SOARS Program Post Planting Report-Squaxin Island

Site History: In 2010 both the Palela Bay site and the BC1 site were locations targeted for Olympia oyster substrate enhancement. Prior to substrate enhancement, the Palela Bay site was soft deep mud with a few naturally occurring Olympia oysters resting on the mud. The BC1 site had a muddy-sand mixed substrate but to a much lesser depth and no known existing Olympia oysters. In 2010 Pacific oyster cultch was spread over both sites creating two footprints of over 2.25 acres in total.

In Palela Bay, an assessment of the naturally recruiting Olympia oysters was conducted on October 30, 2018. In this survey of 54 -2 ft^2 quadrats, the number of live oysters were counted for each quadrate location. The counts of live Olympia oysters per quadrat ranged from 0 to 17 oysters with half of the quadrats containing no oysters at all. This resulted in an estimated an average density of 0.87 Olympia oysters per square foot at the Palela Bay site on the north side of the bay. In November of 2018 approximately 850,000 ¾ inch Olympia oysters were spread on this site. A post planting survey had not been conducted because of the dense green algae mats that occupy this bed in the spring and summer months.

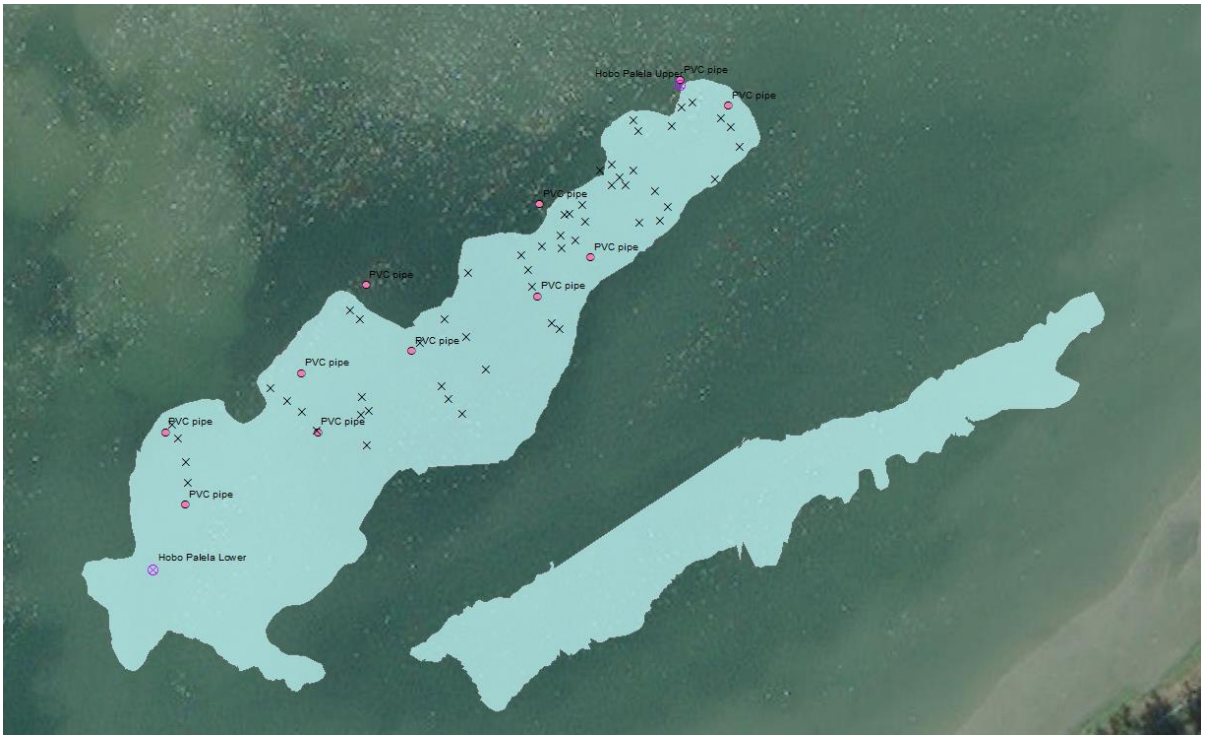
Site Environmental Variables:

Temperature: Three HOBO temperature probes were deployed to monitor the restoration sites beginning on May 14th 2021 and ending on April 19th, 2022. The BC1 site had one probe stationed at the lower end of the site at approximately at -1.5 foot MLLW. The Palela Bay site had 2 probes, the lower probe was at south west end of the plot closest to the mouth of the bay at a tidal height of approximately -1.0 foot MLLW. The second probe is at the north eastern edge of the plot about 500 horizontal feet away and at an approximate tidal height of 4 feet MLLW. Temperatures of the Palela Bay upper probe ranged from 30.4 F to 96.0 F while the lower Palela Bay probe recorded 28.1 F to 86.3 F. The highest readings were from June 27th, 2021 during the heat dome and the coldest readings were from January 1st, 2022. The BC1 site had a smaller range of temperatures with a high of 86.9 F and a low of 34.7 F on the same days as the Palela Bay probes highest and lowest readings.

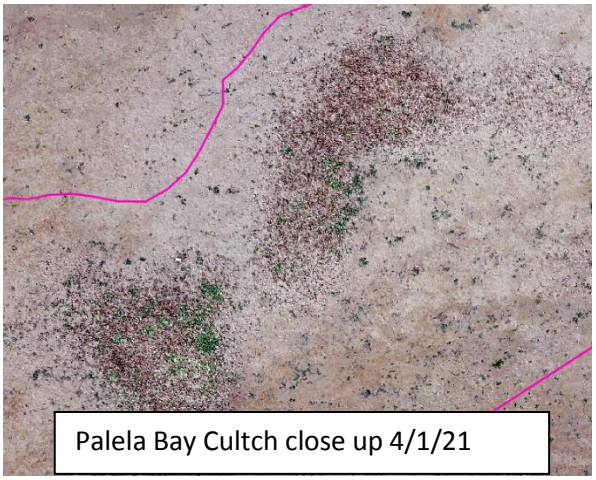
Salinity: Salinity measurements were taken from nearby Washington Department of Health Shellfish Programs Growing area water quality stations. For the BC1 site station 87 was used and for Palela Bay site station 64 was used. Both of these stations are monitored every other month in conjunction with water quality samples. Station 64, at the mouth of Palela Bay, had salinity measurements from 22 to 30 ppt over the course of the last year. In measurements collected since 1992 this station has ranged from 20 to 32 ppt. Station 87, located near the BC1 site, recorded salinities ranging from 27 to 29 ppt. This station has ranged from 17 to 32 ppt in readings taken since 1992.

Preplanting Assessment: Palela Bay

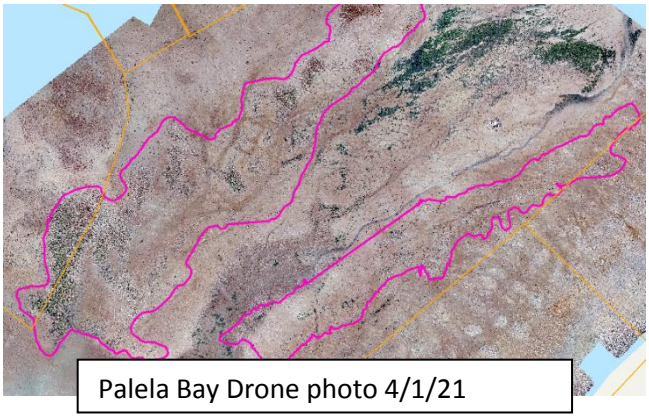
A preplanting assessments was conducted on 4/30/21 for the Palela Bay site. The area assessed was approximately 475 feet by 100 feet within the foot print of the previous shell cultch placement area



from 2010 (green polygons). A drone flight was conducted on April 1st 2021 in an attempt to assess the bed area of the cultch laid down in 2010. The substrate beneath the cultch is soft mud and walking in the area is difficult. Walking through the bed is also



Palela Bay Cultch close up 4/1/21

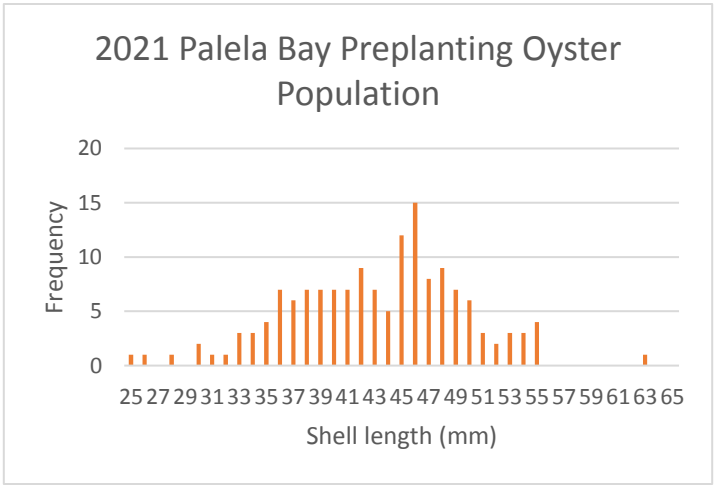


Palela Bay Drone photo 4/1/21

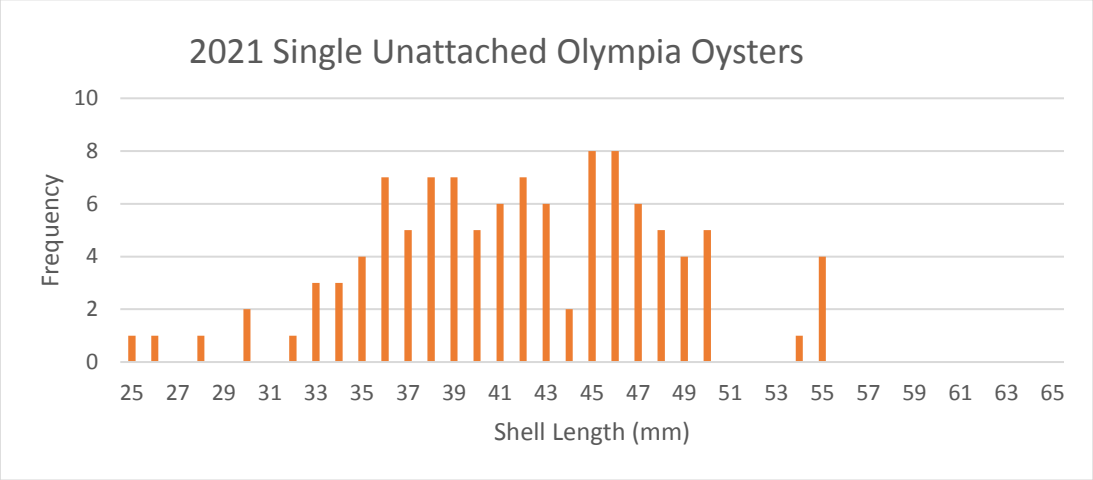
harmful to the oysters if they are stepped on and forced downward into the mud. Using a drone to map the Olympia oyster bed was problematic due to the fact that Olympia oysters were not always in areas of high cultch density. In fact when sampling the bed some of the highest densities of oysters were found in samples with less than half the quadrat area was covered in shell. During the survey on April 30th, 2021, 54 two square foot quadrats were sampled. In these samples, live oysters and empty shells were counted and measured. Each oysters was identified as being either single or attached to shell, a live oyster, or a rock. For each sample location the substrate type, % cultch coverage and % algae coverage was also recorded.

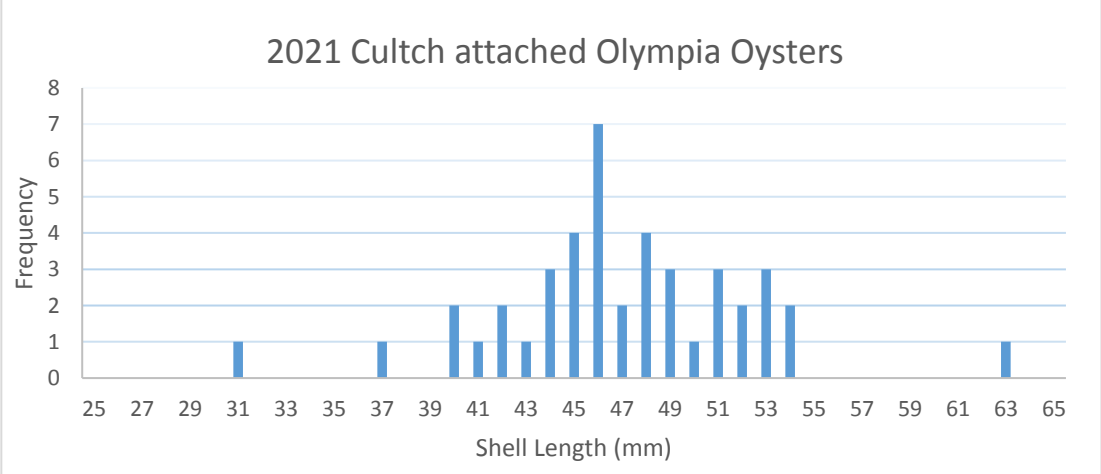
During the assessment algae cover was a problem. Expansive mats of green algae (*Ulva* sp.) began covering much of the area in early spring. The photos of the survey above are in stark contrast to the drone photos on the previous page that show significantly less green algae cover from just one month before.

The oysters attached to shell are assumed to be natural set oysters but while the single oysters were likely planted in 2018 some may have also been natural set oysters as well. Individual shell lengths from the 153 oysters measured ranged from 25 to 63 mm and oyster density ranged from 0 to 27 oysters per 2 ft^2. Of the 54 quadrates, 32 contained no oysters at all. Because of the difficulty in defining the oyster bed area and the high variance in the sample counts, any estimates of average density or number of oysters are unreliable.



When attachment substrate was examined, all oysters were either unattached singles or attached to clutch. Of the 153 oysters measured, 109 were singles and 43 were attached to cultch with no oysters attached to other live oysters or rocks. All cluch attached oysters can be presumed to be wild set however, the single oysters are likely a mix of singles planted in 2018 and wild set singles. Wild set singles have been found at this site over the years prior to the first planing in 2018 and these oysters were usually charatarized by having thicker shells and being a larger size (<~40mm) much like the size ranges of the clutch attached oysters. We did not attempt to differentiate individual oysters between planted and wild set singles durirng the survey. However, we can assume that proportion of oysters found that were wild set recruits is at least 28%.





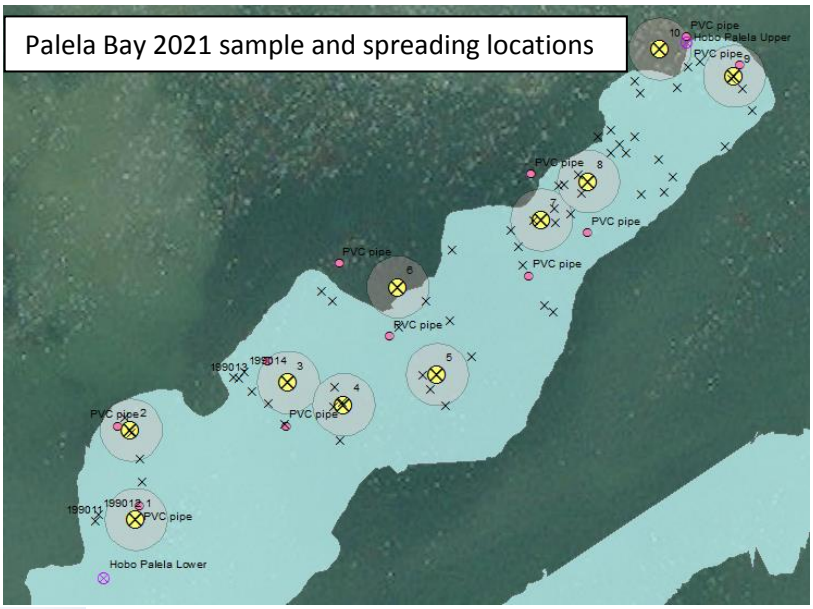
Preplanting Assessment BC1

The BC1 site is a much smaller site located on the north east end of Squaxin Island in Peale Passage. A preplanting survey was conducted on this site on May 14th, 2021. This site was also within the footprint of the shell placement from 2010 but the survey focused on a smaller area identified in 2019 as oyster habitat.

This site is a small delta created from an intermittent drainage from the shore. The substrate is sandy with soft mud and cobble both above and below the bed. Wild set and cultivated Pacific oysters are found adjacent to the site. The pre-planting survey here consisted of 15 two ft^2 quadrats collecting the same data as in the Palela Bay survey. Of these 15 samples only 3 contained Olympia oysters for a total of 10 oysters found and measured. This is similar results to a survey from June of 2019 where 8 quadrats were sampled and 14 Olympia oysters were counted in the same general area. Since this area was never planted with Olympia oysters these oysters are assumed all to be wild set.

Olympia Oyster Planting: Palela Bay

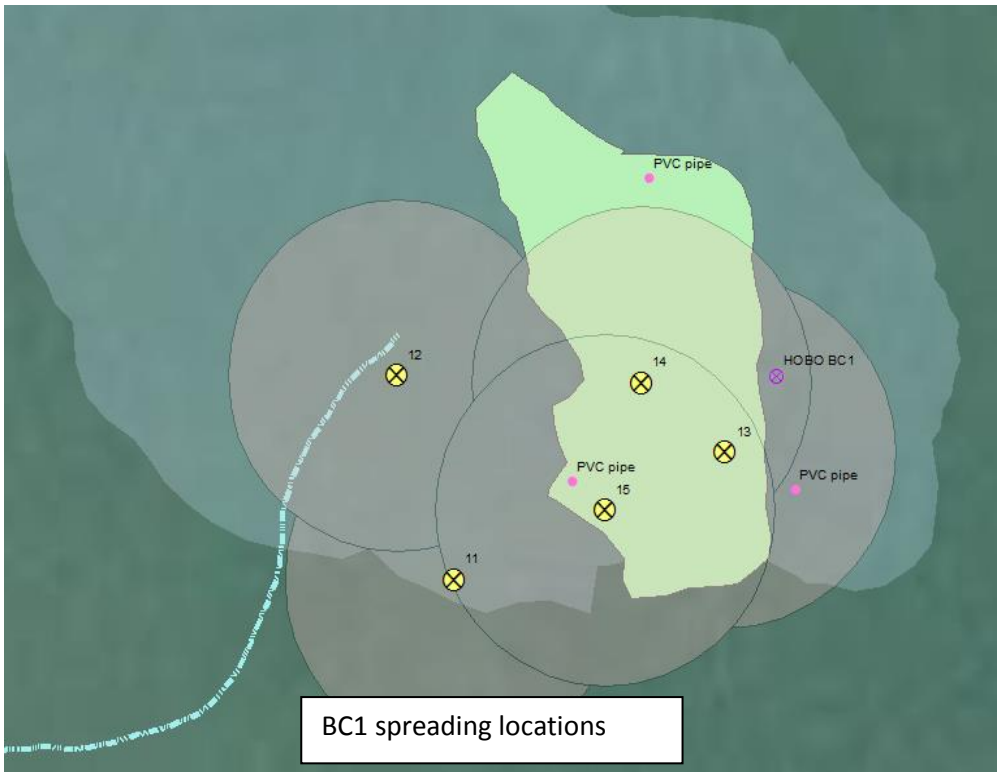
On May 21st, 2021 71,000 adult Olympia oysters were picked up from Chelsea Farms in Eld Inlet through the SOARS Program. These oysters came from 147 oyster bags and were placed in trays for spreading. In Palela Bay 10 locations were selected based on the preplanting survey sample locations that had the highest oyster densities.



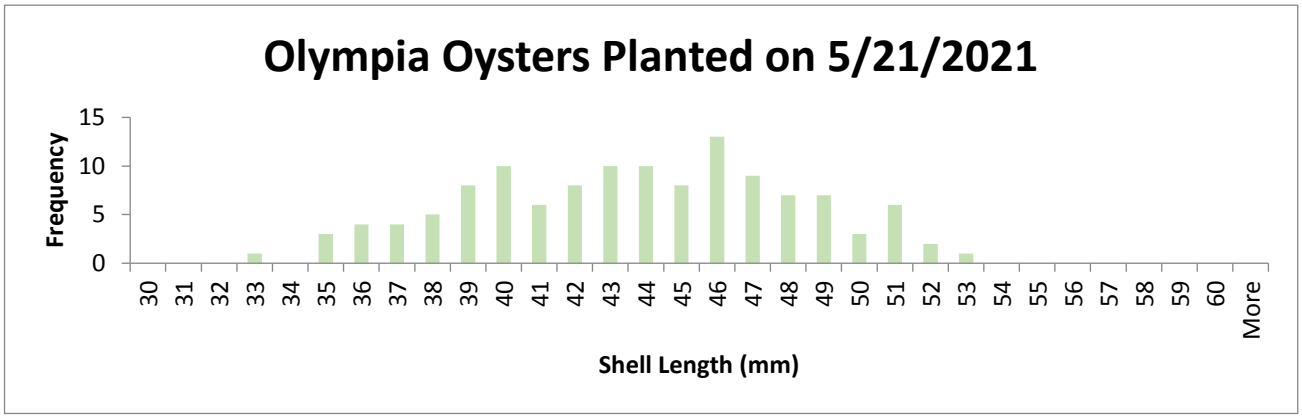
At these locations a buoy was dropped at high tide and the oysters were spread from the boat. Palela Bay spreading locations #1-#9 had 5,800 oysters per site while 4,350 oysters were spread on site #10 for a total of 56,550 adult Olympia oysters.

Olympia Oyster Planting: BC1

On BC1 spreading locations #11-#15 were designated. Due to the much smaller size of the site, these locations were much closer together and the oysters were spread between the locations rather than centered on them. Locations #11 and #12 had 5,800 oyster spread between them while locations #13-#15 had 8,700 oysters planted between them for a BC1 total of 14,500 adult Olympia oysters.

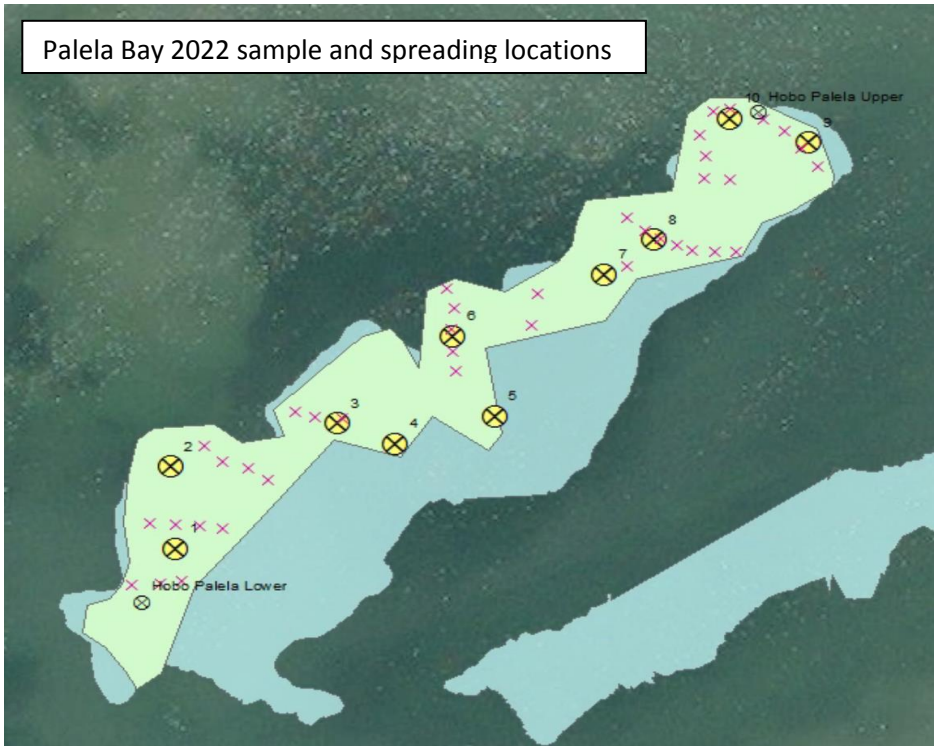


Prior to planting both sites a sample of 125 oysters were measured for shell length. These adult Olympia oysters ranged from 33 mm to 53 mmm in shell length.



Post Planting Survey: Palela Bay

In Palela Bay, a post one year planting survey was conducted on April 19th, 2022. A 0.85 acre area approximately 450 feet long ranging in width from 30 to 100 feet was surveyed (green polygon).



This survey was timed to occur before the spring growth of green algae on the bed like we experienced at the end of April in 2021. To meet this end the earliest possible daylight tide of a low enough tidal height to access the bed was chosen for the survey.

During the survey transects were run at approximately 50 foot intervals and along each transect, samples were taken at 30 foot intervals. Transect directions were somewhat arbitrary and followed along the wider parts of the oyster bed rather than in a uniform and unbiased way. Sampling along each transect stopped as the substrate became softer and the contiguous edge of the cultch substrate was reached even if cultch substrate could be found farther out.

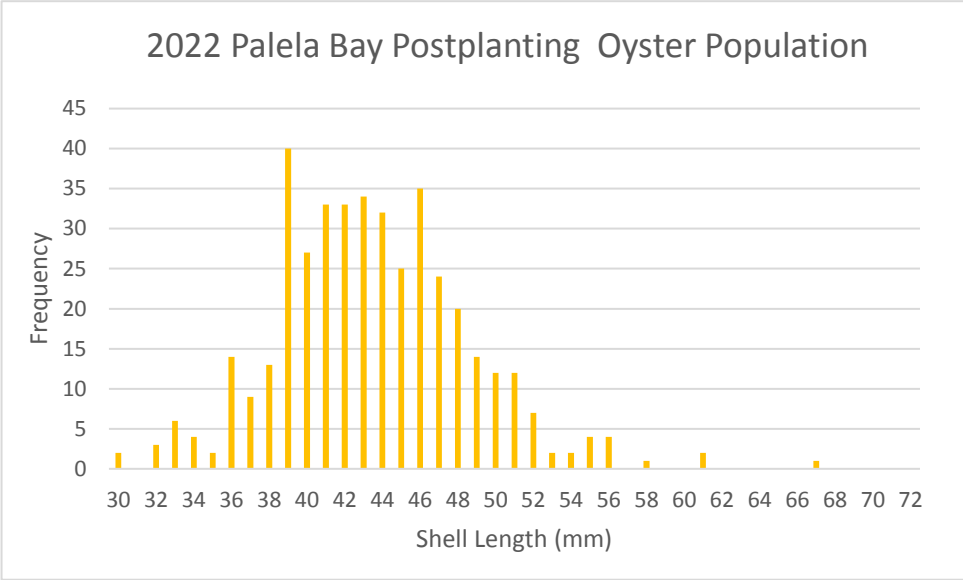
Of the fifty samples laid out only 39 were collected before the tide came in and submerged the bed.

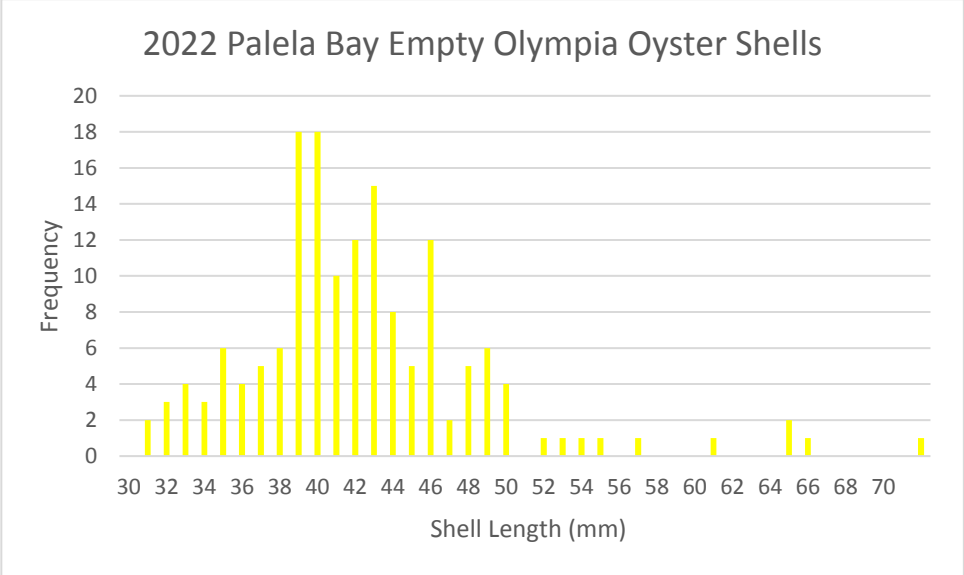
A total of 417 live Olympia oysters and 158 empty Olympia oyster shells were counted and measured in the 39 2 ft^2 samples.

If we assume all oysters were planted and all empty shells were collected, our 1 year survival estimate would be 72%. This doesn't take into account the preexisting oyster population or differentiating between wild set and planted oysters. None the less, the live Olympia oyster density on the plot increased from 1.4 oysters/ft^2 to 5.3 oysters/ft^2 one year after the planting.

This live oyster density applied to the 0.85 acre footprint produces an estimated population of 191,800 Olympia oysters.

Palela Bay Site		
4/30/2021	4/19/2022	
Preplanting	Post planting 1 year	
54	39	samples
108	78	ft^2 sampled
84%	72%	live oysters
28%	2%	cultch oysters (live)
72%	98%	single oysters (live)
0.4	0.1	culch oysters/ft^2
1.0	5.2	singles/ft^2
1.4	5.3	total oysters/ft^2
0.3	2.1	dead oyster/ft^2


2022 Palela Bay Postplanting Oyster Population
Frequency
0
5
10
15
20
25
30
35
40
45
30 32 34 36 38 40 42 44 46 48 50 52 54 56 58 60 62 64 66 68 70 72
Shell Length (mm)


2022 Palela Bay Empty Olympia Oyster Shells
Frequency
0
2
4
6
8
10
12
14
16
18
20
30 32 34 36 38 40 42 44 46 48 50 52 54 56 58 60 62 64 66 68 70
Shell Length (mm)

Post Planting Survey: BC1

On April 19th, 2022 a survey was also conducted on BC1 using the same methods as in Palela Bay. In this survey 15 2 ft^2 samples were taken and 222 live Olympia oysters were counted, seven of which were attached to cultch and therefore assumed to be wild. Oyster densities ranged from 0 to 67 per 2 ft^2 quadrat with four quadrats containing no oyster at all. The average density was 14.8 live oysters per sample or 7.4 oysters per ft^2. Empty shells were also counted in each sample and if all dead oysters were assumed to have been left in place the survival rate from planting would be 87%. A new oyster bed area was estimated to be 3,082 ft^2 or 0.07 acres. The density applied to this area yields a population of 22,800 Olympia oysters.

5/14/2021	4/19/2022	
Preplanting	Post planting 1 year	
15	15	samples
30	30	ft^2 sampled
83%	87%	live oysters
80%	4%	cultch oysters (li
20%	96%	single oysters (li
0.3	0.3	culch oysters/ft^2
0.1	7.1	singles/ft^2
0.3	7.4	total oysters/ft^2
0.1	1.1	dead oyster/ft^2