

COUNTY: Jefferson  
Grant No: SEANWS-2023-JeCoWS-00006

PROJECT TITLE: Jefferson County MRC Operations and Projects  
TASK NUMBER: 5 - Olympia Oyster Restoration

T 5.2 Olympia Oyster 2024 Summary Report

PERIOD COVERED: October 1, 2023 – September 30, 2024



Jefferson County  
**Marine  
Resources  
Committee**



PUGET **SOUND**  
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**Northwest  
Straits**  
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**Jefferson County Marine Resources Committee  
Olympia Oyster Habitat Enhancement Project Summary Report  
October 2023 – September 2024  
Discovery Bay, WA**

**Project Overview**

Discovery Bay has a natural Olympia oyster population near the southwest portion of the bay (Maynard Beach area) as well as scattered occurrences throughout the bay. In partnership with the Jamestown S’Klallam Tribe, WA Department of Fish and Wildlife (WDFW), and the Puget Sound Restoration Fund (PSRF), the MRC has been working to expand the extant population by increasing the availability of substrate (i.e., clean Pacific oyster cultch) in nearby areas to facilitate natural recruitment. In 2014, the MRC began monitoring the Olympia oyster population and spreading clean cultch within a half-acre area in the center of the bay (“Powerlines Site”). In 2018, the MRC added another restoration site nearby (“Lagoon Site”), and in 2022, the MRC expanded the original Powerlines Site (now referred to as the “North Powerlines Site”) to include a parcel (now referred to as the “South Powerlines Site”) located adjacent and just south of the original site. In 2023, the MRC organized population surveys and a large shell spread event (~40 cubic yards) at the Powerlines Site (both North and South). In 2024 we spread 2 yards of unseeded cultch in the lagoons in March. A visual assessment of the cultch in September showed that some of it had collected oyster spat (baby oysters).

Project Lead: Neil Harrington

Subcommittee Members: Gordon King, Sarah Fiskien, Frank Handler, Brenda Johnson, Joanie Hendricks, Bryan DeCaterina, Brad Bebout, Emily Buckner

Volunteers: Heidi Eisenhower, Cheryl Lowe, Keith Knol, Morgan Chase

**October 2023 – September 2024 Olympia Oyster Project Activities**

February 29th – The subcommittee along with the MRC Coordinator met to discuss 2024 plans for the Olympia oyster project

January 10 – The MRC Coordinator secured a WDFW shellfish transfer permit for shell from Taylor Shellfish between March 1 – October 1, 2024

March 6<sup>th</sup>- MRC members and volunteers spread 2 yards of shell donated by Taylor Shellfish in the lagoons within the permitted area on the West side of the Bay.

June 8 – The MRC conducted an Olympia oyster population survey at the North and partial South Powerlines sites. The project lead, Neil, MRC members (Emily, Gordon, Brad, Brenda, Joanie), MRC

Coordinator (Katie), and four community volunteers (Keith, Chris Madelyn, Cheryl) participated.

June 22 – Project lead and 3 MRC members conducted a population survey at Broad Spit to evaluate site for future restoration work.

**An estimated 140 volunteer hours were contributed** to the Olympia oyster restoration project by MRC members and community volunteers, helping to count and measure Olympias as well as spread clean shell to add substrate for new larval settlement.

### Population Survey Data Results

On June 8, the annual population survey of Olympia oysters was conducted at the Powerlines Site (both North and South). 12 people participated in the survey. The group worked as three survey teams of two-three people each, with Neil setting the locations of each transect and quadrat. Each survey team recorded the number and size of Olympia oysters as well as percent cultch cover within each quadrat surveyed. Volunteers reported that they were clear on how to record the data.

#### North Powerlines Site

Volunteers counted each Olympia oyster individual and measured their size (mm) following the Olympia Oyster project QAPP. The sample area was 11.75 m<sup>2</sup> representing a total plot area of 1605 m<sup>2</sup>. Volunteers counted and measured a total of 509 Olympia oysters within the sample area, resulting in an approximate population of 69,527 Olympia oysters within the project site. The average size of Olympia oysters here was determined to be 38 mm, with an average number of 43 Olympia oyster individuals per square meter.

*Table 1: Summary of Discovery Bay North Powerlines Site Data Collected 2017-2024*

Data Collected	2017	2018	2019	2020	2021	2022	2023	2024
# of ¼ m <sup>2</sup> quadrats	48	77	69	85	60	46	40	47
Total # of Olys	592	732	398	375	432	522	369	509
Total area sampled (m <sup>2</sup> )	12	19.25	17.25	21.3	15	11.5	10	11.75
Total plot area (m <sup>2</sup> )	-	-	-	2023.4	1825.5	2023.4	1883.4	1605
Average size of Olys (mm)	38.9	34.0	41.3	40.7	31.9	28.8	30	38.08
Average % cultch cover/quadrat	11.7%	17.2%	8.2%	15.6%	6.9%	21%	12%	20%
Average # of Olys/m <sup>2</sup>	49	38	23	18	29	45	37	43
Total # of Olys in plot	-	-	-	35,708	52,575	79,299	69,497	69527

#### South Powerlines Site

In 2022, the Jefferson MRC acquired a Right of Entry and other agency permits to include the parcel

(now referred to as the South Powerlines Site) located just south and adjacent to the original North Powerlines Site. Due to wave action and currents, Olympia oysters and shell has tended to drift from the North to the South Powerlines Site. The MRC conducted a baseline population survey in 2022 and its second survey in 2023.

In 2024, volunteers counted each Olympia oyster individual and measured their size (mm) within a sample area of 3.5 m<sup>2</sup> representing a total plot area of 371 m<sup>2</sup>. Volunteers counted and measured a total of 369 Olympia oysters within the sample area, resulting in an approximated 41,976 Olympia oysters settled within the project site. The average size of Olympia oysters here was determined to be 40 mm, with an average number of 113 Olympia oyster individuals per square meter. Compared to the 2022 baseline survey, the number of Olympia oysters per m<sup>2</sup> and percent cultch coverage had increased (see Table 2).

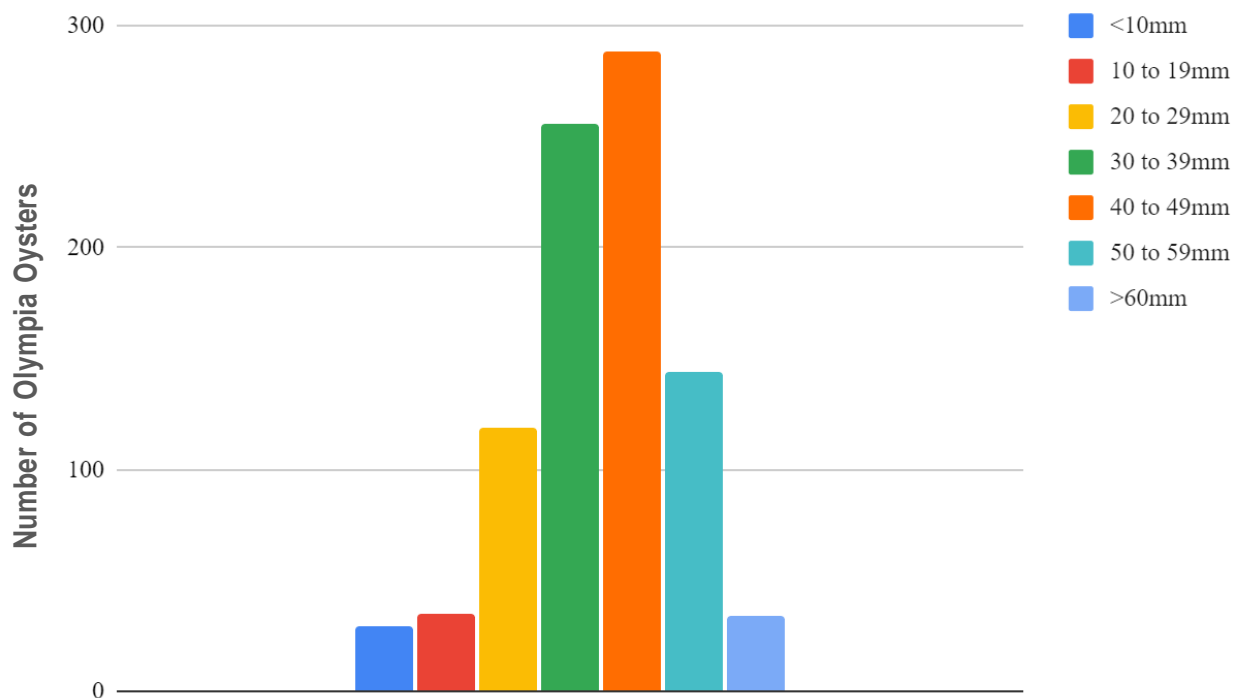
*Table 2: Summary of Discovery Bay South Powerlines Site Data (in the high density area, just south of the existing restoration area) Collected 2022-2024*

<b>Data Collected</b>	<b>2022</b>	<b>2023</b>	<b>2024</b>
# of ¼ m <sup>2</sup> quadrats	14	26	14
Total # of Olys	185	289	396

## Summary

*Table 3: Summary of Discovery Bay South Powerlines Site Data (in the high density area, just south of the existing restoration area) Collected 2022-2024.*

Total area sampled (m <sup>2</sup> )	3.5	6.5	3.5
Average size of Olys (mm)	41.4	35	39.75
Average % cultch cover/quadrat	13%	9%	21%
Average # of Olys/m <sup>2</sup>	53	45	113
Total # of Olys in plot	34886	53,976	41976



*Figure 1. Size class distribution (mm) of Olympia oysters surveyed by the Jefferson MRC across the Powerlines Site (North and South) in South Discovery Bay on June 8, 2024.*

The size class distribution of Olympia oysters measured across both sites demonstrate a normal distribution curve (Figure 1). This continues to support that natural recruitment of native Olympia oysters is occurring across the Powerlines Site. In August, new recruitment was observed on the 40yards of cultch spread in 2023 and this area will be surveyed in 2025. The total estimated population of Olympia oysters across the Powerlines Site as of 2024 is 111,500, compared to an estimated 123000 in 2023 and essentially zero when this project began in 2014. This slight decrease may be due to the smaller area actually surveyed.

### **Shell Spread and Permit Updates**

The MRC acquired a new WDFW Shellfish Transfer Permit in March and spread approximately two yards of shell from Taylor Shellfish in the lagoons and spit on the west side of the Bay.

## Images



Photo caption: Olympia oyster population survey, June 8, 2024, Powerlines Site, Discovery Bay, Wa.  
Photo credit: Katie Kowal





Photo caption: Olympia oyster population survey, June 8, 2024, Powerlines Site, Discovery Bay, Wa.  
 Photo credit: Katie Kowal



Photo caption: *Olympia oyster* 2024 recruitment seen 8/21/24 (*Oly settler in yellow circle*) Powerlines Site, Discovery Bay, Wa.  
 Photo credit: Neil Harrington

# Quality Assurance Project Plan: Discovery Bay Olympia Oyster Restoration Project

January 2023



Prepared for: WA Department of Ecology

Prepared by: Monica Montgomery, Coordinator, Jefferson County MRC



Jefferson County  
Marine  
Resources  
Committee



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## **Publication Information**

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Each study conducted for the EPA using National Estuary Program funds must have an approved Quality Assurance Project Plan (QAPP) describing the objectives of the study and the procedures to be followed to achieve those objectives. The plan and final reports for this project will be available on the Jefferson MRC's website and in the annual reports. Neither document necessarily reflects the views and policies of the EPA, nor does mention of trade names or commercial products constitute endorsement or recommendation for use. This QAPP is valid through July 2025.

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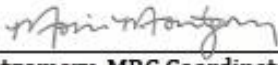
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## Quality Assurance Project Plan Addendum 3: Discovery Bay Olympia Oyster Restoration Project

January 2023

### Approved by

Signature:  Dana Oster, Marine Program Manager, Northwest Straits Commission	Date: 01/27/2023
Signature:  Monica Montgomery, MRC Coordinator, Jefferson Marine Resources Committee	Date: 1/30/2023
Signature:  Neil Harrington, Project Lead, Jefferson Marine Resources Committee	Date: 1/27/23
Signature:  Jennifer Grimm, EPA Grants Coordinator, Puget Sound Partnership	Date: 1/31/2023
Signature: <i>Britta Voss</i> (acting) Arati Kaza, Quality Assurance Officer, Department of Ecology	Date: 01/27/2023

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The Olympia oyster (*Ostrea lurida*) is the only native oyster of the North American Pacific Coast and once thrived in coves, inlets and other protected tidelands in the Puget Sound. By the turn of the 20<sup>th</sup> century, a combination of overharvesting, pollution and non-native oyster cultivation led to a population collapse of the Olympia oyster. The Discovery Bay population is identified in the Washington State Department of Fish & Wildlife (WDFW) Olympia Oyster Recovery Plan (Blake and Bradbury 2012) as one of 19 populations targeted for enhancement or recovery. This bay hosts a small but healthy natural Olympia oyster population concentrated near its southwest shore. The Jefferson County Marine Resources Committee (MRC) has been involved with this population since 2002, assisting with surveys and assessments of test plots in the area in partnership with the Puget Sound Restoration Fund (PSRF), and has actively worked on restoration since 2014. This Quality Assurance Project Plan (QAPP) serves as a guide to expand the density and abundance of a small, self-sustaining population, to monitor biological data, quantify ecological parameters, evaluate restoration success, and facilitate adaptive management practices.

## 2.1 Introduction and Problem Statement

There are seven Marine Resources Committees (MRCs) in the counties of northern Puget Sound created in 1998 when Congress authorized [the Northwest Straits Marine Conservation Initiative](#). This initiative resulted from the [1998 Murray-Metcalf Northwest Straits Citizens Advisory Commission Report](#). The MRCs were created to provide local, broad-based, bottom-up input to the Northwest Straits Commission (NWSC) and affiliated county governments.

The Olympia oyster (*Ostrea lurida*), Washington's only native oyster, forms three-dimensional biogenic habitat that supports fish, invertebrates and other marine organisms (Blake and Bradbury 2012). Olympia oysters once thrived in coves, inlets and other protected tidelands across the Puget Sound. Now, less than 4% of the historical population exists due to overharvesting, pollution, and non-native oyster cultivation (PSRF 2012).

To restore Olympia oyster beds throughout Puget Sound, the Washington Department of Fish and Wildlife (WDFW) identified 19 priority waterbodies with a high likelihood of successful Olympia oyster restoration (Blake and Bradbury 2012). Three broad geographic areas in Jefferson County were identified as having suitable conditions for Olympia oyster restoration:

1. Discovery Bay
2. Kilisut Harbor
3. Quilcene Bay

The Jefferson County MRC, in partnership with WDFW and Jamestown S'Klallam Tribe (JST), has established a 0.78 acre Olympia oyster restoration site at Discovery Bay, WA. The Jefferson MRC continues to add more substrate (clean Pacific oyster shell) to enhance the habitat and provide more area for natural Olympia oyster recruitment to occur (Jefferson MRC 2019). The MRC's current project goal is to facilitate population expansion by providing new habitat areas with appropriate substrate (clean cultch) in collaboration with resource co-managers.

## 2.2 Study Area

This QAPP only includes the Discovery Bay restoration site in Jefferson County. It was chosen as a



restoration project site because the bay historically contained a significant population of native oysters and a small but healthy population is still present nearby (Blake and Bradbury 2012). We are working on two specific areas in South Discovery Bay:

#### Powerline Area:

An area located in the bay adjacent to the powerlines on Washington Department of Natural Resources (DNR) tidelands between approximately +1.0 and 0.0 MLLW. The coordinates are 47.99505 N, 122.87777 W. Olympia oysters were found in the immediate vicinity attached to the occasional rock or other hard surfaces such as the foundations of the utility poles, but most of the project area had no “starter” substrate. The MRC placed clean Pacific oyster shells here in 2014, 2016, 2020, and 2021 not too far from the extant population. Annual monitoring began in 2015. As of 2022, agency permits have been secured to add another parcel, located adjacent and SW to the Powerline Area, which expands the shell spread area to 0.78 acres. The original Powerline Area is now referred to as the “North Powerlines” Area and the new parcel as the “South Powerlines” Area.

#### Lagoon Area:

An area adjacent to the remnant population established in 2019. The coordinates are 47.997638 N, 122.882278 W. Our 2018 activities here were centered around permit applications. In 2019, with the help of co-managers, we collected baseline data on the extant population and added clean cultch in 2019, 2020, 2021, and 2022. Co-Managers and our permit conditions will guide us in how we continue to distribute new cultch in the Lagoon Area.

See Appendix A for map of project areas.

## 2.2.1 History of the Study Area

In Discovery Bay, a railroad grade was constructed in 1914 atop fill placed on the tidelands. This created an artificial lagoon now entering the bay under a creosote railroad trestle. The Jefferson County Marine Resources Committee (MRC) worked with partners on a restoration effort to remove the railroad grade from the shoreline (Jefferson MRC 2010). The MRC has been involved with the Olympia oyster population here since 2002, including assisting with surveys and assessments of test plots in the area in collaboration with the Puget Sound Restoration Fund (PSRF).

In August 2014, eight cubic yards of clean shell (100 bags) were placed at the Powerline Area, following receipt of all required permits from state, federal and local agencies. No shell was placed within a 25-foot buffer around eelgrass patches that were located within or adjacent to the project area, as described in the HPA permit. Cultch was distributed over the ¼-acre area. (Coarsely crushed shell was placed in two smaller sub-plots to see what happened with smaller shell pieces, but these were no longer visible by spring of 2015 and that aspect of the test was abandoned.)

One of the project goals is to test the effectiveness of a low-density application of shell as a way to jump-start a population expansion. We aimed to initially place shells at a density of approximately 2 shells/sq. ft. In August 2015 (during the first year of monitoring), the WDFW Co-Manager Brady Blake recommended adding additional clean cultch to the site in 2016 to bring the available shell back up to our target density, as tides and wind waves had moved some of the initial shell out of the project area and some shell had settled deep into the mud. On July 21, 2016, 13 MRC volunteers dispersed an additional 80 bags of clean cultch on the project site. (The original installation permits prohibited in-water activity before July 15 of each year.)

This adaptive management action meant that a direct comparison of 2015 and 2016 data was influenced by this addition of new, clean shell. The 2016 data established a new baseline for 2017 and 2018 monitoring, although the 2016 project report did note some possible trends. In addition to the comparisons made in that report, the MRC found several Pacific oyster shells with large numbers of attached Olympia oyster just outside of the area where shell was placed. We assumed these had to be the Pacific oyster shell placed there in 2014, as we found only a few scattered shells present on or near the project site before the MRC began its work.

Three shell stacks from a Puget Sound Restoration Fund (PSRF) project have also been and will continue to be deployed each summer (May–August) starting in 2015 at this location; this approach for measuring recruitment allows PSRF to compare results from various sites around Puget Sound, while we focus on more detailed site information of interest to the MRC and WDFW.

## 2.2.2 Summary of Previous Studies and Existing Data

The WDFW first identified the need for native oyster restoration in their Olympia oyster Stock Rebuilding Plan (Cook et. al 1998, Blake and Bradbury 2012). The initial plan was not implemented but the Puget Sound Restoration Fund (PSRF) adopted aspects of the plan and created the goal of establishing 100 acres of Olympia oyster habitat by 2020 (PSRF 2012). As a part of this program, many MRCs began implementing Olympia oyster restoration projects within their counties. Currently, Clallam, Jefferson, and Skagit MRCs have implemented full-scale Olympia oyster restoration projects (Clallam MRC 2019, Jefferson MRC 2019, Dinnel et al. 2009).

The Jefferson County MRC, in partnership with WDFW and JST, has established a 0.5-acre Olympia restoration site in Discovery Bay, WA. The Jefferson MRC continues to add more substrate to enhance the habitat and provide more area for natural Olympia oyster recruitment to occur (Jefferson MRC 2019).

The Clallam County MRC, in partnership with the Jamestown S’Klallam Tribe (JST), has established a 1.5-acre Olympia oyster restoration site in Sequim Bay, WA. According to summary reports of the restoration at this site, “Olympia oysters are surviving, growing, reproducing and expanding their population area well beyond the bounds of the restoration site” (Clallam MRC 2019).

Skagit MRC has one of the most successful Olympia oyster restoration projects in Puget Sound. The Fidalgo Bay restoration site now has an estimated 2.9 million Olympia oysters and, with the addition of more habitat enhancing substrate, recruitment of juvenile Olympia oysters continues to occur (Dinnel 2018).

Whatcom MRC started the North Chuckanut Bay pilot study in hopes to contribute to the success of the Olympia oyster restoration projects. Limited data exists for North Chuckanut Bay specifically as only one Olympia oyster population study has been conducted, occurring in 2019 (Whatcom MRC 2019).

## 2.2.3 Parameters of Interest

The parameters of interest to this monitoring include:

- Recruitment, growth, and survival of Olympia oysters at plots with clean cultch added to improve habitat substrate near the small extant population.
- Natural recruitment of Olympia oyster spat, using the Puget Sound Restoration Fund’s shell stack method, placing stacks within the restoration area of Discovery Bay.

Recruitment refers to the presence of newly settled juvenile Olympia oysters and the presence of multiple age (size) classes of Olympia oysters within each plot. Natural recruitment refers to the presence of juvenile Olympia oysters on clean cultch. In either case, recruitment will be quantified as the number of live Olympia oyster settlements per shell.

The number and size (mm) of spat will be recorded as well as percent shell cover within 0.25m<sup>2</sup> quadrats. If spat numbers are high, measurements will be taken of no more than the first 100 spat/quadrat.

#### PSRF Recruitment Monitoring

Use of shell-string collectors is based on the Puget Sound Restoration Fund's (PSRF) method of using shell stacks to assess natural recruitment. Three shell-string collectors will be placed at equal intervals within the restoration area about 15 feet apart, and the GPS location will be marked and recorded. The shell strings will be collected in late summer after a 3-month deployment.

Jefferson MRC receives the shell stacks already assembled from PSRF. The shell stacks are installed by pressing the dowel into the substrate so that the shells are nacre-side down and the tag label is at the top.



Figure 1. Shell stack collector.

## 2.2.4 Regulatory Criteria or Standards

Not applicable. Does not assess compliance or regulatory criteria.

## 2.3 Water Quality Impairment Studies

Not applicable.

## 2.4 Effectiveness Monitoring Studies

Not applicable.

# 3.0 Project Description

### *3.1 Project Goals*

1. Expand Olympia oyster habitat and population in Discovery Bay, where the native oysters historically thrived.
2. Demonstrate that a low-impact strategy to encourage natural seed set from the existing Olympia oyster population can be successful. (For more details about completed work, see Jefferson MRC's 2016, 2017 and 2018 Olympia oyster project reports and maps.)

### *3.2 Project Objectives*

1. Monitor recruitment, growth and survival of oysters in project enhancement areas, collecting data on estimated oyster numbers and size distribution.
2. Train and empower citizen scientists to conduct surveys using standardized methods.

### *3.3 Information Needed and Sources*

This project is designed to collect baseline data to determine the status of low impact restoration methods in Discovery Bay and assess the need for adaptive changes following restoration actions. It will also be used to inform planning, research, project development, and implementation of future Olympia oyster restoration projects in Jefferson County. The restoration methods and results provide information on the feasibility of low impact restoration for other sites identified as a priority for Olympia oyster restoration where a small population is already present.

### *3.4 Project Tasks*

1. Train new volunteers on oyster sampling methods.
2. Review previous season's data and discuss lessons learned and strategies for upcoming survey season.
3. MRC project lead schedules annual distribution of clean cultch.
4. MRC project lead schedules annual sampling event and communicates schedule to participating volunteers.
5. MRC project manager receives data and raw datasheets and provides report and data to NWSC.
6. NWSC reviews data and checks quality.

### *3.5 Systemic Planning Process*

Not applicable.

## **4.0 Organization and Schedule**

### *4.1 Key Individuals and Their Responsibilities*

The Jefferson MRC is responsible for coordinating surveys at the site annually. The survey data are saved



by the MRC Project Manager and copies are given to the NWSC. Key staff with the Jefferson MRC are identified below in Table 1.

*Table 1 Organization of Project Staff*

Role	Position Who is Responsible	As of 6/1/2020
Manages volunteer coordination, coordinates with the MRC Project Lead, and tracks training needs. Creates MRC reports and manages data. Writes QAPP.	MRC Project Manager	Monica Montgomery (Jefferson MRC)
Sets dates for fieldwork, manages volunteer coordination, and leads data collection following protocols and QAPP	MRC Project Lead	Neil Harrington (JST Biologist; MRC Co-chair/Tribal Rep)
Assist MRC project lead with surveying	MRC Volunteers	MRC members and community volunteers
Provide technical assistance when needed	Co-Managers	Brady Blake (WDFW), Chris Eardley (WDFW)
Reviews QAPP and ensures that all proposed actions meet the Washington Department of Ecology requirements	Project Quality Assurance Officer	Dana Oster (NWSC)

MRC: Marine Resources Committee

JST: Jamestown S'Klallam Tribe

WDFW: Washington Department of Fish and Wildlife

NWSC: Northwest Straits Commission

## 4.2 Special Training and Certifications

Citizen scientists participating in Olympia oyster population surveys will receive required training from the Project Lead and/or the Project Manager to participate in this project. The training will elaborate upon the protocol used during population surveys, describe basic oyster species identification, and demonstrate proper oyster measurement techniques. Citizen scientists will also be trained on how to complete field data sheets properly to report whole and accurate data. Training will also include safety precautions to prevent the spread of COVID-19 as well as precautions to prevent the spread of invasive species (see section 7.1).

The Project Manager and Project Lead work with WA Department of Fish and Wildlife (WDFW) shellfish biologist, Brady Blake, and WDFW shellfish policy coordinator, Chris Eardley, who provide training, technical guidance and recommendations for site management.

Before starting the population survey, citizen scientists will be provided with a copy of the protocol to review. The Project Lead and/or the Project Manager will explain the protocol step-by-step ensuring citizen scientists understand their roles. At each step of the protocol related to the process of collecting and recording data, the Project Lead and/or the Project Manager will demonstrate exactly how the process should be conducted. This will include proper use of calipers, how to toss quadrats, and how to count Olympia oysters. After the demonstration, each new citizen scientist will practice collecting data outside of the established plots for a few minutes. The data collection practice will include using calipers, tossing quadrats, counting dead and living oysters, and understanding what to record on the data sheet.

## 4.3 Organization Chart

Not applicable. See Table 1 for roles and responsibilities.

## 4.4 Project Schedule

Table 2 Project Schedule from March 2020 to September 2025

Event	FY 2021	2022-2025
Recruit and train MRC Volunteers	Ongoing	Ongoing
Review previous season's data and discuss lessons learned and strategies for upcoming survey season. Submit necessary permit applications.	March	Annually, in March
Placement of clean cultch at Powerline Area	April	Annually, in April - until the site reaches at least 50% shell cover, as permits allow
Placement of clean cultch at Lagoon Area	April	Annually, in April - until the site reaches at least 50% shell cover, as permits allow
Monitor Powerline Site for % shell cover, # and size of spat	August	Annually, May-August
Monitor Lagoon Site for % shell cover, # and size of spat	August	Annually, May-August
Annual Summary Report	September	Annually, in September

Note: field activities and dates may change due to COVID-19 restrictions and safety.

## 4.5 Budget and Funding

Data collection for this program is primarily volunteer-run. Staff support for this program is provided by Jefferson County.

Table 1 Estimated Project Budget for FY 2020-2021

Staff Support	Estimated Cost
MRC Project Manager support (salary, benefits, and indirect)	\$3,720.00
Supplies and Materials (clean cultch, incl. delivery)	\$1,050.00
Travel	\$200
TOTAL*	\$4,970

\*2020-21 funding comes from Washington State General Fund and EPA National Estuary Program through the Northwest Straits Commission to the Jefferson County MRC.

## 5.0 Quality Objectives

### 5.1 Data Quality Objectives

The overall quality objective for this project is to provide high quality data on Olympia oyster populations for Discovery Bay as part of the restoration project. The current QAPP will put forward a set of guidelines for current and future MRC members or staff to evaluate restoration success and facilitate adaptive management practices. Components of the QAPP include sampling methodology and monitoring frequency. To keep the QAPP current, the document will be revised as appropriate to capture any changes in the protocols or added tasks and submitted as addendums.

The quality objectives are met when volunteers:

- Perform Olympia oyster population surveys during the desired tidal height ( $\leq -1.0$  Mean Lower Low Water (MLLW)).
- Conduct surveys annually while maintaining similar timing each year.
- Collect all height and count measurements of Olympia oysters in each subsample consistently and following the protocol.
- Return fully completed data sheets to the MRC Project Manager.
- Submit annual project reports to NWSC.

## *5.2 Measurement Quality Objectives*

To achieve comparability over time, multiple actions will be taken during the population surveys. Protocols for surveys are designed to follow similar local protocols used by partner MRCs. Additionally, those protocols are modelled after regional steps for Puget Sound (Puget Sound Restoration Fund and WDFW), and national standards. Data collected is in accordance with established restoration guidelines for oyster restoration by NOAA (Wasson et al. 2014). The protocols for this project are provided in Appendix B.

Specific steps taken to assure measurement quality are as follows. Dial calipers will be used to collect oyster height and length measurements accurately and consistently to the nearest mm. A standard 0.25 m<sup>2</sup> quadrat will be used during the population survey for each of the five subsamples per plot. A handheld GPS device will be verified for accuracy according to manufacture requirements and used to mark plot and quadrat locations (recorded to 5 decimal places). Field data will be recorded on waterproof data sheets. Participating MRC members and citizen scientists not associated with the MRC are trained in and follow standard oyster measurement protocols (Appendix B). Citizen scientists will be accompanied by the MRC Project Lead and/or Project Manager.

### *5.2.1 Target for Precision and Sensitivity*

Measurements for height and length will be taken to the nearest mm and considered accurate within  $\pm 1$  mm. Volunteers should expect height measurements around 35 mm though smaller and larger Olympia oysters will be measured. Oysters with heights larger than 75 mm will not be counted as this is outside of the typical size range for Olympia oysters and, thus, is likely a different oyster species (Couch and Hassler 1989). Oyster heights less than 1 mm will not be counted as that would exceed the precision of the calipers and would negate our targeted accuracy of  $\pm 1$  mm. The length measurements will follow the same parameters as the height measurements as there is limited published scientific information on maximum, minimum, and median lengths of Olympia oysters.

### *5.2.2 Target for Comparability, Representativeness, and Completeness*

Data from population surveys are comparable with other Olympia oyster restoration projects as similar metrics are being obtained. For example, all MRCs record height and count of Olympia oysters as these are metrics recommended by NOAA (Wasson et al. 2014) and The Nature Conservancy (Baggett et al. 2014) for all oyster restoration projects.

The sampling frequency of one population survey per year captures growth that occurred over the year and allows for recruitment to be seen. Sampling between May through August allows for the MRC to

capture growth that occurred over winter and consistently sampling during summer allows for comparison between years.

As sampling occurs once a year, it is considered complete and successful if that annual sampling event is maintained, meaning a 100% target for planned sampling events are achieved. Sampling flexibilities are included by allowing some variability on the reoccurring month that samples are collected (see Table 2).

### *5.3 Acceptance Criteria for Quality of Existing Data*

The data collection method described in this QAPP is nearly the same method employed in previous years at the Discovery Bay Olympia oyster enhancement site (since 2015), in order to create a long-term data set for assessing the efficacy of a low impact restoration strategy. One exception is that shell heights (technical term for length) were categorized as greater or less than 15 mm in the first two years of monitoring. Starting in 2017, and continuing forward, oysters are being measured to the closest mm using calipers.

### *5.4 Model Quality Objectives*

Not applicable.

## **6.0 Study Design**

### *6.1 Study Boundaries*

This QAPP only includes the area encompassing Discovery Bay (See section 2.2).

### *6.2 Field Data Collection*

See section 2.2 Study area for field locations. The sampling frequency is one population survey annually during the summer season, from May through August. The field protocol is described in Appendix C and is based upon global (Baggett et al. 2014) and regional recommendations by NOAA (Wasson et al. 2014), and follow similar protocols used by other MRCs (Clallam MRC 2019, Dinnel 2018).

### *6.3 Modeling and Analysis Design*

Not applicable.

### *6.4 Assumptions of Study Design*

The study design assumes the survey event would occur during a  $\leq -1.0$  MLLW tidal event so all study plots are above the water line during surveys and during consistent times in the calendar year to capture Olympia oyster growth. Descriptions of the overall site condition and individual plot observations, such as noting the presence of algae, loss of shell or predation, are subject to interpretation of the volunteers and are considered qualitative.

### *6.5 Possible Challenges and Contingencies*

Monitoring at each site will be constrained by two primary factors: Human resources to conduct the monitoring, and safe conditions. If weather or site conditions are unsafe, the survey is postponed to a time when they are safe. Safety considerations for survey teams will also include COVID-19 precautions.

## **7.0 Field Procedures**



## *7.1 Invasive Species Evaluation*

Samples are not collected, so deliberate transfer of invasive species is not possible in this project. Footwear used during field surveys could potentially act as a carrier of invasive species. When possible, footwear will be cleaned at the site. If volunteers are unable to do so, they will be instructed to brush off dirt and debris from the soles after the footwear has completely dried. Additionally, volunteers will be asked to clean their footwear away from any water source, if not at the site, to minimize the potential for spreading invasive species.

## *7.2 Measurement and Sampling Procedures*

Monitoring will be done using 0.25 m<sup>2</sup> quadrats placed along transects within the project area. Transects will be evenly spaced 7 paces apart, with a random number determining the initial distance north of the powerlines (and one transect just south of the powerlines) to mark the starting point of each transect. Quadrats are then placed 5 paces apart on each transect, with a different random number determining the initial distance from the end of each transect. For each quadrat, the number and size of spat will be recorded, and approximate percent shell cover within the quadrat. If spat numbers are high, measurements will be taken of no more than the first 100 spat/quadrat. |

See attached Discovery Bay Olympia Oyster Monitoring Protocol for details (Appendix B).

There is no preliminary baseline data about spat size and numbers collected. Anecdotally, at the time of clean cultch placement, only a few Olympia oysters were found and there was minimal substrate present for oysters to settle upon. It is therefore assumed that there were no Olympia oysters in the study area prior to the placement of clean cultch for this project.

### **Quantity:**

All spat on either side of each shell in the quadrat will be counted.

### **Size:**

Oysters are being measured to the closest mm using calipers.

## *7.3 Containers, Preservation Methods, Holding Times*

Not applicable.

## *7.4 Equipment Decontamination*

Not applicable.

## *7.5 Sample ID*

Not applicable.

## *7.6 Chain of Custody*

Not applicable.

## *7.7 Field Log Requirements*

Each sampling event will include the completion of the Discovery Bay Olympia Oyster Monitoring Data Sheet included in Appendix C.

## *7.8 Other Activities*

The following procedures will be used to maintain quality of data in this project:

1. Follow the standard procedures as described in the previous sections among plots and among volunteers. This includes filling out the field form completely. Each participant reviews the protocols prior to going out in the field each year. The Project Lead will also review the previous year's results and have a printed copy of last year's data on hand for comparison of Olympia oyster length.
2. Only individuals who successfully complete Olympia oyster measurement training will participate.
3. Only the MRC Project Lead and/or Project Manager will lead fieldwork activities and be responsible for the integrity of the sampling.
4. Prior to leaving the site the Project Lead will evaluate data sheets as they are submitted in the field to ensure completeness and address ambiguities. If any unusual results are found, they will be corrected before leaving the field. Any changes made to the data sheet will be initialed by the Project Lead or Project Manager.
5. Data sheets and GPS data are provided by the Project Lead to the MRC Project Manager for data storage and reporting.

## *9.1 Table of Field and Laboratory Quality Control*

See steps listed above.

## *9.2 Corrective Action Processes*

Sample collection is conducted by multiple volunteers. This often provides multiple sets of eyes and experience that can identify a potential issue with field sampling or data. If there are concerns about data while the team is surveying, they will start again and use a new datasheet. If questions arise regarding suspect data after leaving the field, the Project Manager or Project Lead will make necessary efforts to contact the responsible surveyor(s) for clarification. If the surveyors are unable to clarify the suspect data, that data will be considered inaccurate and not included during analysis. If time allows, a second survey may be scheduled that season to document correctly that year's results.

All project data will be maintained by the Project Manager in both paper and electronic forms. The project documents include this QAPP, data sheets, electronic files, permits, photo documentation, and annual reports.

## **11.0 Audits and Reports**

### *11.1 Audits*

Audits are not anticipated for this project. Progress reports and volunteer hours will be submitted annually.

## *11.2 Responsible Personnel*

The MRC Project Manager is responsible for reporting annually to the NWSC on sampling activity.

## *11.3 Frequency and Distribution of Reports*

A copy of protocols and QAPP will be developed to meet the needs of the restoration goals and reviewed annually. Raw data and a report on survey activities will be submitted annually. The report will include:

- A narrative of the field research
- A summary of sampling effort
- Results of the count, size, and recruitment surveys of Olympia oysters
- Raw data and data sheets
- Recommendations for any modification of the procedures and the overall program

## *11.4 Responsibility for Reports*

The MRC Project Manager (see Table 1) is responsible for annual report submission to the NWSC.

## *12.1 Field Data Verification, Requirements, and Responsibilities*

The Project Lead will evaluate data sheets as they are submitted in the field to ensure completeness and address ambiguities. If any unusual results are found, they will be corrected before leaving the field.

## *12.2 Laboratory Data Verification*

Not applicable.

## *12.3 Validation Requirements, if Necessary*

Not applicable.

## *12.4 Model Quality Assessment*

Not applicable.

## *13.1 Process for determining project objectives were met*

The sampling objectives were met if all sample results are submitted to NWSC and reviewed by WDFW Co-Managers. The objective is to collect annual Olympia oyster population surveys from all plots successfully.

## *13.2 Treatment of non-detects*

Not applicable.

### 13.3 Data analysis and presentation methods

Not applicable.

### 13.4 Sampling design evaluation

Not applicable.

- Baggett, L.P., S.P. Powers, R. Brumbaugh, L.D. Coen, B. DeAngelis, J. Greene, B. Hancock, and S. Morlock, 2014. Oyster habitat restoration monitoring and assessment handbook. The Nature Conservancy, Arlington, VA, USA. 96pp. <http://www.oyster-restoration.org/wp-content/uploads/2014/01/Oyster-Habitat-Restoration-Monitoring-and-Assessment-Handbook.pdf>
- Blake, B., A. Bradbury. 2012. Washington Department of Fish and Wildlife plan for rebuilding Olympia oyster (*Ostrea lurida*) populations in Puget Sound with a historical and contemporary overview. Washington Department of Fish and Wildlife, Brinnon, WA. [https://erb7v36cnte3ws6d42lk0gge-wpengine.netdna-ssl.com/wp-content/uploads/2019/02/olympia\\_oyster\\_restoration\\_plan\\_final.pdf](https://erb7v36cnte3ws6d42lk0gge-wpengine.netdna-ssl.com/wp-content/uploads/2019/02/olympia_oyster_restoration_plan_final.pdf)
- Clallam MRC [Marine Resources Committee]. 2019. Final Olympia Oyster Restoration Report. Prepared for the Northwest Straits Commission. 16 pp. <https://www.nwstraits.org/media/2905/clallam-olympia-oyster-restoration-report-2019.pdf>
- Cook, A.E., J.A. Shaffer, B. Dumbauld. 1998. Olympia oyster stock rebuilding plan for Washington State public tidelands. Report to the Washington State Fish and Wildlife Commission. 35 pp.
- Couch, D., and T.J. Hassler. 1989. Species profiles: life histories and environmental requirements of coastal fishes and invertebrates (Pacific Northwest)--Olympia oyster. U.S. Fish Wildl. Serv. Biol. Rep. 82(11.124). U.S. Army Corps of Engineers, TR EL-82-4. 8 pp [https://salishseare restoration.org/images/d/d2/USFWS\\_1983\\_olympia\\_oyster\\_species\\_profile.pdf](https://salishseare restoration.org/images/d/d2/USFWS_1983_olympia_oyster_species_profile.pdf)
- Dinnel, P.A., B. Peabody, T. Peter-Contesse. 2009. Rebuilding Olympia oysters, *Ostrea lurida* Carpenter 1864, in Fidalgo Bay, Washington. Journal of Shellfish Research 28:79-85. <https://eagle.fish.washington.edu/dermochelys/OstreaLuridaProject/Ostrea%20lurida%20research/Oyster%20Publication.pdf>
- Dinnel, P. 2018. Restoration of the Olympia oyster, *Ostrea lurida*, in Fidalgo Bay and Cypress Island. Skagit County Marine Resources Committee Annual Report prepared for the Northwest Straits Commission. <https://www.nwstraits.org/media/2773/skagit-county-marine-resources-committee-annual-report-2018.pdf>
- Jefferson MRC [Marine Resources Committee]. 2010. Northwest Straits Commission Benchmark Account Application 2010, Maynard Nearshore Restoration Project. <https://nwstraits.org/media/1951/jefferson-mrc-2010-0020-discoverybay-olyoysters-field-report.pdf>
- Jefferson MRC [Marine Resources Committee]. 2016. Olympia Oyster Summary Report On Delivery And Distribution Of Seeded Cultch. <https://www.nwstraits.org/media/2290/jef-2016-olympia-oysters.pdf>

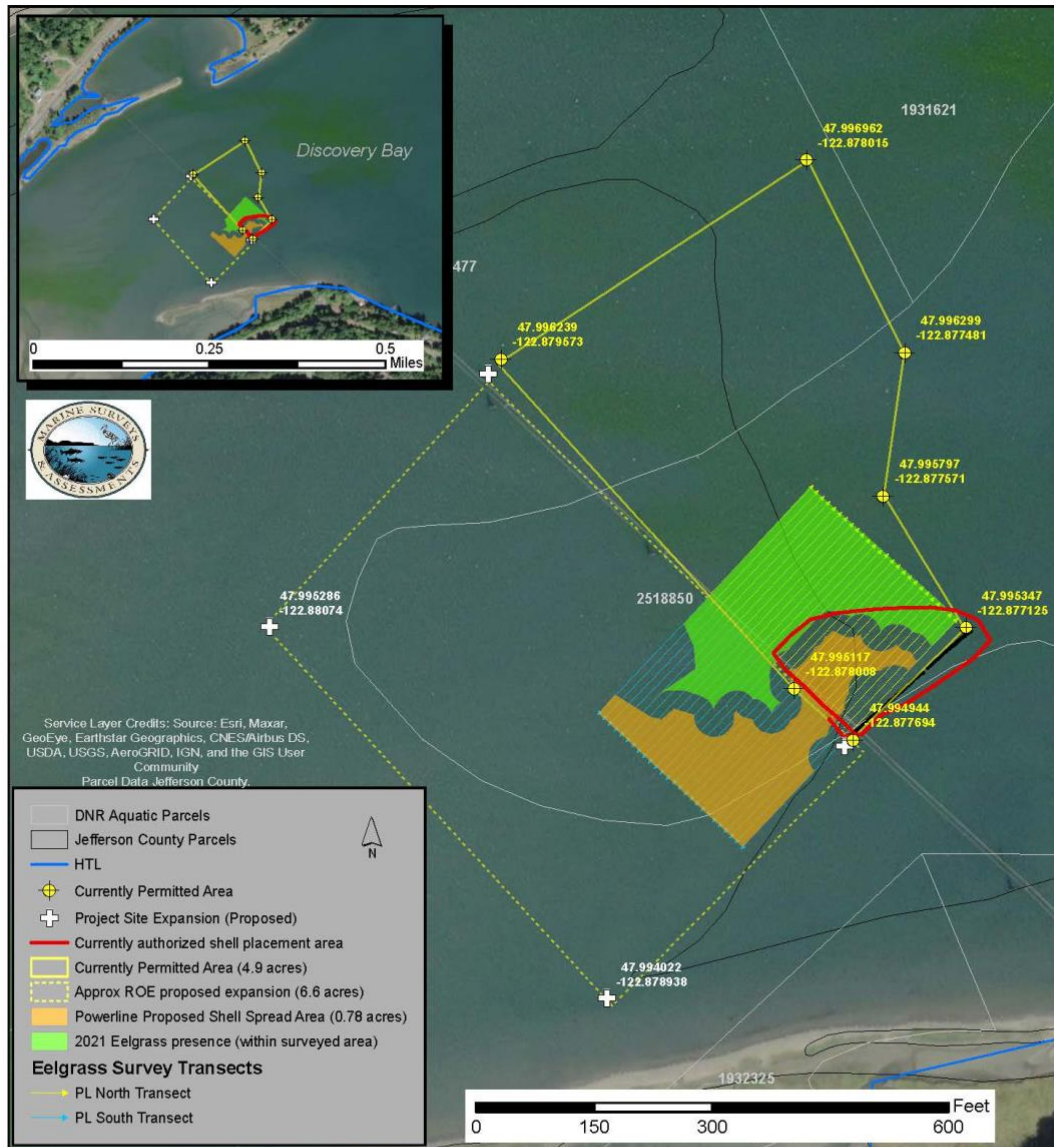


- Jefferson MRC [Marine Resources Committee]. 2017. Olympia Oyster Survey Data & Summary Report for Discovery Bay. [https://www.nwstraits.org/media/2495/jeff\\_2017\\_olyoysterdiscobsummary.pdf](https://www.nwstraits.org/media/2495/jeff_2017_olyoysterdiscobsummary.pdf)
- Jefferson MRC [Marine Resources Committee]. 2018. 2018 Olympia Oyster Survey Data & Summary Report. [https://www.nwstraits.org/media/2697/q4\\_t65\\_olympiaoster-rev21519.pdf](https://www.nwstraits.org/media/2697/q4_t65_olympiaoster-rev21519.pdf)
- Jefferson MRC [Marine Resources Committee]. 2019. Olympia Oyster Monitoring Report for Discovery Bay. Prepared for the Northwest Straits Commission. 7 pp. [https://www.nwstraits.org/media/2939/jef-2019\\_olyoysters.pdf](https://www.nwstraits.org/media/2939/jef-2019_olyoysters.pdf)
- PSRF [Puget Sound Restoration Fund]. 2012. Olympia oyster restoration in Puget Sound. <https://erb7v36cnte3ws6d42lk0gge-wpengine.netdna-ssl.com/wp-content/uploads/2019/02/Olympia-Oyster-Flyer-August-2012.pdf>
- Wasson, K., C. Zabin, J. Bible, E. Ceballos, A. Chang, B. Cheng, A. Deck, T. Grosholz, M. Latta, M. Ferner. 2014. A guide to Olympia oyster restoration and conservation: Environmental conditions and sites that support sustainable populations in central California. 47 pp. [http://www.oyster-restoration.org/wp-content/uploads/2014/10/Olympia-Oyster-Full-Report-10\\_7\\_2014.pdf](http://www.oyster-restoration.org/wp-content/uploads/2014/10/Olympia-Oyster-Full-Report-10_7_2014.pdf)
- Whatcom MRC [Marine Resources Committee]. 2019. Pilot Olympia Oyster Restoration in Chuckanut Bay: 2019 Final Report. 8 pp. [https://www.nwstraits.org/media/2940/wha-2019\\_olympiaoster.pdf](https://www.nwstraits.org/media/2940/wha-2019_olympiaoster.pdf)

## Discovery Bay Olympia Oyster Enhancement Site Maps

### Powerline Area (including the expansion area):

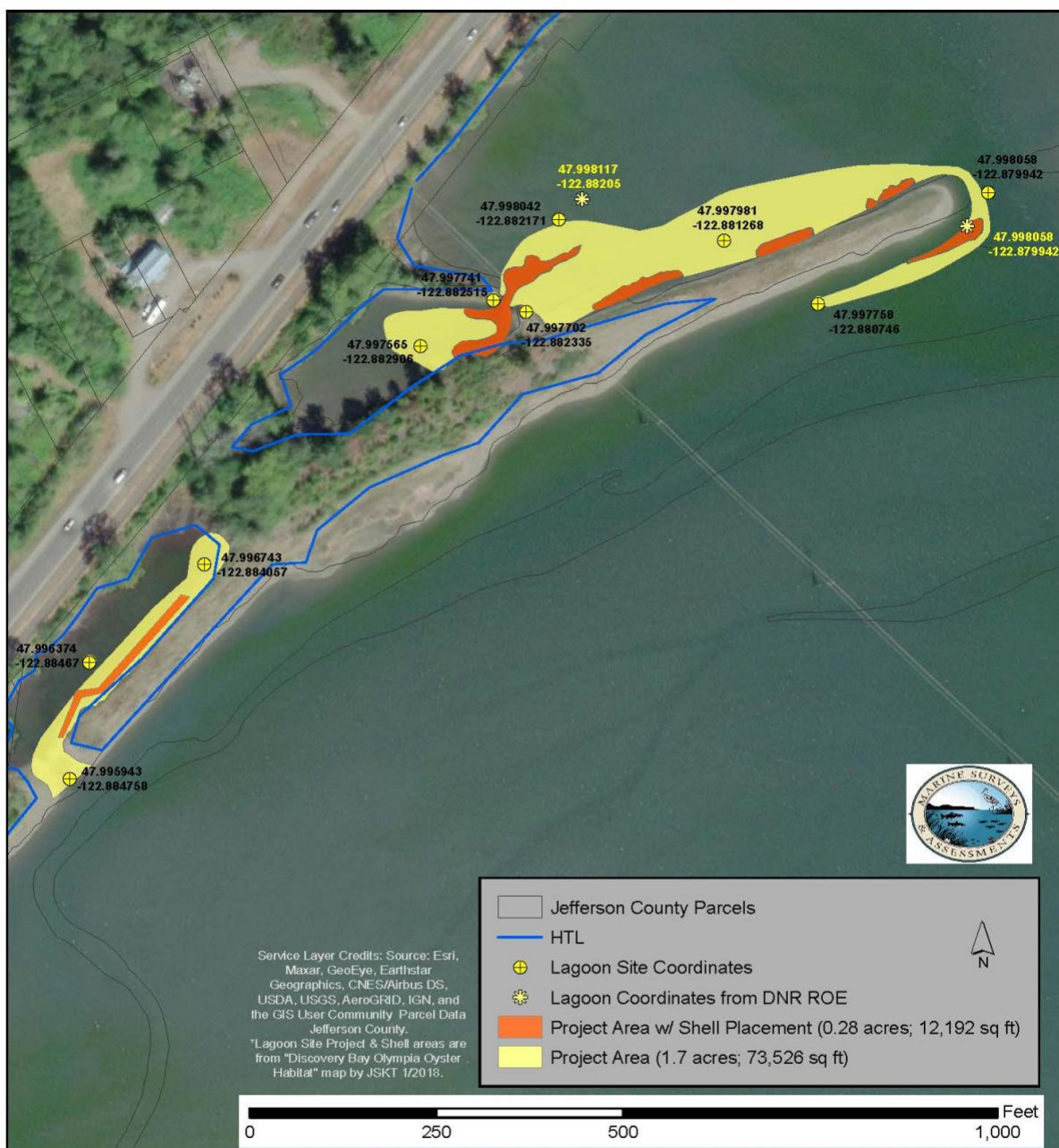
An area located in the bay adjacent to the powerlines on DNR tidelands between approximately +1.0 and 0.0 MLLW. General location (latitude/longitude coordinates) are 47.99505 N, 122.87777 W.



USACE REFERENCE #:	PARCEL ID/OWNER	PROPOSED PROJECT
NWS-2014-292		
APPLICANT: Jefferson County Marine Resources Committee c/o Monica Montgomery	000000001 - Department of Natural Resources (referred to as "Site b." under Right of Entry No. 23-097627)	Olympia oyster habitat enhancement w/ shell placement
LOCATION: Parcel # 000000001 (waterways) Area corners: 47.996962 / -122.878015, 47.995347 / -122.877125, 47.995286 / -122.88074, 47.994022 / -122.878938 In: Discovery Bay      Near: Port Townsend County: Jefferson      State: WA	ADJACENT PROPERTY OWNERS: 902243045 - Jefferson Land Trust 1033 Lawrence St., Port Townsend, WA 98368 902243039 - Julie Campbell 17871 SE 192nd Dr., Renton, WA 98058	Sheet 3 of 3  DATE: 11/16/2021  Tidal datum: ft MLLW

### Lagoon Area:

An area adjacent to the remnant population established in 2019. General location (latitude/longitude coordinates) is 47.997638 N, 122.882278 W.



USACE REFERENCE #:	PARCEL ID/OWNER	PROPOSED PROJECT
NWS 2018-540	902242005 - State of Washington-FISH/WDLF Real Estate Services Div, 600 Capitol Way N, Olympia, WA 98501 621900000 & 000000001 - Department of Natural Resources (referred to as "Site a." under Right of Entry No. 23-097627)	Olympia oyster habitat enhancement w/ shell placement
APPLICANT: Jefferson County Marine Resources Committee c/o Monica Montgomery	ADJACENT PROPERTY OWNERS: 964514806 - Chester Northup Irrev Family Trust c/o Carol Miles, 910 Mayberry St., Forks, WA 98331 964516004 - Thomas Johnson c/o Betty Kirchner, 325 E Washington St. #179, Sequim, WA 98382	Sheet 2 of 3  DATE: 11/16/2021  Tidal datum: ft MLLW
LOCATION: Parcel # 902242005, 000000001, 621900000 NE end (tip of spit): 47.998058 N / -122.879942 W N (at widest point): 47.998117 N / -122.882050 W In: Discovery Bay Near: Port Townsend County: Jefferson State: WA		

## Discovery Bay Olympia Oyster Monitoring Protocol (*Field notes in italics*)

Basic protocols approved by WDFW Shellfish Biologist Brady Blake, August 2015. New sequence of random numbers generated annually.

### Goal:

To monitor oyster spat set on clean Pacific oyster shells placed in a ½-acre area in lower Discovery Bay. Shell placement is to test effectiveness of a low-impact strategy to encourage natural seed set from a nearby existing Olympia Oyster population. For more details about initial work, see Jefferson MRC's Olympia oyster project report and maps (2016, 2017, 2018, 2019).

### Equipment:

- GPS & notebook for writing notes
- 100' tape measures—3 tapes for 3 teams
- camera for quadrat pix & people pix
- 3 sets of data sheets (on waterproof paper), pencils, clipboards (**NOTE: 25 data sheets, with 4 blank pages not used**).
- Stakes or pin flags to mark transect start, end and quadrat centers. Wooden stakes & flags & flagging tape
- Flagging and 20 wire flags
- Volunteer sign-in forms
- Safety review & first aid kit
- Gloves
- Mudboots
- Calipers
- 4 x 5-gal buckets
- Collect shell stacks (in August)
- Snacks
- Compass or functioning GPS compass

Random numbers for July 13, 2018: 9, 3, 2, 3, 7, 1, 8, 5, 1, 9, 7, 6

**GPS Reference Point for project area:  $\Delta$  = 3-pole wood powerline tower**

**GPS =  $\Delta$  47° 59.702'N and 122° 52.668'W  $\pm$ 16 ft.**

### Protocol:

Random numbers are used to locate the start of transects and quadrats within the project area (pace = one step of one leg). Because a number of shells have drifted south of the Powerlines (southern boundary of original project area, one transect parallel to and 9 paces south of the Powerline was added in 2018.

1. Use the Powerlines as the guidelines for the South boundary of the plot (it's actually SW edge).  
*NOTE: due to orientation, baseline was 20 degrees NE to allow more accurately follow the edge of the plot and visible shell. Transect lines were laid out parallel to the Powerlines for ease of orientation.*
2. Beginning at approximately the SE end of the Powerlines pole (GPS =  $\Delta$  47° 59.702'N and 122° 52.668'W  $\pm$ 16 ft.), Walk **South 9 paces** and mark the start of the Transect #1 with a stake. **Record all GPS end points of all transects once they are marked.** These were then transferred to the first page of the data sheets for each transect from the field notebook.



3. Go back to the Powerline SE end (GPS lat-long: *Δ noted above*), walk **North**, using flags to mark a long N-S Baseline transect on the E side of the plot. This line is where all the E-W transects will start from, except Transect #1.
4. Walk **3** [random number above] of paces in a N direction along the N-S Baseline to beginning point of Transect 2. Mark with a stake for beginning of Transect #2. *One person recorded GPS end points of all transects once they were marked, as only one person had the GPS).*
5. *All subsequent transects are parallel to the powerlines and 7 paces north of the Transect 2.*
6. Walk **7** more paces along the Baseline and mark beginning of transect #3 (using stakes or wire flags).
7. *Repeat for each additional parallel transect until very little shell is seen on the ground at the north end of the project area.*
8. From each Transect starting point, facing NW in a line parallel to the powerlines, walk a straight line out to the end of the visible shell, or when you reach the edge of the eelgrass, and put a tall, flagged stake in the mud. *(13 transects in total. We had more time after doing transect 12 at the end of the shell area, so added Transect 1A along the powerlines). Again, see GPS points in field notebook.*
9. **Go back to the East starting point** of Transect #1 and **walk** [random number] of paces. Put a wire flag at that point. You will place the quadrat frames on the ground with the stake at the center and the tape (or imaginary transect line) running through the center of the quadrat. After the first wire flag, **walk 5 more paces** and place another wire flag/quadrat in the same orientation. Repeat to the end of the Transect #1, with each quadrat 5 paces apart.
10. Repeat for each transect, starting at:
  - **3 paces for #2**
  - **7 paces for #3**
  - **1 pace for #4**
  - **Repeat this pattern of (random) paces using random numbers list on first page, to start placement of the first quadrat along each transect, keeping all the other quadrat spacing at 5 paces apart.**

### **Quadrat Instructions**

1. For each quadrat, you will
  - a. *Find all shell and put them in one quarter quadrat in preparation for data collection*
  - b. Measure and record the size of each Oly spat found on each shell
  - c. Estimate percent cover of oyster shell.
2. Move all the shell into one or two quarter sections of the quadrat and then start inspecting and moving them into that first quarter section as you collect data. Pick up each shell piece and inspect it for Olympia oyster spat. Record sizes of all Oly spat found on each shell. Once you have counted a shell, place it on the ground in that first quarter section that was emptied, *or place it outside the quadrat frame so you don't count it twice.*

To estimate overall coverage, place all the counted shells with edges touching so you can easily estimate the total % cover for that quadrat. **Record the % cover estimate on the data sheet for**



**that quadrat and take a photo** (automatically time-stamped), so we can match them up (for percent cover.)

3. **Go to the next quadrat in that transect.**
4. *Clearly note on data sheet when you start a new quadrat, and also when you start a new transect.*
5. Repeat for each quadrat in each transect.

# Discovery Bay Olympia Oyster Monitoring Data Sheet

Jefferson MRC Olympia Oyster Population Survey Data Form - Page 1 of 3

Survey Date: \_\_\_\_\_ Start Time: \_\_\_\_\_

Low Tide & Time: \_\_\_\_\_ End Time: \_\_\_\_\_

Random # from Powerline to start of Transect #1: \_\_\_\_\_

	Transect 1	Flag #'s	Transect 5	Flag #'s
Random # to 1st flag				
LAT (start)				
LONG (start)				
LAT (end)				
LONG (end)				
	Transect 2	Flag #'s	Transect 6	Flag #'s
Random # to 1st flag				
LAT (start)				
LONG (start)				
LAT (end)				
LONG (end)				
	Transect 3	Flag #'s	Transect 7	Flag #'s
Random # to 1st flag				
LAT (start)				
LONG (start)				
LAT (end)				
LONG (end)				
	Transect 4	Flag #'s	Transect 8	Flag #'s
Random # to 1st flag				
LAT (start)				
LONG (start)				
LAT (end)				
LONG (end)				

GPS	Transect 9	Flag #'s	Transect 13	Flag #'s
Random # to 1st flag				
LAT (start)				
LONG (start)				
LAT (end)				
LONG (end)				
Random # to 1st flag	Transect 10	Flag #'s	Transect 14	Flag #'s
LAT (start)				
LONG (start)				
LAT (end)				
LONG (end)				
Random # to 1st flag	Transect 11	Flag #'s	Transect 15	Flag #'s
LAT (start)				
LONG (start)				
LAT (end)				
LONG (end)				
Random # to 1st flag	Transect 12	Flag #'s	Transect 16	Flag #'s
LAT (start)				
LONG (start)				
LAT (end)				
LONG (end)				

**SITE MAP & NOTES:**

Site Name: \_\_\_\_\_

Survey Date: \_\_\_\_\_

Survey Date:

[illegible]

Random Number Table (between 1 & 50)

30	8	29	46	47	5	45	10	40
1	18	31	10	35	19	22	16	4
49	7	43	38	34	45	23	19	37
30	15	37	16	14	27	9	36	21
36	28	22	7	34	25	44	34	11
35	24	44	18	5	22	38	6	20
30	35	47	35	12	41	8	28	34
19	26	36	43	36	11	28	12	4
24	22	36	38	50	20	34	23	4
49	24	17	9	41	46	18	18	33
20	9	4	6	50	47	48	39	47
47	7	26	50	46	47	20	37	23
27	26	22	45	14	44	4	12	22
3	17	13	26	10	19	42	10	29
41	17	35	28	45	9	38	29	12
5	39	30	5	37	24	23	6	10
42	1	9	48	17	26	23	1	46
5	44	44	4	6	40	15	5	32
10	31	50	6	10	4	9	6	30
14	15	33	5	42	33	17	46	50
28	31	20	49	33	37	40	3	1
1	21	21	24	15	13	2	38	39
1	46	46	1	29	40	10	19	27
12	47	8	6	24	25	10	4	5
27	10	8	30	23	34	25	24	22
21	42	27	12	42	2	6	39	38
22	33	19	29	20	39	49	33	26
15	5	11	19	1	42	27	37	34
35	47	41	30	24	25	28	15	44
6	38	24	29	21	44	38	35	19
16	39	17	7	38	11	10	33	49
8	21	13	33	2	25	10	5	35
43	38	34	50	25	37	41	49	21
27	33	19	19	49	23	42	48	41
26	25	44	34	34	25	19	28	40
19	10	3	9	1	6	35	27	24
11	14	35	13	12	33	12	42	26
43	10	22	12	49	39	11	25	28
40	41	8	20	3	4	45	11	33
12	25	37	33	7	38	37	8	7
43	22	32	6	18	10	31	34	28
45	19	12	9	37	40	43	11	35



# Appendix B – June 8, 2024 population survey datasheets

## Jefferson MRC Olympia Oyster Population Survey Data Sheet

Site Name: DISCOVERY BAY - NORTH POWER LINES Survey Date: 6/8/2024

Monitor Names: MORGAN + KATIE + EMILY

Entered?

Flag #	% Coverage	Length (mm) of each Olympia oyster (separate by commas)	Notes
✓ 7	35	50, 23,	
✓ 11	40	28, 64, 64, 52, 48, 40, 51, 52, 64, 53, 20, 50	
		44, 41, 23, 64, 42, 45, 22, 38, 29, 49, 27, 43, 30,	
		43, 32, 42, 32, 12, 51, 23, 48, 59, 74, 51, 38, 35,	
		24, 54, 30, 43, 48, 40, 52, 34, 36, 33, 39, 54, 49, 49,	
		58, 29, 53,	
✓ 18	50	27, 37, 42, 71, 43, 52, 76, 32, 50, 50, 30, 54, 45, 57, 29	71 x 30
		47, 53, 43, 44, 58, 51, 46, 44, 33, 42, 60, 55, 55, 44,	
		32, 55, 40, 44, 43, 60, 30, 41, 39, 28, 44, 44, 40, 42,	
		55, 31, 37, 32, 45, 8, 5, 34, 26, 34,	
✓ 21	5	54, 45	
✓ 29	3	Ø	
✓ 28	93	30, 21, 26, 32, 27, 29, 22, 36, 44, 27, 27, 31, 31, 18, 30,	
		28, 33, 36, 43, 34, 30, 26, 18, 19, 16, 25, 36, 29, 28, 34,	
✓ 42	8	Ø	
✓ 30	30	38, 32, 43, 26, 48, 34, 84, 51, 47,	
✓ 45	15	43,	

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# Jefferson MRC Olympia Oyster Population Survey Data Sheet

Site Name: DISCOVERY BAY - SOUTH POWER LINES

Survey Date: 6/8/2024

Monitor Names: MORGAN + KATIE + EMILY

Flag #	% Coverage	Length (mm) of each Olympia oyster (separate by commas)	Notes
✓ 50	30	51, 36, 34, 47, 49, 21, 45, 33, 41, 61, 58, 45, 24, 37, 43, 41, 102, 30, 45, 54, 56, 45, 27, 36, 53, 19, 56, 36, 40, 50, 45, 36, 34, 55, 41, 36, 46, 56, 36, 32, 48, 41, 29, 47, 38, 58, 53, 48, 35, 30, 27, 42, 28, 52	55
✓ 54	35	49, 44, 61, 54, 58, 50, 47, 47, 40, 53, 47, 50, 41, 21, 35, 48, 54, 22, 47, 57, 50, 49, 17, 30, 24, 34, 52, 46, 40, 42, 15, 57, 40, 41, 49, 45, 43, 38, 48, 56, 31, 58, 43, 49, 26, 27, 48, 34, 39, 51, 37, 44, 43, 36, 46, 59, 33, 37, 57, 56, 51, 32, 43, 46, 45, 45, 20, 32	68 10
✓ 57	<del>10</del> 15	34, 35, 49, 37, 16, 25, 22, 59, 55, 69, 52, 44, 49, 50, 43,	15
✓ 59	30	41, 50, 44, 31, 45, 60, 45, 35, 46, 32, 44, 33, 33, 24, 34, 52, 29, 34, 57, 22, 57, 26, 33, 48, 31, 54, 50, 49	35
✓ 61	20	45, 46, 48, 24, 45, 34, 53, 60, 49,	

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# Jefferson MRC Olympia Oyster Population Survey Data Sheet

Site Name: Powerlines N.

Survey Date: 6-8-24

Monitor Names: Kieth, Gordon, Franck

Flag #	% Coverage	Length (mm) of each Olympia oyster (separate by commas)	Notes
✓ 1	12	41, 35, 22, 52, 35	5
✓ 4	18	60, 46, 54, 48, 51, 46	6
✓ 5	8	57, 51, 34, 31, 38, 21, 37, 26, 55	9
✓ 14	4	—	
✓ 13	1	46	1
✓ 10	7	38, 52, 55	3
✓ 15	1	—	
✓ 16	25	44, 57,	2
✓ 17	18	40, 64, 33, 51, 28, 34, 29, 35, 45, 45, 25	13
	'cont	46, 46	8
✓ 23	2	—	
✓ 24	27	41, 52, 50, 33, 51, 39, 48, 34, 52, 48, 29	
	'cont	33, 40, 36, 39, 31, 40, 47, 31, 22, 44, 47	27
	'cont	41, 33, 49, 49, 39	



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## Jefferson MRC Olympia Oyster Population Survey Data Sheet

Site Name: N. PowerlinesSurvey Date: 6-8-24Monitor Names: Gordon, Lieth, Jeanie

Flag #	% Coverage	Length (mm) of each Olympia oyster (separate by commas)	Notes
✓ 60	3	52, 28	

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## Jefferson MRC Olympia Oyster Population Survey Data Sheet

Site Name: Power lines N.Survey Date: 6-8-24Monitor Names: Gordon Kieth Joanie

Flag #	% Coverage	Length (mm) of each Olympia oyster (separate by commas)	Notes
✓ 25	5	47, 39, 26, 27, 33, 29, 47	7
✓ 26	23	22, 32, 42, 33, 35, 51, 35, 29	8
✓ 32	24	40, <del>24</del> , 50, 31, 33, 47, 38, 42, <del>36</del> 23, 43, 37	
	cont	22, 41, 20, 42, 48, 41, 30	18
✓ 31	25	33, 32, 26, 25, 40, 22, <del>35</del> , 21, 52, 32, 44, 16, 41	
	cont	32, 49, 45, 28, 30, 39, 46, 15, 41	22
✓ 43	<del>20</del>	27, 46, 36, 47	4
✓ 48	52	39, 16, 22, 35, 44, 34, 42, 22, 45, 32, 17, 37, 26, 36	Start W. Powerline
	cont	39, 26, 53, 46, 41, 46, 39, 35, 35, 41, 49, 39	✓
	cont	52, 38, 25, 43, 41, 40, 58, 18, 12, 11, 55, 44, 26, 32	
	cont	16, 30, 40, 42, 21, 41, 33, 57, 36, 30, 35, 14, 39	
	cont	37, 27, 52, 22, 38, 42, 37, 26, 42, 62, 37, 48, 41	
	cont	35, 42, 38, 35, 24, 52, 34, 38, 46, 34, 43, 22, 35	(The last 21 numbers from 48 were in one cluster)
	cont	27, 29, 35, 46, 21, 28, 39, 22, 39, 37, 27, 34, 14	
	cont	38	159



## Jefferson MRC Olympia Oyster Population Survey Data Sheet

Site Name: South Power lineSurvey Date: 06.08.24Monitor Names: Brenda Johnson, Chris Pike, Madalyn Walker

Flag #	% Coverage	Length (mm) of each Olympia oyster (separate by commas)	Notes
✓ 49	1%	—	
✓ 52	15%	33, 8, 45, 33, 43, 38, 48, 28, 11, 6, 34, 52	12
✓ 55	5%	59, 34, 32, 31	4
✓ 56	20%	31, 21, 63, 33, 30, 12, 6, 43, 32, 19, 35, 30, 49, 18, 11, 30, 51	20
✓ 58	25%	48, 31, 30 25, 46, 30, 35, 48, 22, 21, 28, 51, 48, 28, 38, 35, 37, 50, 51, 43, 60, 28, 45	20

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# Jefferson MRC Olympia Oyster Population Survey Data Sheet

Site Name: Powerline South (~~North~~ <sup>is above the electric line</sup>)

Survey Date: \_\_\_\_\_

Monitor Names: Brad & Cheryl

Flag #	% Coverage	Length (mm) of each Olympia oyster (separate by commas)	Notes
✓38	2%	46	1
✓37	25%	24, 53	2
✓44	3%	44	1
✓51	3%	36, 42, 20, 27, 45, 48, 47, 50, 70	9
✓53	60%	37, 51, 52, 50, 44, 48, 32, 41, 52, 45, 41, 40, 40, 54, 47, 37	
53	continued	57, 44, 41, 28, 41, 55, 53, 46, 46, 51, 52, 51, 41, 38, 33, 40	
53	continued	41, 45, 31, 45, 34, 52, 35, 44, 42, 49, 50, 40, 45, 45, 35,	
53	continued	37, 32, 32, 53, 37, 31, 43, 36, 28, 45, 27, 59, 42, 34, 52, 54	63

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# Jefferson MRC Olympia Oyster Population Survey Data Sheet

Site Name: North Power Line

Survey Date: 06-08-24

Monitor Names: Brenda Johnson, Chris Pike, Madalyn Walker

\*high barnacle population seen across transects

Flag #	% Coverage	Length (mm) of each Olympia oyster (separate by commas)	Notes
✓ 3	45%	33, 29, 45, 30, 35, 39, 33, 44, 36, 45, 40, 39, 40, 42, 32, 36, 21, 43, 50, 36, 31, 43, 44, 49, 33, 26, 50, 35, 36, 48, 48, 50, 19, 33, 56, 53, 48, 41, 30, 43, 19, 33, 38, 52, 51, 36, 27, 57, 61, 45, 44, 36	
✓ 8	0%	—	algae mat covering quadrat area
✓ 9	15%	49, 49, 32, 43, 50, 25, 32, 45, 48, 30, 34, 34, 21, 14, 21, 25	Heavy algae coverage
✓ 20	55%	31, 39, 33, 41, 32, 40, 8, 6, 6, 4, 15, 4, 2	
✓ 22	40%	9, 3, 3, 4, 43	
✓ 36	0%	—	
✓ 35	≤ 10%	6, 3	
✓ 34	50%	15, 8, 3, 6, 5, 5, 4, 14, 5, 4, 37, 37, 38, 40, 17, 12, 5, 3, 14, 26, 42, 29, 17, 9, 8, 20	
✓ 46	1%	—	
✓ 47	30%	—	

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# Jefferson MRC Olympia Oyster Population Survey Data Sheet

Site Name: Powerline North

Survey Date: June 8, 2024

Monitor Names: Brad, Cheryl

Flag #	% Coverage	Length (mm) of each Olympia oyster (separate by commas)	Notes
✓ 2	25%	41, 49, 38, 28, 40, 35, 41, 37, 39, 21, 30, 43, 40, 42, 35	
2	contin	53, 42, 31, 47, 43, 49, 48, 47, 44, 50	25
✓ 6	4%	21, 56, 50, 66, 53	4
✓ 12	35%	71, 53, 50, <sup>54</sup> 31, 32, 48, 43, 43, 75, 62, 36, 42, 53, 44	
12	contin	63, 43, 43, 34, 50, 27, 47, 41, 57, 60, 31, 51, 42, 46, 43	31
✓ 19	60%	29, 43, 53, 43, 52, 29, 44, 38, 38, 46, 35, 41, 37, 41, 43, 47	
19	cont'd	55, 25, 47, 52, 37, 32, 50, 48, 49, 40, 62, 32, 62, 21, 35, 48, 57	
19	cont'd	35, 54, 48, 33, 26, 31, 31, 49, 49, 35, 35, 44, 37	46
✓ 27	25%	34, 44, 35, 44, 46, 47, 43, 50, 35	9
✓ 33	0	0	
✓ 41	4%	0	
✓ 40	0	0	
✓ 39	0	0	

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# Jefferson MRC Olympia Oyster Population Survey Data Sheet

Site Name: DISCOVERY BAY - NORTH POWER LINES Survey Date: 6/8/2024

Monitor Names: MORGAN + KATIE + EMILY

Entered?

Flag #	% Coverage	Length (mm) of each Olympia oyster (separate by commas)	Notes
✓ 7	35	50, 23,	
✓ 11	40	28, 64, 64, 52, 48, 40, 51, 52, 64, 53, 20, 50	
		44, 41, 23, 64, 42, 45, 22, 38, 29, 49, 27, 43, 30,	
		43, 32, 42, 32, 12, 51, 23, 48, 59, 74, 51, 38, 35,	
		24, 54, 30, 43, 48, 40, 52, 34, 36, 33, 39, 54, 49, 49,	
		58, 29, 53,	
✓ 18	50	27, 37, 42, 71, 43, 52, 76, 32, 50, 50, 30, 54, 45, 57, 29	71 x 30
		47, 53, 43, 44, 58, 51, 46, 44, 33, 42, 60, 55, 55, 44,	
		32, 55, 40, 44, 43, 60, 30, 41, 39, 28, 44, 44, 40, 42,	
		55, 31, 37, 32, 45, 8, 5, 34, 26, 34,	
✓ 21	5	56, 45	
✓ 29	3	Ø	
✓ 28	93	30, 21, 36, 32, 27, 29, 22, 31, 44, 27, 27, 31, 31, 18, 30,	
		28, 33, 36, 43, 34, 30, 26, 18, 19, 16, 25, 36, 29, 28, 34,	
✓ 42	8	Ø	
✓ 30	30	38, 32, 43, 26, 48, 34, 84, 51, 47,	
✓ 45	15	43,	

2

55 mm  
50

51

2

30

9

1

150



# Jefferson MRC Olympia Oyster Population Survey Data Sheet

Site Name: DISCOVERY BAY - SOUTH POWER LINES

Survey Date: 6/8/2024

Monitor Names: MORGAN + KATIE + EMILY

Flag #	% Coverage	Length (mm) of each Olympia oyster (separate by commas)	Notes
✓ 50	30	51, 36, 34, 47, 49, 21, 45, 33, 41, 61, 58, 45, 24, 37, 43, 41, 102, 30, 45, 54, 56, 45, 27, 36, 53, 19, 56, 36, 40, 50, 45, 36, 34, 55, 41, 36, 46, 56, 36, 32, 48, 41, 29, 47, 38, 58, 53, 48, 35, 30, 27, 42, 28, 52	55
✓ 54	35	49, 44, 61, 54, 58, 50, 47, 47, 40, 53, 47, 50, 41, 21, 35, 48, 54, 22, 47, 57, 50, 49, 17, 30, 24, 34, 52, 46, 40, 42, 15, 57, 40, 41, 49, 45, 43, 38, 48, 56, 31, 58, 43, 49, 26, 27, 48, 34, 39, 51, 37, 44, 43, 36, 46, 59, 33, 37, 57, 56, 51, 32, 43, 46, 45, 45, 20, 32	68 10
✓ 57	<del>10</del> 15	34, 35, 49, 37, 16, 25, 22, 59, 55, 69, 52, 44, 49, 50, 43,	15
✓ 59	30	41, 50, 44, 31, 45, 60, 45, 35, 46, 32, 44, 33, 33, 24, 34, 52, 29, 34, 57, 22, 57, 26, 33, 48, 31, 54, 50, 49	35
✓ 61	20	45, 46, 48, 24, 45, 34, 53, 60, 49,	

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# Jefferson MRC Olympia Oyster Population Survey Data Sheet

Site Name: Powerlines N.

Survey Date: 6-8-24

Monitor Names: Kieth, Gordon, Franke

Flag #	% Coverage	Length (mm) of each Olympia oyster (separate by commas)	Notes
✓ 1	12	41, 35, 22, 52, 35	5
✓ 4	18	60, 46, 54, 48, 51, 46	6
✓ 5	8	57, 51, 34, 31, 38, 21, 37, 26, 55	9
✓ 14	4	—	
✓ 13	1	46	1
✓ 10	7	38, 52, 55	3
✓ 15	1	—	
✓ 16	25	44, 57,	2
✓ 17	18	40, 64, 33, 51, 28, 34, 29, 35, 45, 45, 25	13
	'cont	46, 46	8
✓ 23	2	—	
✓ 24	27	41, 52, 50, 33, 51, 39, 48, 34, 52, 48, 29	
	'cont	33, 40, 36, 39, 31, 40, 47, 31, 22, 44, 47	27
	'cont	41, 33, 49, 49, 39	

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## Jefferson MRC Olympia Oyster Population Survey Data Sheet

Site Name: N. PowerlinesSurvey Date: 6-8-24Monitor Names: Gordon, Lieth, Jeanie

Flag #	% Coverage	Length (mm) of each Olympia oyster (separate by commas)	Notes
✓ 60	3	52, 28	

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## Jefferson MRC Olympia Oyster Population Survey Data Sheet

Site Name: Power lines N.Survey Date: 6-8-24Monitor Names: Gordon Kieth Joanie

Flag #	% Coverage	Length (mm) of each Olympia oyster (separate by commas)	Notes
✓ 25	5	47, 39, 26, 27, 33, 29, 47	7
✓ 26	23	22, 32, 42, 33, 35, 51, 35, 29	8
✓ 32	24	40, <del>24</del> , 50, 31, 33, 47, 38, 42, <del>36</del> 23, 43, 37	
	cont	22, 41, 20, 42, 48, 41, 30	18
✓ 31	25	33, 32, 26, 25, 40, 22, <del>35</del> , 21, 52, 32, 44, 16, 41	
	cont	32, 49, 45, 28, 30, 39, 46, 15, 41	22
✓ 43	<del>20</del>	27, 46, 36, 47	4
✓ 48	52	39, 16, 22, 35, 44, 34, 42, 22, 45, 32, 17, 37, 26, 36	Start W. Powerline
	cont	39, 26, 53, 46, 41, 46, 39, 35, 35, 41, 49, 39	✓
	cont	52, 38, 25, 43, 41, 40, 58, 18, 12, 11, 55, 44, 26, 32	
	cont	16, 30, 40, 42, 21, 41, 33, 57, 36, 30, 35, 14, 39	
	cont	37, 27, 52, 22, 38, 42, 37, 26, 42, 62, 37, 48, 41	
	cont	35, 42, 38, 35, 24, 52, 34, 38, 46, 34, 43, 22, 35	(The last 21 numbers from 48 were in one cluster)
	cont	27, 29, 35, 46, 21, 28, 39, 22, 39, 37, 27, 34, 14	
	cont	38	159

## Jefferson MRC Olympia Oyster Population Survey Data Sheet

Site Name: South Power lineSurvey Date: 06.08.24Monitor Names: Brenda Johnson, Chris Pike, Madalyn Walker

Flag #	% Coverage	Length (mm) of each Olympia oyster (separate by commas)	Notes
✓ 49	1%	—	
✓ 52	15%	33, 8, 45, 33, 43, 38, 48, 28, 11, 6, 34, 52	12
✓ 55	5%	59, 34, 32, 31	4
✓ 56	20%	31, 21, 63, 33, 30, 12, 6, 43, 32, 19, 35, 30, 49, 18, 11, 30, 51	20
✓ 58	25%	48, 31, 30 25, 46, 30, 35, 48, 22, 21, 28, 51, 48, 28, 38, 35, 37, 50, 51, 43, 60, 28, 45	20

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# Jefferson MRC Olympia Oyster Population Survey Data Sheet

Site Name: Powerline South (~~North~~ <sup>is above the electric line</sup>)

Survey Date: \_\_\_\_\_

Monitor Names: Brad & Cheryl

Flag #	% Coverage	Length (mm) of each Olympia oyster (separate by commas)	Notes
✓38	2%	46	1
✓37	25%	24, 53	2
✓44	3%	44	1
✓51	3%	36, 42, 20, 27, 45, 48, 47, 50, 70	9
✓53	60%	37, 51, 52, 50, 44, 48, 32, 41, 52, 45, 41, 40, 40, 54, 47, 37	
53	continued	57, 44, 41, 28, 41, 55, 53, 46, 46, 51, 52, 51, 41, 38, 33, 40	
53	continued	41, 45, 31, 45, 34, 52, 35, 44, 42, 49, 50, 40, 45, 45, 35,	
53	continued	37, 32, 32, 53, 37, 31, 43, 36, 28, 45, 27, 59, 42, 34, 52, 54	63

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# Jefferson MRC Olympia Oyster Population Survey Data Sheet

Site Name: North Power Line

Survey Date: 06-08-24

Monitor Names: Brenda Johnson, Chris Pike, Madalyn Walker

\*high barnacle population seen across transects

Flag #	% Coverage	Length (mm) of each Olympia oyster (separate by commas)	Notes
✓ 3	45%	33, 29, 45, 30, 35, 39, 33, 44, 36, 45, 40, 39, 40, 42, 32, 36, 21, 43, 50, 36, 31, 43, 44, 49, 33, 26, 50, 35, 36, 48, 48, 50, 19, 33, 56, 53, 48, 41, 30, 43, 19, 33, 38, 52, 51, 36, 27, 57, 61, 45, 44, 36	
✓ 8	0%	—	algae mat covering quadrat area
✓ 9	15%	49, 49, 32, 43, 50, 25, 32, 45, 48, 30, 34, 34, 21, 14, 21, 25	Heavy algae coverage
✓ 20	55%	31, 39, 33, 41, 32, 40, 8, 6, 6, 4, 15, 4, 2	
✓ 22	40%	9, 3, 3, 4, 43	
✓ 36	0%	—	
✓ 35	≤ 10%	6, 3	
✓ 34	50%	15, 8, 3, 6, 5, 5, 4, 14, 5, 4, 37, 37, 38, 40, 17, 12, 5, 3, 14, 26, 42, 29, 17, 9, 8, 20	
✓ 46	1%	—	
✓ 47	30%	—	

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# Jefferson MRC Olympia Oyster Population Survey Data Sheet

Site Name: Powerline North

Survey Date: June 8, 2024

Monitor Names: Brad, Cheryl

Flag #	% Coverage	Length (mm) of each Olympia oyster (separate by commas)	Notes
2	25%	41, 49, 38, 28, 40, 35, 41, 37, 39, 21, 30, 43, 40, 42, 35	
2	contin	53, 42, 31, 47, 43, 49, 48, 47, 44, 50	
6	4%	21, 56, 50, 66, 58	
12	35%	71, 53, 50, <sup>54</sup> <del>58</del> , 31, 32, 48, 43, 43, 75, 62, 36, 42, 53, 44	
12	cont	63, 43, 43, 34, 50, 27, 47, 41, 57, 60, 31, 51, 42, 46, 46, 43	
19	60%	29, 43, 53, 43, 52, 29, 44, 38, 38, 46, 35, 41, 37, 41, 43, 47	
19	cont'd	55, 25, 47, 52, 32, 32, 50, 48, 49, 40, 62, 22, 62, 21, 25, 48, 57	
19	cont'd	35, 54, 48, 33, 26, 31, 31, 49, 49, 35, 35, 44, 37	
27	25%	34, 44, 35, 44, 16, 47, 43, 50, 35	
33	0	0	
41	4%	0	
40	0	0	
39	0	0	