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Olympia Oyster Restoration

Introduction

The Clallam County Marine Resources Committee (Clallam MRC), Jamestown S'Klallam Tribe (JST) and Puget Sound Restoration Fund are working together to restore Olympia oysters in Clallam County with a focus on Sequim Bay. The effort is part of a larger goal underway to restore 100 acres of Olympia oyster habitat in the Puget Sound area by 2020.

In 2012 one acre of JST tidelands in Sequim Bay near Blyn was dedicated to Olympia oysters. Grow-out bags with approximately 6,200 Olympia oyster seed were planted on the tidelands and the following year seeded cultch bags with approximately 500,000 oysters were spread onto the tidelands. In 2014 seeded cultch bags with approximately 250,000 seed were spread on to an additional half acre of tidelands making the total restoration site 1.5 acres.

The successful restoration effort on Jamestown's tidelands prompted Clallam MRC and their partners to search for other potential restoration sites. Several potential sites in Sequim and Dungeness Bay were investigated unsuccessfully. In May 2018 the JST proposed using a parcel of tidelands that they lease from WA Department of Natural Resources at the head of Sequim Bay. The site is approximately 700 ft. east of the current restoration site and covers an area of 0.3 acre. In July and August 2019 more than 100 bags of Olympia oyster seed were moved from the area they have overwintered to the new restoration site at the head of Sequim Bay and spread at the site. In addition, 67 cubic yards of blank shells were spread at the 1.5 acre Jamestown Tidelands Restoration Site and 850 of blank shells at the 0.3 acre Blyn DNR Restoration Site.

Olympia Oyster Restoration Efforts Summer 2020

After the busy 2019 restoration season the 2020 season at the two restoration sites was quiet giving the Olympia oyster populations time to respond to the blank shells spread in 2019. In August 2020 two population surveys were conducted at the restoration sites. The surveys were led by Liz Tobin, JST shellfish biologist, and assisted by Clallam MRC members. Summary reports for the two surveys are included in this report.

As stated in the introduction the goal of the restoration effort in Sequim was to restore 2 acres of Olympia oysters by 2020. Based on the 2020 surveys the goal was not met within the two restoration sites with Olympia oyster populations on approximately 1.60 acres of tidelands. However, as shown in Figure 3 of the Jamestown Tidelands Restoration Site report, part of the Olympia oyster population extends beyond the borders of the 1.5 acres site.

To address this issue and also to investigate a notable increase in Olympia oysters observed by Jamestown's Natural Resources staff throughout the Blyn tidelands, a large-scale survey to identify patches of Olympia oysters throughout Jamestown's tribal tidelands was conducted in March and July of 2020. The purpose of this tideland-wide survey was to identify patches ("hot

spots") of Olympia oysters and their preferred habitat at the head of Sequim Bay. The outcomes of the survey will be available this coming winter and it is very likely that the goal of 2 acres has been met based on Olympia oyster populations present throughout the tidelands at the head of Sequim Bay.

Figure 1. MRC Members Lyn Muench and Ed Bowlby participating in the population survey on the Jamestown Tidelands Restoration Site.

Report prepared by:
JST Shellfish Biologist - Liz Tobin
9/25/2020

2020 Olympia Oyster Population Survey
Jamestown Tidelands Restoration Site

An Olympia oyster population survey was completed at the Blyn restoration site by three members of the Clallam Country Marine Resources Committee (MRC): Lyn Muench, Ed Bowlby and Ioana Bociu, and three members of Jamestown's Natural Resources Department: Liz Tobin, Chris Burns and Jarrett Burns, on August 3, 2020. The purpose of this survey was to conduct an annual population estimate, including total abundance and size distribution of the Olympia oyster bed associated with the 1.5-acre restoration site located on Jamestown's tribal tidelands at the head of Sequim Bay, "Blyn" (Fig. 1). Results of the 2020 survey are reported here and submitted to the Clallam Country MRC.

Survey Methods:

The population survey was carried out using a systematic random design to eliminate any bias in the sampling scheme yet provide consistent stratified sampling throughout the site. The Olympia oyster survey was conducted during a -1.7 ft. MLLW tide so that the entire oyster bed was exposed to allow for complete sampling. Seven transects, spaced 30 feet apart, were laid out along a 4° compass heading running from the southern to the northern boundary of the restoration site (Fig. 2). Along each transect, Olympia oysters were sampled using a 0.25 m^2 quadrat ("sample plot"). The starting position of the first transect from the Southwest corner and the starting position of the first 0.25 m^2 sample plot for each transect were randomized using a random number generator. After placement of the first 0.25 m^2 quadrat, subsequent sample plots were spaced approximately every 30 feet along each transect. A total of 71 sample plots (equal to an area of 17.8 m^2) were examined for Olympia oysters within the bounds of the 1.5-acre restoration site. All substrate, down to approximately 2 inches, within a sample plot was examined to determine the total number of live and dead Olympia oysters. Shell length (measurement from the hinge to the longest edge of the shell) was measured using calipers to the nearest 1.0 mm for every live Olympia oyster identified within the 71 sample plots. All field data was recorded on data sheets, and collected, compiled and analyzed by Jamestown's Shellfish Biologist.

Population Survey Results:

For consistency with population surveys from previous years, the 2020 survey was conducted within the bounds of the 1.5-acre restoration site which resulted in a population estimate of 40,858 viable oysters and an average oyster density of 7 oysters per m^2 (Table 1). Olympia oysters at this site exhibit a high-level of patchiness, resulting in the relatively low oyster density due to a large number "zero" observations (Fig. 3). To moderate the number of zero observations, sample plots falling outside of the identify oyster bed area were eliminated which resulted in a more targeted population estimate of 47,161 oysters at an average density of 8 oysters per m^2 (Table 1; Fig. 3).

Assessment of Olympia oyster survivorship indicated that 63% of the total number of oysters identified were viable. The size range of the subsampled live oysters was 7 – 61 mm (Fig. 4). No hatchery produced Olympia oyster seed has been spread within the restoration site in several years. Given documented grow rates of 0.08 – 0.37 mm/day in spring – fall in Washington waters (Prichard et al. 2015), any oyster smaller than 20 mm were considered new recruits (i.e., < 1 year old) to the restoration site.

Summary:
The 2020 population survey results continue to support that joint Clallam County MRC-Jamestown Tribe Olympia oyster restoration efforts in the Blyn tidelands have and continue to be successful. The 2020 survey results indicated that oyster density and abundance within the restoration site have increased from previous years when the same survey approach was used (i.e., 2017 – 2020). Further, recruitment to the site appears to be high with 38% of the total oysters sampled being smaller than 20 mm (i.e., < 1 year old). We attribute this increase in new recruitment to shell substrate enhancement efforts that occurred in 2019 (Fig. 5). Annual population monitoring clearly shows that Olympia oysters are surviving, growing, reproducing and expanding their population area within and beyond the bounds of the restoration site.

While not captured in this survey, a notable increase in Olympia oysters has been observed by Jamestown's Natural Resources staff throughout the Blyn tidelands. To better understand the extent of this expansion, a large-scale survey to identify patches of Olympia oysters throughout Jamestown's tribal tidelands was conducted in March and July of 2020. The purpose of this tideland-wide survey is to identify patches ("hot spots") of Olympia oysters and their preferred habitat at the head of Sequim Bay. The outcomes of this tideland-wide survey will be shared with CMRC when available.

A health assessment of Olympia oysters on Jamestown's tribal tidelands was completely by AquaTechnics on October 4, 2018 to evaluate their suitability for Puget Sound Restoration Fund's broodstock program. The results found no known or certifiable infectious diseases and identified the Blyn oysters to be "well fed" and reproductively healthy (a copy of this report can be provided upon request). This health assessment provides further support that the joint restoration efforts have been successful in establishing a healthy and viable Olympia oyster population in Sequim Bay.

References:
Pritchard, C., Shanks, A., Rimler, R., Oates, M., & Rumrill, S. (2015). The Olympia oyster Ostrea lurida: recent advances in natural history, ecology, and restoration. Journal of Shellfish Research, 34(2), 259-271.

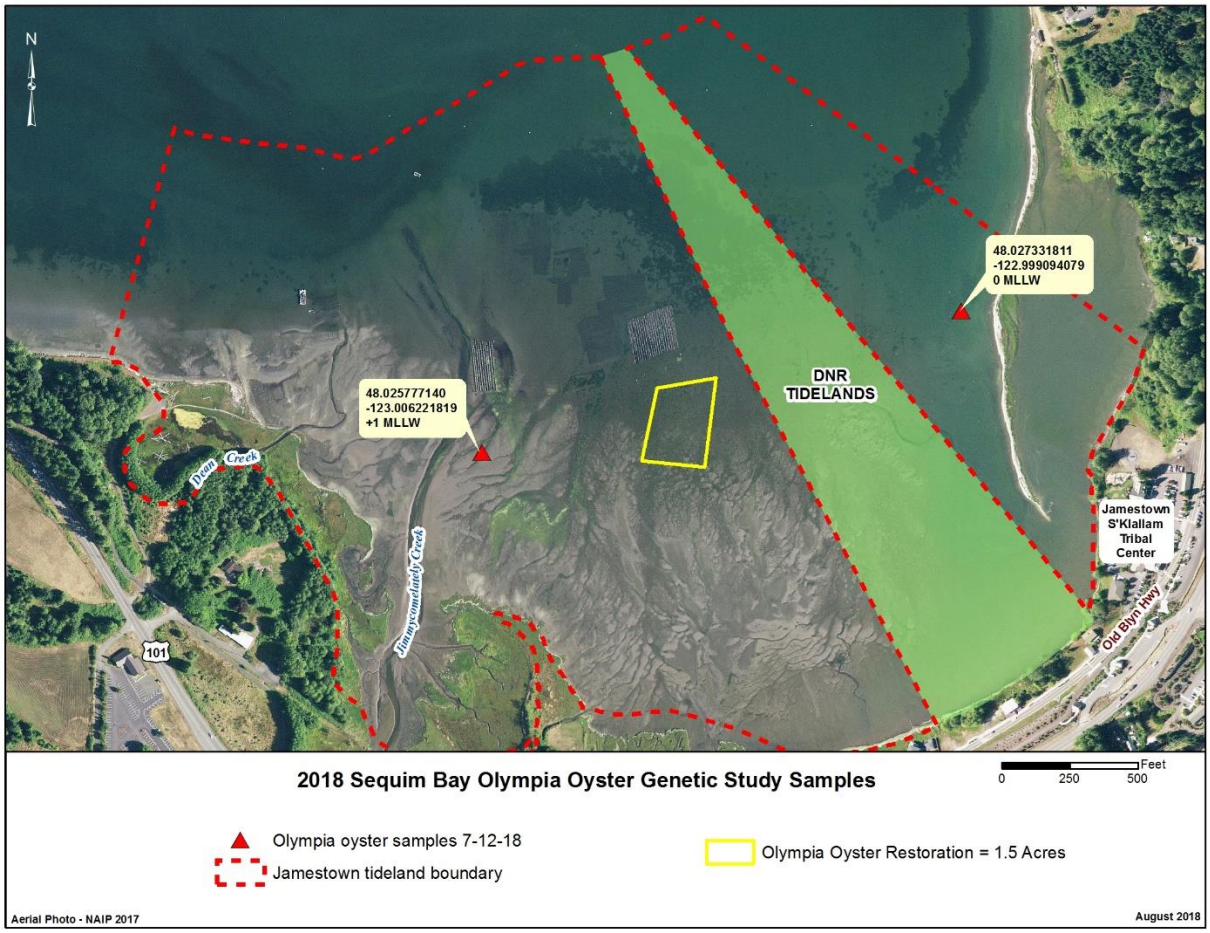

Figure 1: Maps of Jamestown tribal tidelands showing the location of the 1.5-acre Blyn restoration site (yellow polygon) at the head of Sequim Bay and locations were Olympia oysters were collected for broodstock health assessment in 2018 (red triangles).

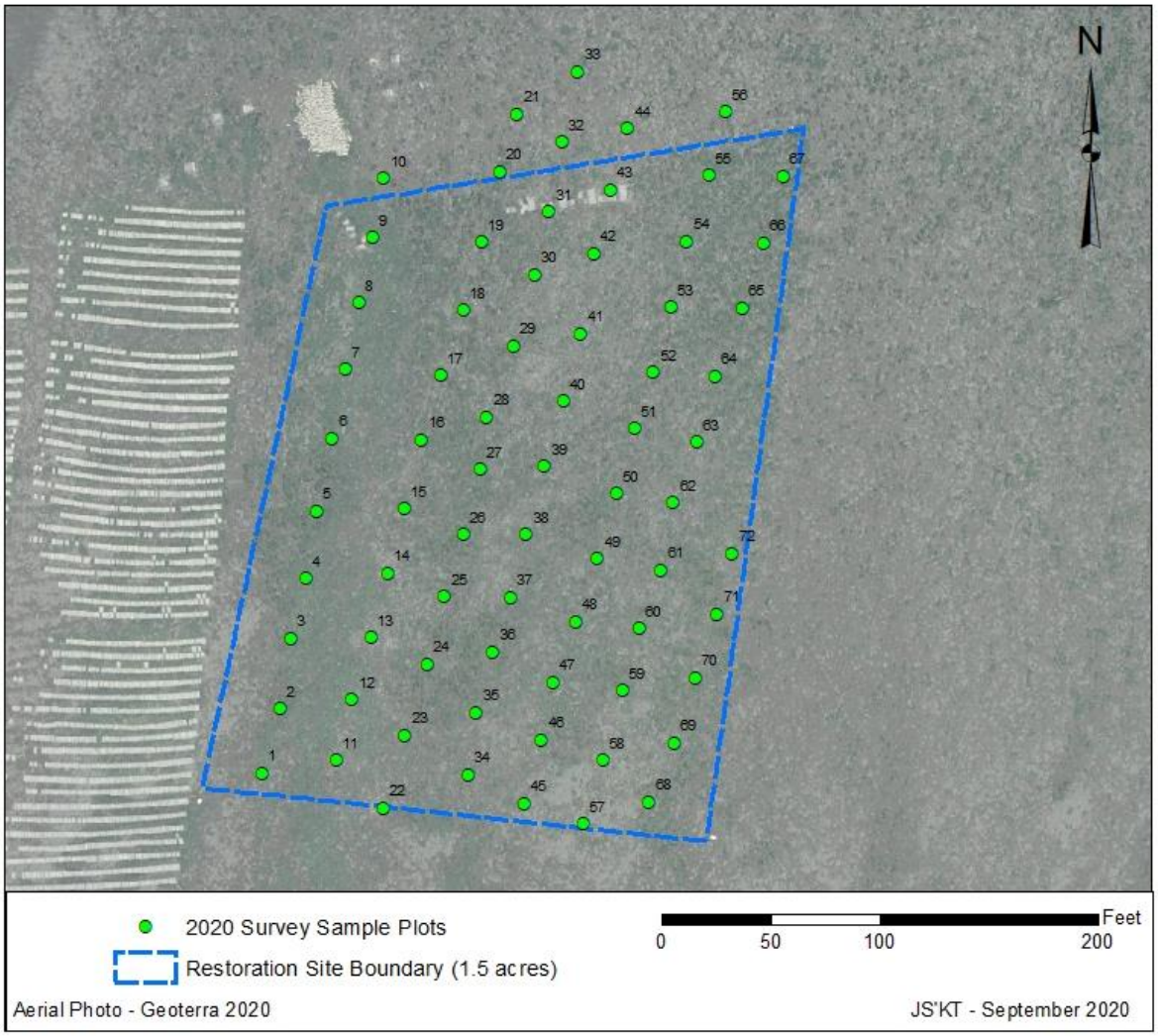

Figure 2: 2020 Jamestown tidelands Olympia oyster restoration site population survey design. Note sample plot #34 was accidentally missed by the survey team resulting in 71 total plots being sampled.

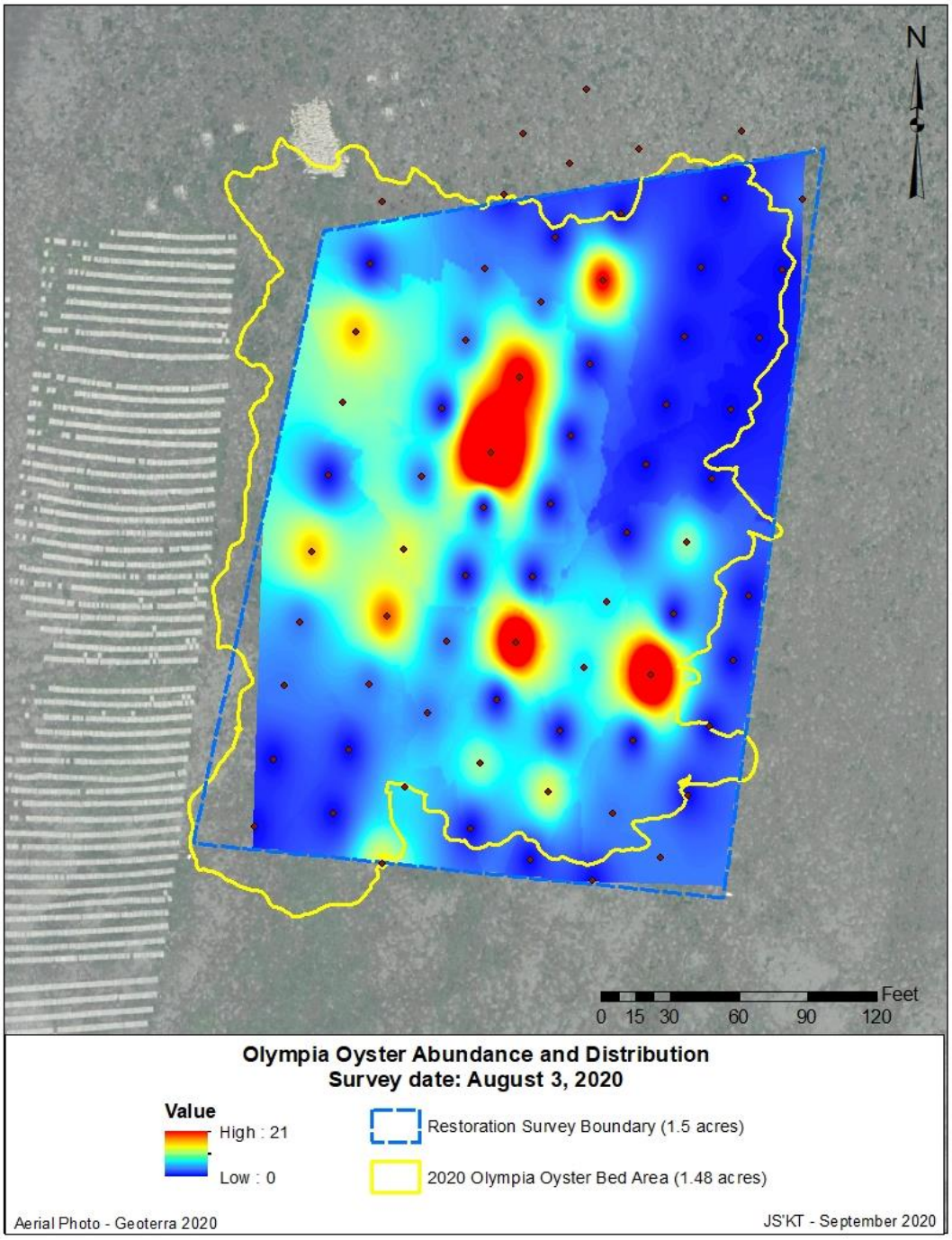

Figure 3. Heatmap of Olympia oyster abundance from the 2020 population survey at the Jamestown restoration site. Data are interpolated in ArcGIS 10.5.1 using inverse distance weighting. The analysis was masked by the restoration site boundary and oyster bed area. The color map identifies areas of low (blue) and high (red) oyster abundance within the restoration site.

Table 1: Oyster density, population area and population abundance estimate for the Jamestown Olympia oyster restoration site from 2014 – 2020. The 2017 – 2020 population estimates include 95% confidence intervals.

Survey Year	Mean Restoration Site Density (# m^{-2})	Population Area (acres)	Mean Population Area Density (# m^{-2})	Population Estimate	Notes
2014	--	0.42	28	46,800	Survey only within oyster bed area; 39 subsamples
2015	18	0.64	24	46,620	Unseeded cultch added; Survey throughout 1.5 acre restoration site
2016	15	0.74	19	55,770	Survey throughout 1.5 acre restoration site: 51 subsamples
2017[+]	5	1.05	8	33,978 (±15,783)	Restoration site shifted southward, Survey throughout 1.5 acre restoration site: 78 subsamples
2018[+]	4	1.05	5	19,429 (±10,431)	Survey throughout 1.5 acre restoration site: 63 subsamples
2019*[+]	4	--	--	24,584 (±20,453)	Survey throughout 1.5 acres restoration site: 70 subsamples
2020[+]	7	1.48	8	40,858 (±20,180)	Survey throughout 1.5 acres restoration site: 71 subsamples

*67 cubic yards of blank oyster shell was spread throughout the 1.5-acre restoration site from May – June 2019 for substrate enhancement prior to the population survey being conducted on July 16, 2019 (Fig. 5).
[+]Population survey conducted using stratified random design with 30 ft spacing between transects and sample plots.

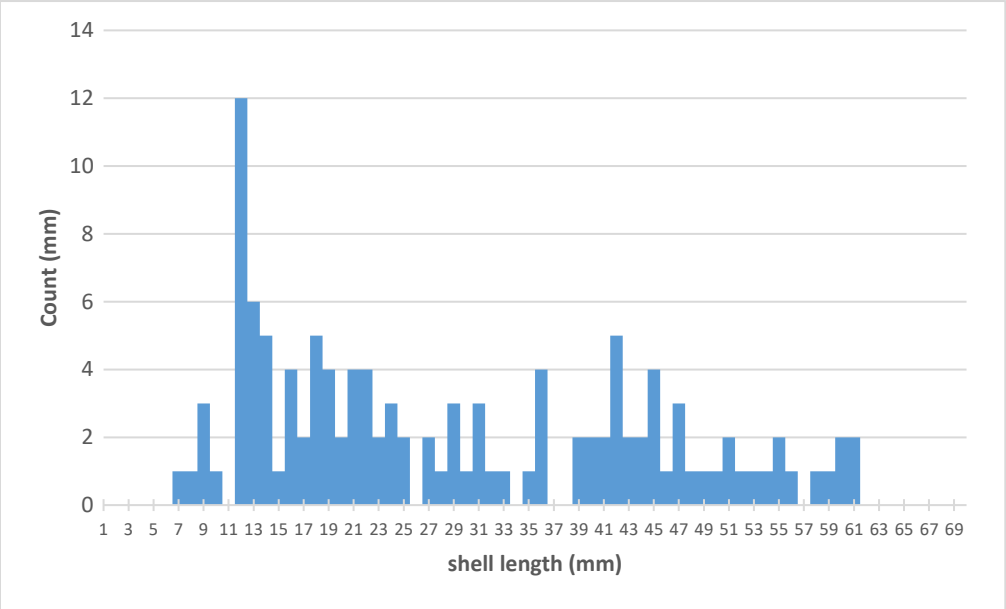

Figure 4. Size distribution of subsampled Olympia oysters from the 1.5-acre Jamestown restoration site during the 2020 population survey. Total number of oysters measured = 119.

Figure 5. Photo showing blank oyster shell that was spread for substrate enhancement in May/June 2019 within the 1.5-acre restoration site.

Maps and report prepared by:
JST Shellfish Biologist, Liz Tobin
9/25/2020

2020 Olympia Oyster Population Survey
Department of Natural Resources (DNR) Lease
Restoration Site

An Olympia oyster (*Ostrea lurida*) population survey was completed on August 4, 2020 at the 0.3-acre Blyn restoration site located within the DNR lease parcel adjacent to Jamestown's tribal tidelands. Four Jamestown S'Klallam Tribe (JST) staff and two members of the Clallam County Marine Resources Committee (CMRC) participated in the population survey. The purpose of this survey was to estimate total Olympia oyster abundance and density (# oysters per m^2); identify the population size distribution and delineate the perimeter of the Olympia oyster bed associated with the restoration site.

Survey Methods:

The population survey employed a systematic random design to allow for consistent sampling throughout the site and eliminate any bias in the sampling scheme. The survey was conducted on a -1.4 ft. MLLW tide so that the entire oyster bed was exposed to allow for complete sampling. Five transects, spaced 20 feet apart, were laid out running from the southern to the northern boundary of the restoration site (Fig. 1). Olympia oysters were sampled (counted and measured) within a 0.25 m^2 quadrat ("sample plot"). The starting position of the first transect from the Southwest corner and the starting position of the first 0.25 m^2 sample plot for each transect were randomized using a random number generator. After placement of the first 0.25 m^2 quadrat, subsequent sample plots were spaced every 20 feet along the transect (Fig. 1). A total of 39 sample plots (equal to a total sampled area of ~10 m^2) were examined for Olympia oysters within the restoration site boundary. All substrate, down to approximately 2 inches, within the sample plot was examined to determine the total number of live and dead Olympia oysters. The population estimate is based on live counts of Olympia oysters. The shell length (measurement from the hinge to the longest edge of the shell) was measured for every Olympia oyster sampled from each plot. A survey grade GPS unit was used to collect coordinates for each sample plot location within the restoration site. All field data was compiled and analyzed by Jamestown's Shellfish Biologist and reported to the Clallam MRC.

Survey Results and Summary:

Seeded cultch acquired from the Puget Sound Restoration Fund using Sequim Bay Olympia oyster broodstock was outplanted on the DNR restoration site in August 2018. Assessment of Olympia oyster survivorship found that 30% of the total oysters counted were viable, indicating a high degree of mortality. The size range of the 161 subsampled live oysters was 6 – 51 mm. An average density of 16 oysters per m^2 was calculated for the 0.3-acre restoration site, with a population estimate of 18,895 (±15,895) oysters. The large amount of uncertainty (i.e., wide confidence intervals) around the population estimate is due to the high degree of patchiness, and hence, large number of zero observations within the site (Fig 3, blue area). The 2020 population survey indicates an approximate 40% reduction in oyster density compared to the 2019 survey. While oysters appear to have marginal survival at this site, both growth of existing oysters and new recruitment was observed as indicated by the bimodal size range distribution (Fig. 2) Approximately 26% of the total viable oysters sampled were less than 20 mm, and considered to be new recruits. Continued monitoring will be required to assess the long-term success of restoration efforts at this site.

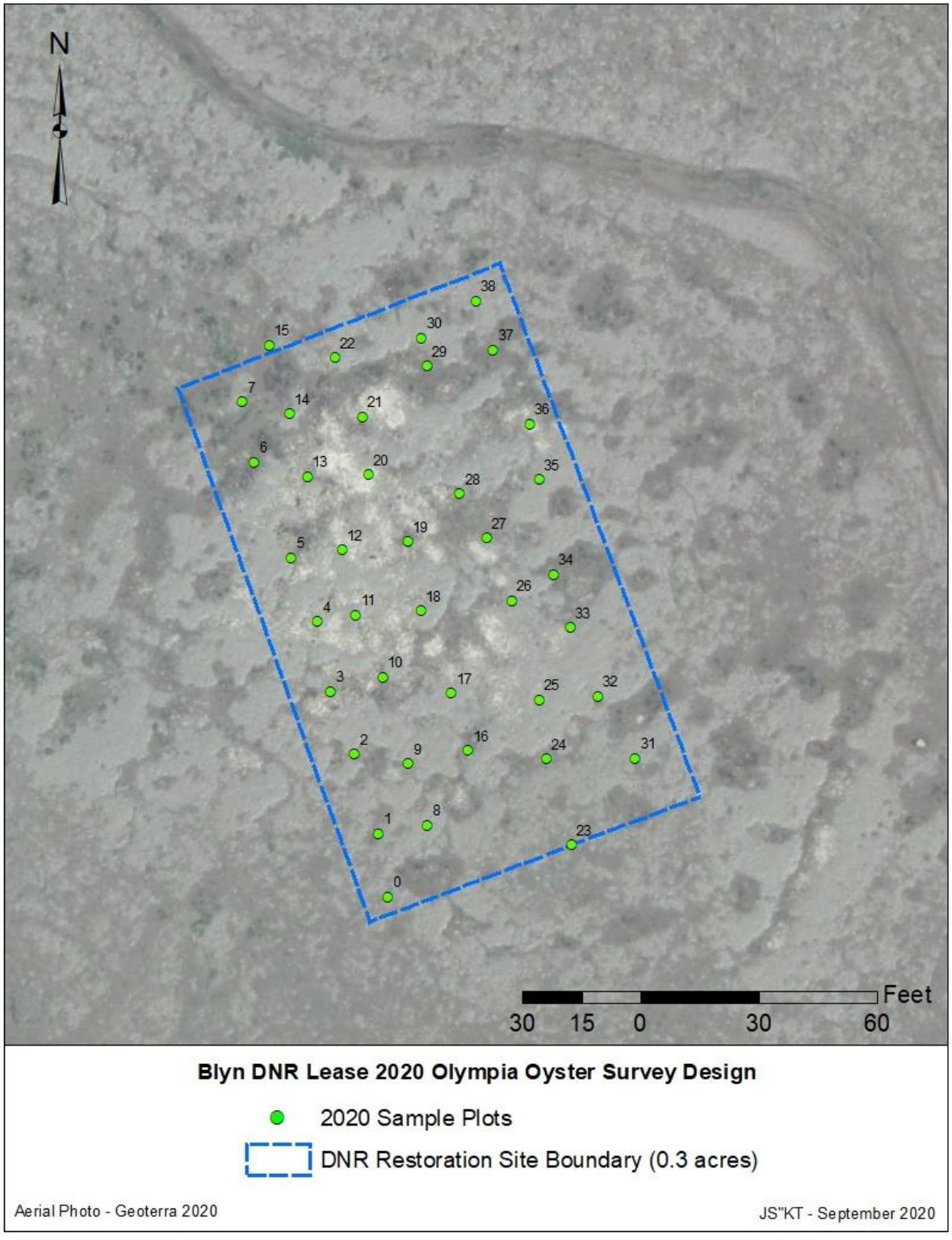

Figure 1: 2019 Blyn DNR site Olympia oyster population survey design

Maps and report prepared by:
JST Shellfish Biologist, Liz Tobin
9/25/2020

Table 1. Oyster density and abundance estimates for the Blyn DNR restoration site in 2019 & 2020.

Survey Year	Mean Oyster Density (# m^2)	Population Estimate	Notes
2019	27	31,296 (±33,419)	Survey throughout 0.3 acres restoration site: 36 subsamples
2020	16	18,895 (±15,522)	Survey throughout 0.3 acres restoration site: 39 subsamples

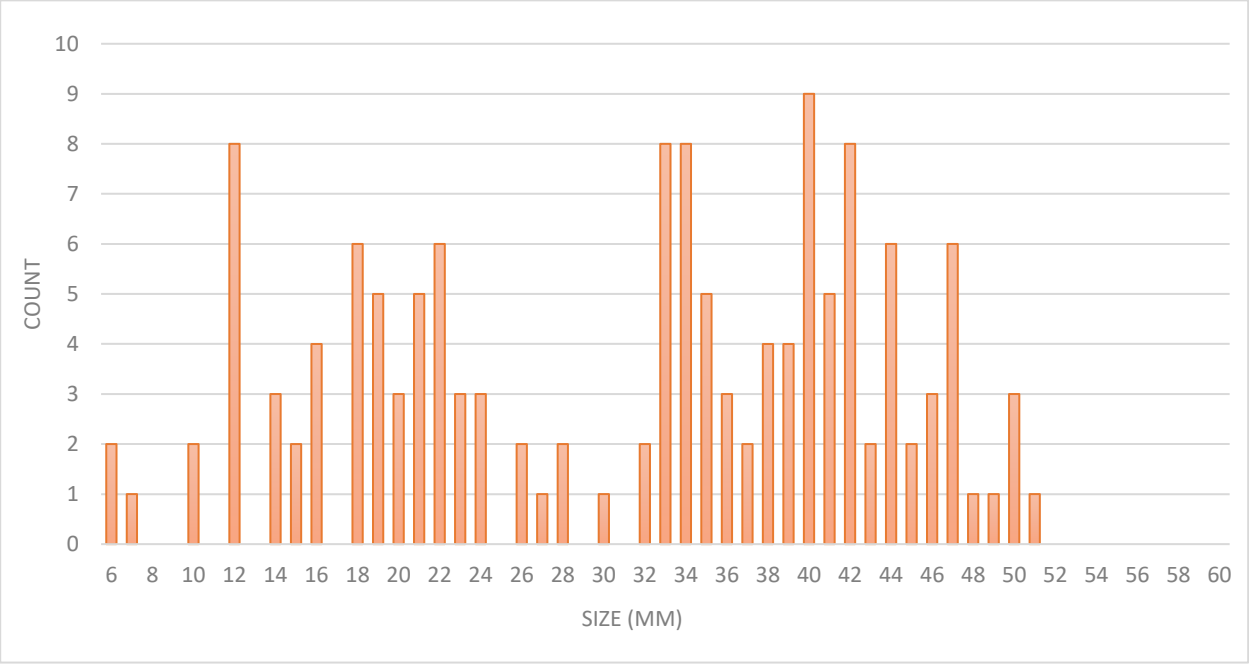

Figure 2. 2020 Olympia oyster size distribution at the Blyn DNR restoration site.

Maps and report prepared by:
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9/25/2020

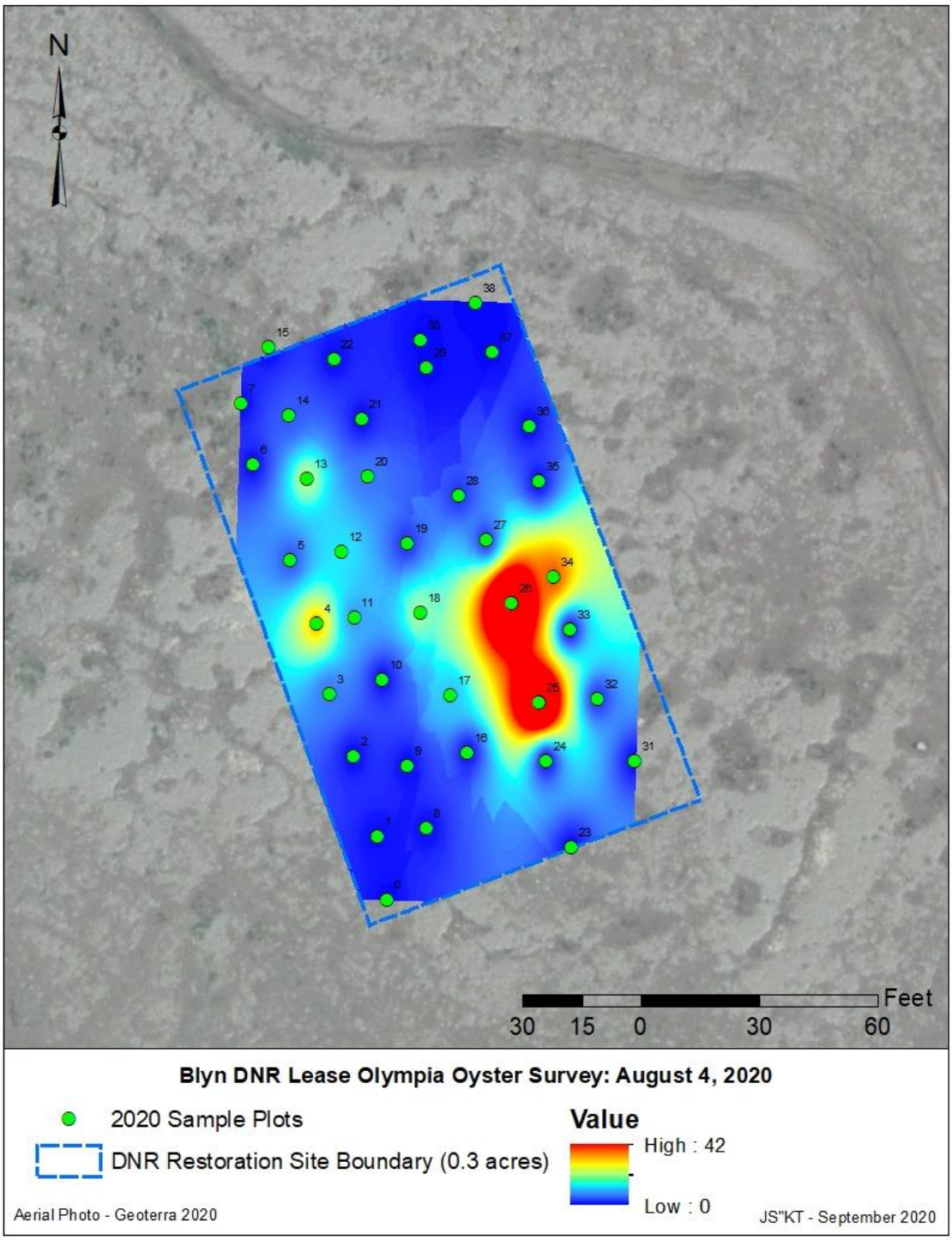

Figure 3. 2020 Olympia oyster density (#/m^2) at the DNR lease restoration site at the head of Sequim Bay. Data are interpolated in ArcGIS 10.5.1 using inverse distance weighting. The analysis was masked by the restoration site boundary. Red designates highest densities of Olympia oysters within the surveyed area.