/a		

n/a = not applicable or not requested

Methods:

Shellfish were inspected at an assumed pathogen prevalence level of 5% (60 individuals tested), according to USFWS & AFS-FHS (2014) and OIE (2012) protocols. Shellfish were examined for any external or internal morphological abnormalities and fouling organisms. Cross-sections and additional tissues collected were screened for targeted etiologic agents using a combination of RFTM, histology and PCR. Two or more assays were used per targeted pathogen where available and additional testing pursued as needed.

Comments:

Evaluation during necropsy did not indicate any external or internal abnormalities. Testing results for targeted agents are summarized above.

Please feel free to call with any questions or concerns. Thank you for working with Kennebec River Biosciences, Inc.

Sincerely,

Cem Giray Ph.D., Chief Science Officer

Victoria A. Bowie, Quality Systems Manager

41 Main St. Richmond, ME 04357 USA Tel: 207.737.2637 Fax: 207.737.4504 www.kennebecriverbiosciences.com

KENNEBEC RIVER BIOSCIENCES

Shellfish Health Inspection

RECEIVED
APR – 7 2015

Company: Massachusetts Division of Marine Fisheries
Address: 30 Emerson Ave.
Gloucester, MA 01930

Site: O'Connell's B.Y., Fall River, MA
Species: *Mercenaria mercenaria*
Age:
Size: Avg. 64 mm

Report Date: 06-Apr-15
Receipt Date: 17-Mar-15
Accession: M15031719

Collected By: Greg Sawyer
Date Collected: 16-Mar-15
Witnessed by: James Rossignol

Agent	Common Name	Results	Prevalence	Comments
Perkinsus spp.	Dermo	not detected		
Haplosporidium nelsoni	MSX	n/a		
Haplosporidium costale	SSO	n/a		
n/a	QPX	not detected		
Roseovarius crassostreae	JOD/ROD	n/a		
n/a	Neoplastic cells	not detected		
Bonamia ostreae		n/a		
Bonamia exitiosa		n/a		

n/a = not applicable or not requested

OK

Methods:

Shellfish were inspected at an assumed pathogen prevalence level of 5% (60 individuals tested), according to USFWS & AFS-FHS (2014) and OIE (2012) protocols. Shellfish were examined for any external or internal morphological abnormalities and fouling organisms. Cross-sections and additional tissues collected were screened for targeted etiologic agents using a combination of RFTM, histology and PCR. Two or more assays were used per targeted pathogen where available and additional testing pursued as needed.

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Please feel free to call with any questions or concerns. Thank you for working with Kennebec River Biosciences, Inc.

Sincerely,

Cem Giray Ph.D., Chief Science Officer

Victoria Bowie

Victoria A. Bowie, Quality Systems Manager

KENNEBEC RIVER BIOSCIENCES

Shellfish Health Inspection

RECEIVED
APR – 7 2015

Company: Massachusetts Division of Marine Fisheries
Address: 30 Emerson Ave.
Gloucester, MA 01930

Site: Breeds Cove, Somerset, MA
Species: *Mercenaria mercenaria*
Age:
Size: Avg. 72 mm

Report Date: 06-Apr-15
Receipt Date: 17-Mar-15
Accession: M15031718

Collected By: Greg Sawyer
Date Collected: 16-Mar-15
Witnessed by: James Rossignol

Agent	Common Name	Results	Prevalence	Comments
Perkinsus spp.	Dermo	not detected		
Haplosporidium nelsoni	MSX	n/a		
Haplosporidium costale	SSO	n/a		
n/a	QPX	not detected		
Roseovarius crassostreae	JOD/ROD	n/a		
n/a	Neoplastic cells	not detected		
Bonamia ostreae		n/a		
Bonamia exitiosa		n/a		

n/a = not applicable or not requested

Methods:

Shellfish were inspected at an assumed pathogen prevalence level of 5% (60 individuals tested), according to USFWS & AFS-FHS (2014) and OIE (2012) protocols. Shellfish were examined for any external or internal morphological abnormalities and fouling organisms. Cross-sections and additional tissues collected were screened for targeted etiologic agents using a combination of RFTM, histology and PCR. Two or more assays were used per targeted pathogen where available and additional testing pursued as needed.

Comments:

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Please feel free to call with any questions or concerns. Thank you for working with Kennebec River Biosciences, Inc.

Sincerely,

Cem Giray Ph.D., Chief Science Officer

Victoria A. Bowie, Quality Systems Manager

2016 Pathology Results

KENNEBEC RIVER BIOSCIENCES

Shellfish Health Inspection

Company: Massachusetts Division of Marine Fisheries
Address: 30 Emerson Ave.
Gloucester, MA 01930

Site: Borden Flats Lighthouse, Somerset, MA
Species: *Mercenaria mercenaria*
Age: Adult
Size: Avg. 89 mm

Report Date: 29-Mar-16
Receipt Date: 23-Feb-16
Accession: M16022305

Collected By: Greg Sawyer
Date Collected: 22-Feb-16
Witnessed by: Katelyn Kotfila

Agent	Common Name	Results	Prevalence	Comments
Perkinsus spp.	Dermo	not detected		
Haplosporidium nelsoni	MSX	n/a		
Haplosporidium costale	SSO	n/a		
n/a	QPX	not detected		
Roseovarius crassostreae	JOD/ROD	n/a		
n/a	Neoplastic cells	not detected		
Bonamia ostreae		n/a		
Bonamia exitiosa		n/a		

n/a = not applicable or not requested

Methods:

Shellfish were inspected at an assumed pathogen prevalence level of 5% (60 individuals tested), according to USFWS & AFS-FHS (2014) and OIE (2014) protocols. Shellfish were examined for any external or internal morphological abnormalities and fouling organisms. Cross-sections and additional tissues collected were screened for targeted etiologic agents using a combination of RFTM, histology and PCR.

Comments:

Evaluation during necropsy did not indicate any external or internal abnormalities. Testing results for targeted agents are summarized above.

Please feel free to call with any questions or concerns. Thank you for working with Kennebec River Biosciences, Inc.

Sincerely,

Cem Giray Ph.D., Chief Science Officer

KENNEBEC RIVER BIOSCIENCES

Shellfish Health Inspection

Company:	Massachusetts Division of Marine Fisheries	**Report Date:**	29-Mar-16
Address:	30 Emerson Ave.	**Receipt Date:**	23-Feb-16
	Gloucester, MA 01930	**Accession:**	M16022306
Site:	Breeds Cove, Somerset, MA		
Species:	*Mercenaria mercenaria*	**Collected By:**	Greg Sawyer
Age:	Adult	**Date Collected:**	22-Feb-16
Size:	Avg. 75 mm	**Witnessed by:**	Katelyn Kotfila

Agent	Common Name	Results	Prevalence	Comments
Perkinsus spp.	Dermo	not detected		
Haplosporidium nelsoni	MSX	n/a		
Haplosporidium costale	SSO	n/a		
n/a	QPX	not detected		
Roseovarius crassostreae	JOD/ROD	n/a		
n/a	Neoplastic cells	not detected		
Bonamia ostreae		n/a		
Bonamia exitiosa		n/a		

n/a = not applicable or not requested

Methods:

Shellfish were inspected at an assumed pathogen prevalence level of 5% (60 individuals tested), according to USFWS & AFS-FHS (2014) and OIE (2014) protocols. Shellfish were examined for any external or internal morphological abnormalities and fouling organisms. Cross-sections and additional tissues collected were screened for targeted etiologic agents using a combination of RFTM, histology and PCR.

Comments:

Evaluation during necropsy did not indicate any external or internal abnormalities. Testing results for targeted agents are summarized above.

Please feel free to call with any questions or concerns. Thank you for working with Kennebec River Biosciences, Inc.

Sincerely,

Cem Giray Ph.D., Chief Science Officer

KENNEBEC RIVER BIOSCIENCES

Shellfish Health Inspection

Company:	Massachusetts Division of Marine Fisheries	**Report Date:**	29-Mar-16
Address:	30 Emerson Ave.	**Receipt Date:**	23-Feb-16
	Gloucester, MA 01930	**Accession:**	M16022307
Site:	Green Can #3 (N.of ARC Bait), Fall River, MA		
Species:	*Mercenaria mercenaria*	**Collected By:**	Greg Sawyer
Age:	Adult	**Date Collected:**	22-Feb-16
Size:	Avg. 73 mm	**Witnessed by:**	Katelyn Kotfila

Agent	Common Name	Results	Prevalence	Comments
Perkinsus spp.	Dermo	not detected		
Haplosporidium nelsoni	MSX	n/a		
Haplosporidium costale	SSO	n/a		
n/a	QPX	not detected		
Roseovarius crassostreae	JOD/ROD	n/a		
n/a	Neoplastic cells	not detected		
Bonamia ostreae		n/a		
Bonamia exitiosa		n/a		

n/a = not applicable or not requested

Methods:

Shellfish were inspected at an assumed pathogen prevalence level of 5% (60 individuals tested), according to USFWS & AFS-FHS (2014) and OIE (2014) protocols. Shellfish were examined for any external or internal morphological abnormalities and fouling organisms. Cross-sections and additional tissues collected were screened for targeted etiologic agents using a combination of RFTM, histology and PCR.

Comments:

Evaluation during necropsy did not indicate any external or internal abnormalities. Testing results for targeted agents are summarized above.

Please feel free to call with any questions or concerns. Thank you for working with Kennebec River Biosciences, Inc.

Sincerely,

Cem Giray Ph.D., Chief Science Officer

APPENDIX III

Bacteriological Sample Results for 2015 and 2016 Transplant Quahogs Prior to Opening Sites to Shellfishing

2015 Transplants

SHELLFISH SPECIES	
SS	Softshell Clams
SC	Surf Clam
RC	Razor Clam
QH	Quahog
OQ	Ocean Quahog
BS	Bay Scallop
CS	Sea Scallop
BM	Blue Mussel
RM	Rib Mussel
OY	Oyster

ACTIVITY CODE	
N	No Activity
A	Animals
D	Dredging
S	Shellfishing
B	Boats
W	Waterfowl
P	People
F	Flow

MASSACHUSETTS DIVISION OF MARINE FISHERIES SHELLFISH PROGRAM
GROWING AREA MICROBIOLOGICAL DATA SHEET

Page 1 of 1

East Seth - Cuttyhunk

Water Quality Area: E 9 Area Name: Cuttyhunk Pond Town/City: Gosnold

Date Collected: 10/3/16 Last Rain: days 2 inches 1/2 Collected By: Tom S/John M

LOW Tide: 3:30pm HIGH Tide: _____ Wind: Direction: NE Min: 3 Max: 7

Shore/Boat/Both: _____ Temps: Air: 75° Cooler: 41

Remarks: _____

B-120 Transplant 2015 MEAT & WATER

TIDAL STAGES	
E1	Ebb Top Half
E2	Ebb Bottom Half
F1	Fld Top Half
F2	Fld Lower Half
H	High Tide
L	Low Tide
U	Unknown

Type of Test Requested: MEAT & WATER

Date of Analysis: 10-4-16 Time of Analysis: 12:45/13:30 Date of Results: 10-6-16

Date Entered: _____ By: _____

Date Reviewed: _____ By: _____

Lab #	Bottle #	Sta.	Class Area Code	Location	Time	Tidal Stage	Temp °F	Activity Code	Activity #	SF or Salinity °/00	Results
2016-25		2015 Quahogs		Quahogs		E2	62.7	B	10 anchor	QH	<20
		RDAY site									
05S434	319			Water sample		E2	62.7	B	10 anchor	33	<1

Revised Data Form 8/2003

SHELLFISH SPECIES	
SS	Softshell Clams
SC	Surf Clam
RC	Razor Clam
QH	Quahog
OQ	Ocean Quahog
BS	Bay Scallop
CS	Sea Scallop
BM	Blue Mussel
RM	Rib Mussel
OY	Oyster

ACTIVITY CODE	
N	No Activity
A	Animals
D	Dredging
S	Shellfishing
B	Boats
W	Waterfowl
P	People
F	Flow

MASSACHUSETTS DIVISION OF MARINE FISHERIES SHELLFISH PROGRAM
GROWING AREA MICROBIOLOGICAL DATA SHEET

Page ___ of ___

Water Quality Area: BB30 Area Name: Hiller Cove Town/City: Mattapoisett

Date Collected: 7-11-16 Last Rain: days 1 inches .05" Collected By: GS

LOW Tide: 707 HIGH Tide: _____ Wind: Direction: C Min: ____ Max: ____

Shore/Boat/Both: _____ Temps: Air: 65 Cooler: 62

Remarks: B-120 Relay double bag

TIDAL STAGES	
E1	Ebb Top Half
E2	Ebb Bottom Half
F1	Fld Top Half
F2	Fld Lower Half
H	High Tide
L	Low Tide
U	Unknown

Type of Test Requested: _____

Date of Analysis: 7-11-16 Time of Analysis: 9:30/11:30 Date of Results: 7-13-16

Date Entered: _____ By: ____

Date Reviewed: _____ By: ____

Lab #	Bottle #	Sta.	Class Area Code	Location	Time	Tidal Stage	Temp °F	Activity Code	#	SF or Salinity °/00	Results
2016-05				Quahogs – Hiller Cove	715	L	71	N	—	QH	<20
CF[illegible]8	740			Water sample	720	L	71	N	—	32	1

Revised Data Form 8/2003

SHELLFISH SPECIES	
SS	Softshell Clams
SC	Surf Clam
RC	Razor Clam
QH	Quahog
OQ	Ocean Quahog
BS	Bay Scallop
CS	Sea Scallop
BM	Blue Mussel
RM	Rib Mussel
OY	Oyster

ACTIVITY CODE	
N	No Activity
A	Animals
D	Dredging
S	Shellfishing
B	Boats
W	Waterfowl
P	People
F	Flow

MASSACHUSETTS DIVISION OF MARINE FISHERIES SHELLFISH PROGRAM
GROWING AREA MICROBIOLOGICAL DATA SHEET

Page ___ of ___

Water Quality Area: ~~B13~~ Area Name: Clark Cove Town/City: New Bedford

Date Collected: 7-13-16 Last Rain: days 3 inches .52" Collected By: RF, GS

LOW Tide: 843 HIGH Tide: _____ Wind: Direction: SW Min: 10 Max: 15

Shore/Boat/Both: _____ Temps: Air: 70 Cooler: _____

Remarks: 8:20-9:45, H_2O sampl = 75°F
B-120 Relay (2015 Planting)

TIDAL STAGES	
E1	Ebb Top Half
E2	Ebb Bottom Half
F1	Fld Top Half
F2	Fld Lower Half
H	High Tide
L	Low Tide
U	Unknown

Type of Test Requested: _____

Date of Analysis: 7-13-16 Time of Analysis: 8 11:15/15:00 Date of Results: 7-15-16

Date Entered: _____ By: ____
Date Reviewed: _____ By: ____

Lab #	Bottle #	Sta.	Class Area Code	Location	Time	Tidal Stage	Temp °F	Activity Code	Activity #	SF or Salinity °/₀₀	Results
2016-07	~~1067~~			Quahogs - N.E. Corner	8:45	L		N	\		45
058003	1067			Water Sample	8:20	L	75	N	\	32	4

Revised Data Form 8/2003

SHELLFISH SPECIES	
SS	Softshell Clams
SC	Surf Clam
RC	Razor Clam
QH	Quahog
OQ	Ocean Quahog
BS	Bay Scallop
CS	Sea Scallop
BM	Blue Mussel
RM	Rib Mussel
OY	Oyster

ACTIVITY CODE	
N	No Activity
A	Animals
D	Dredging
S	Shellfishing
B	Boats
W	Waterfowl
P	People
F	Flow

MASSACHUSETTS DIVISION OF MARINE FISHERIES SHELLFISH PROGRAM
GROWING AREA MICROBIOLOGICAL DATA SHEET

Water Quality Area: BB4 Area Name: East Branch Town/City: Westport

Date Collected: 5/2/18 Last Rain: days 2 inches .07 Collected By: HB

LOW Tide: _____ HIGH Tide: 1030 Wind: Direction: SW Min: ~~14~~ Max: ~~24~~

Shore/Boat/Both: _____ Temps: Air: ~~73~~ Cooler: 53.6

Remarks: 2015 B-120 RELAY

TIDAL STAGES	
E1	Ebb Top Half
E2	Ebb Bottom Half
F1	Fld Top Half
F2	Fld Lower Half
H	High Tide
L	Low Tide
U	Unknown

Type of Test Requested: _____

Date of Analysis: 5-2-18 Time of Analysis: 13:40/14:22 Date of Results: 5-4-18

Date Entered: _____ By: _____

Date Reviewed: _____ By: _____

Lab #	Bottle #	Sta.	Class Area Code	Location	Time	Tidal Stage	Temp °F	Activity Code	Activity #	SF or Salinity °/₀₀	Results
2018-19				Quahogs – Emma Tripp Landing, the Let	1025	H	51	N	/	QH	<20
3	682			Water sample	1025	H	51	N	/	25	8
	331			Temp							

Revised Data Form 8/2003

2016 Transplants

SHELLFISH SPECIES	
SS	Softshell Clams
SC	Surf Clam
RC	Razor Clam
QH	Quahog
OQ	Ocean Quahog
BS	Bay Scallop
CS	Sea Scallop
BM	Blue Mussel
RM	Rib Mussel
OY	Oyster

ACTIVITY CODE	
N	No Activity
A	Animals
D	Dredging
S	Shellfishing
B	Boats
W	Waterfowl
P	People
F	Flow

MASSACHUSETTS DIVISION OF MARINE FISHERIES SHELLFISH PROGRAM
GROWING AREA MICROBIOLOGICAL DATA SHEET

Page ____ of ____

Water Quality Area: BB4 Area Name: East Branch Town/City: Westport
Date Collected: 5/14/18 Last Rain: days 2 inches 0.07 Collected By: HB, GL
LOW Tide: _____ HIGH Tide: 09:00 Wind: Direction: S Min: 5 Max: 10 mph
Shore/Boat/Both: _____ Temps: Air: 57° Cooler: 41°
Remarks: **2016 B-120 Relay**

TIDAL STAGES	
E1	Ebb Top Half
E2	Ebb Bottom Half
F1	Fld Top Half
F2	Fld Lower Half
H	High Tide
L	Low Tide
U	Unknown

Type of Test Requested: _____
Date of Analysis: 5-15-18 Time of Analysis: 10:30/10:20 Date of Results: 5-17-18

Date Entered: _____ By: _____
Date Reviewed: _____ By: _____

Lab #	Bottle #	Sta.	Class Area Code	Location	Time	Tidal Stage	Temp °F	Activity Code	Activity #	SF or Salinity °/00	Results
2018-20				Quahogs – The Let (NE quadrant)						QH	20
	813	G10		Water sample	0952	F.H	61°	N	—	25	17
	240	Temp		Water	0952	F.H	41°	N	—		

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SHELLFISH SPECIES	
SS	Softshell Clams
SC	Surf Clam
RC	Razor Clam
QH	Quahog
OQ	Ocean Quahog
BS	Bay Scallop
CS	Sea Scallop
BM	Blue Mussel
RM	Rib Mussel
OY	Oyster

ACTIVITY CODE	
N	No Activity
A	Animals
D	Dredging
S	Shellfishing
B	Boats
W	Waterfowl
P	People
F	Flow

MASSACHUSETTS DIVISION OF MARINE FISHERIES SHELLFISH PROGRAM
GROWING AREA MICROBIOLOGICAL DATA SHEET

Water Quality Area: BB13 Area Name: Clarks Cove Town/City: New Bedford
Date Collected: 6-25-18 Last Rain: days 1 inches .54" Collected By: GS/TR
LOW Tide: 1200 HIGH Tide: _____ Wind: Direction: N Min: 20 Max: ____
Shore/Boat/Both: _____ Temps: Air: 75 Cooler: _____
Remarks: **2016 B-120 Relay**

TIDAL STAGES	
E1	Ebb Top Half
E2	Ebb Bottom Half
F1	Fld Top Half
F2	Fld Lower Half
H	High Tide
L	Low Tide
U	Unknown

Type of Test Requested: _____
Date of Analysis: 6-25-18 Time of Analysis: 13:55/15:30 Date of Results: 6-27-18

Date Entered: _____ By: _____
Date Reviewed: _____ By: _____

Lab #	Bottle #	Sta.	Class Area Code	Location	Time	Tidal Stage	Temp °F	Activity Code	Activity #	SF or Salinity °/₀₀	Results
2018-23				Dudley Street	1255	E1		N	—	QH	20
07-305	323			Water Sample	1235	E1	72	N	—	32	4

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SHELLFISH SPECIES	
SS	Softshell Clams
SC	Surf Clam
RC	Razor Clam
QH	Quahog
OQ	Ocean Quahog
BS	Bay Scallop
CS	Sea Scallop
BM	Blue Mussel
RM	Rib Mussel
OY	Oyster

ACTIVITY CODE	
N	No Activity
A	Animals
D	Dredging
S	Shellfishing
B	Boats
W	Waterfowl
P	People
F	Flow

MASSACHUSETTS DIVISION OF MARINE FISHERIES SHELLFISH PROGRAM
GROWING AREA MICROBIOLOGICAL DATA SHEET

Water Quality Area: E 4 Area Name: Gosnold West Coastal Town/City: Gosnold

Date Collected: 7/18/18 Last Rain: days 1 inches 0.3 Collected By: JM, HB

LOW Tide: 06:17 HIGH Tide: 13:08 Wind: Direction: NNE Min: 5 Max: 15

Shore/Boat/Both: _____ Temps: Air: 75°F Cooler: _____

Remarks: 2016 B-120 Relay

TIDAL STAGES	
E1	Ebb Top Half
E2	Ebb Bottom Half
F1	Fld Top Half
F2	Fld Lower Half
H	High Tide
L	Low Tide
U	Unknown

Type of Test Requested: 11:15

Date of Analysis: 7-18-18 Time of Analysis: 14:30 Date of Results: 7-20-18

Date Entered: _____ By: _____

Date Reviewed: _____ By: _____

Lab #	Bottle #	Sta.	Class Area Code	Location	Time	Tidal Stage	Temp °F	Activity Code	Activity #	SF or Salinity °/₀₀	Results
2018-26				Quahogs	07:15	F1		—	—	QH	<20
QH-7-18-904				Water sample	08:30	F1		—	—	30	1

Revised Data Form 8/2003

SHELLFISH SPECIES	
SS	Softshell Clams
SC	Surf Clam
RC	Razor Clam
QH	Quahog
OQ	Ocean Quahog
BS	Bay Scallop
CS	Sea Scallop
BM	Blue Mussel
RM	Rib Mussel
OY	Oyster

ACTIVITY CODE	
N	No Activity
A	Animals
D	Dredging
S	Shellfishing
B	Boats
W	Waterfowl
P	People
F	Flow

MASSACHUSETTS DIVISION OF MARINE FISHERIES SHELLFISH PROGRAM
GROWING AREA MICROBIOLOGICAL DATA SHEET

TIDAL STAGES	
E1	Ebb Top Half
E2	Ebb Bottom Half
F1	Fld Top Half
F2	Fld Lower Half
H	High Tide
L	Low Tide
U	Unknown

Water Quality Area: BB32 Area Name: Sippican Harbor Town/City: Marion

Date Collected: 7-30-17 Last Rain: days 1 inches .1 Collected By: GS

LOW Tide: 710 HIGH Tide: _____ Wind: Direction: N Min: 10 Max: ____

Shore/Boat/Both: _____ Temps: Air: 64 Cooler: 61

Remarks: _____

B-120 Relay (2016)

Type of Test Requested: _____

Date of Analysis: 7/31/17 Time of Analysis: 8:56/10:30 Date of Results: 8-2-17

Date Entered: _____ By: _____

Date Reviewed: _____ By: _____

Lab #	Bottle #	Sta.	Class Area Code	Location	Time	Tidal Stage	Temp °F	Activity Code	Activity #	SF or Salinity ‰	Results
2017-05				Quahogs - Planting Island Cove	730	L		N	—	[illegible]	<20
[illegible]	677			Water sample	732	L	70	N	—	32	<1

Revised Data Form 8/2003

SHELLFISH SPECIES	
SS	Softshell Clams
SC	Surf Clam
RC	Razor Clam
QH	Quahog
OQ	Ocean Quahog
BS	Bay Scallop
CS	Sea Scallop
BM	Blue Mussel
RM	Rib Mussel
OY	Oyster

ACTIVITY CODE	
N	No Activity
A	Animals
D	Dredging
S	Shellfishing
B	Boats
W	Waterfowl
P	People
F	Flow

MASSACHUSETTS DIVISION OF MARINE FISHERIES SHELLFISH PROGRAM
GROWING AREA MICROBIOLOGICAL DATA SHEET

Water Quality Area: BB:12 **Area Name:** Apponagansett Bay **Town/City:** Dartmouth

Date Collected: 10-23-17 **Last Rain: days** 8+ **inches** .05 **Collected By:** GL

LOW Tide: 1645 **HIGH Tide:** _____ **Wind: Direction:** SW **Max:** 7 **Min:** 14

Shore/Boat/Both: _____ **Temps: Air:** 70° **Cooler:** 52°

Remarks: RELAY

TIDAL STAGES	
E1	Ebb Top Half
E2	Ebb Bottom Half
F1	Fld Top Half
F2	Fld Lower Half
H	High Tide
L	Low Tide
U	Unknown

Type of Test Requested: _____

Date of Analysis: 10-24-17 **Time of Analysis:** 13:26/13:32 **Date of Results:** 10-26-17

Date Entered: _____ **By:** _____
Date Reviewed: _____ **By:** _____

Lab #	Bottle #	Sta.	Class Area Code	Location	Time	Tidal Stage	Temp °F	Activity Code	Activity #	SF or Salinity °/00	Results
		2	R	**Highland Street**							
		5	CA	**Star of the Sea Villa**							
		5B	CA	**Middle of Area 1**							
		6	CA	**Gulf Rd. Bridge**							
066984		7	R	**Town Landing** B120 Quahog Relay (water)	1610	E_2	60°	N		31	10
		6B	CA	**Middle of Area 2**							
		3	R	**Joy's Landing**							
		9B	A	**Northwest Corner**							
		9C	P	**New Bedford Yacht Club Pier (gas dock)**							
		4	A	**Bush Point**							
		8	A	**Knowles Pier**							
		9	A	**East Avenue**							
		9D	CA	**Between Middle & South Piers (NBYC)**							
2017-26				B120 Quahog Relay (Quahog meat)	1620	E_2		N		QH	20
				Temp Blank							

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SHELLFISH SPECIES	
SS	Softshell Clams
SC	Surf Clam
RC	Razor Clam
QH	Quahog
OQ	Ocean Quahog
BS	Bay Scallop
CS	Sea Scallop
BM	Blue Mussel
RM	Rib Mussel
OY	Oyster

ACTIVITY CODE	
N	No Activity
A	Animals
D	Dredging
S	Shellfishing
B	Boats
W	Waterfowl
P	People
F	Flow

MASSACHUSETTS DIVISION OF MARINE FISHERIES SHELLFISH PROGRAM
GROWING AREA MICROBIOLOGICAL DATA SHEET

Water Quality Area: BB18 Area Name: West Island North Town/City: Fairhaven
Date Collected: 8-2-17 Last Rain: days____ inches____ Collected By: GL
LOW Tide: 0959 HIGH Tide:____ Wind: Direction SSW Min: 5 Max: 10
(Shore)/Boat/Both: ____ Temps: Air: 83° Cooler:____
Remarks:____

TIDAL STAGES	
E1	Ebb Top Half
E2	Ebb Bottom Half
F1	Fld Top Half
F2	Fld Lower Half
H	High Tide
L	Low Tide
U	Unknown

B-120 Relay (2016)

Type of Test Requested: ____
Date of Analysis: 8-2-17 Time of Analysis: 14:10/15:10 Date of Results: 8-4-17

Date Entered:____ By:____
Date Reviewed:____ By:____

Lab #	Bottle #	Sta.	Class Area Code	Location	Time	Tidal Stage	Temp °F	Activity Code	Activity #	SF or Salinity ‰	Results
2017-00				Quahogs – Jack's Cove	1005	L	66°	B	4	QH	<20
[redacted]				Water sample	1000	L	66°	B	4	32	<1

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SHELLFISH SPECIES	
SS	Softshell Clams
SC	Surf Clam
RC	Razor Clam
QH	Quahog
OQ	Ocean Quahog
BS	Bay Scallop
CS	Sea Scallop
BM	Blue Mussel
RM	Rib Mussel
OY	Oyster

ACTIVITY CODE	
N	No Activity
A	Animals
D	Dredging
S	Shellfishing
B	Boats
W	Waterfowl
P	People
F	Flow

MASSACHUSETTS DIVISION OF MARINE FISHERIES SHELLFISH PROGRAM
GROWING AREA MICROBIOLOGICAL DATA SHEET

Water Quality Area: BB23 Area Name: Brant Island Cove Town/City: Mattapoisett
Date Collected: 7-30-17 Last Rain: days 1 inches .1" Collected By: GS
LOW Tide: 709 HIGH Tide: _____ Wind: Direction: N Min: 10 Max: 15
Shore/Boat/Both: _____ Temps: Air: 64 Cooler: 61
Remarks: _____

B-120 Relay (2016)

TIDAL STAGES	
E1	Ebb Top Half
E2	Ebb Bottom Half
F1	Fld Top Half
F2	Fld Lower Half
H	High Tide
L	Low Tide
U	Unknown

Type of Test Requested: _____
Date of Analysis: 7-31-17 Time of Analysis: 8:50/10:30 Date of Results: 8-2-17

Date Entered: _____ By: _____
Date Reviewed: _____ By: _____

Lab #	Bottle #	Sta.	Class Area Code	Location	Time	Tidal Stage	Temp °F	Activity Code	#	SF or Salinity °/00	Results
2017-04				Quahogs – Brandt Island Cove	759	L		N	–	6H	20
07-03	491			Water sample	801	L	71	N	–	32	<1

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