COUNTY: WHATCOM

Grant Number: SEANWS-2019-WhCoPW-00001

PROJECT TITLE: Whatcom County Marine Resources Committee (MRC) Operations and Projects

TASK NUMBER: 3.10 (Olympia Oyster Final Report)

PERIOD COVERED: 10/1/2019 – 09/30/2020

DATE SUBMITTED: 09/30/2020

This project has been funded wholly or in part by the United States Environmental Protection Agency. The contents of this document do not necessarily reflect the views and policies of the Environmental Protection Agency under Assistance Agreement [CE-01J65401]. The contents of this document do not necessarily reflect the views and policies of the Environmental Protection Agency, nor does mention of trade names or commercial products constitute endorsement or recommendation for use.

Pilot Olympia Oyster Restoration Final Report

2019-2020

This report summarizes the activities completed between October 1, 2019 – September 30, 2020 by the Whatcom Marine Resources Committee for the pilot Olympia oyster restoration project in North Chuckanut Bay.

Report prepared by: Austin Rose, Whatcom County Public Works
Whatcom Marine Resources Committee Coordinator

9/30/2020

Pilot Olympia Oyster Restoration Final Report

The Whatcom MRC continued a pilot project to establish a self-sustaining population of Olympia oysters to enhance habitat complexity and diversity in North Chuckanut Bay. Following the planting of approximately 95,000 oysters in pilot restoration plots in May 2018, the MRC annually surveys the plots to assess oyster abundance, recruitment; and the live oyster size distribution. After a few years of collecting this data, the MRC will evaluate oyster retention and determine the potential for Olympia oyster restoration in North Chuckanut Bay.

Pilot Olympia Oyster Restoration Plots

In June 2016, the Washington Department of Fish and Wildlife (WDFW) identified seven pilot restoration plots – otherwise referred to a test plots - as suitable to plant seeded Olympia oyster cultch (Figure 1). In 2017, The MRC purchased 35 bags of Olympia oyster spat on Pacific oyster shell from the Puget Sound Restoration Fund. Each bag had a minimum of 250 shells and 3-5 spat (or seed) per shell. These bags were delivered to the Whatcom MRC in May 2017 and placed at a secure location in Fidalgo Bay for overwintering. In May 2018, the MRC spread the seeded cultch within six test plots and identified Oly 4 as the reference plot, where no cultch was added.

Figure 1: Whatcom MRC Olympia Oyster Test Plots. Map by Austin Rose, Whatcom County Public Works

Quality Assurance Project Plan (QAPP)

Until 2020, the MRC was referencing a working monitoring plan that was developed with information from other MRC Olympia oyster restoration projects, marine conservation students from Western Washington University, and shellfish restoration experts within the Northwest Straits Initiative. In 2020, MRC Staff worked with Northwest Straits Commission staff to develop an official Quality Assurance Project Plan (QAPP) to guide the collection of baseline biological data, and the evaluation of restoration potential. This QAPP is attached with this report. The QAPP outlines the survey protocols and includes the field sheet used by volunteers.

2020 Pilot Plot Survey

The MRC has previously conducted surveys within the pilot restoration plots at low tide in May or early June. Due to the COVID-19 outbreak in March 2020, and uncertainty about safety of conducting field work with volunteers, the 2020 survey was conducted on August 19. Six MRC members and three outside volunteers (names listed below) conducted a population survey within all six pilot plots and the reference plot.

Dr. Paul Dinnel, specialist of marine ecology, shellfish resources, and member of the Skagit MRC, visited the test plots in North Chuckanut Bay in 2019 and suggested placing several bags of seasoned Pacific oyster shell within the plots to assess for natural larvae recruitment. Three bags of approximately 20 shells were provided by Dr. Dinnel in 2019, and assessed in the 2020 survey, but there was no evidence of larvae recruitment. In July 2020, twelve bags of seasoned Pacific oyster shell were donated by Taylor Shellfish Farms. MRC staff obtained a Shellfish Transfer permit (see attached with this report) to move the shell into North Chuckanut Bay. Two bags of the seasoned shell were placed within the six test plots (Oly 1, Oly 2, Oly 3, Oly 5, Oly 6, Oly 7).

Photos above: Austin Rose, Whatcom County Public Works. *Olympia oysters found within survey quadrats in test plots.*

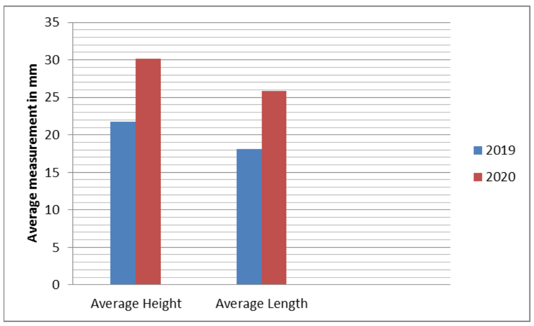
<u>2020 Olympia Oyster Survey Participants</u>

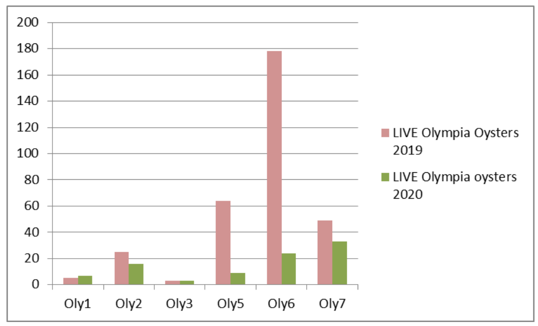
Name	Affiliation
Alex	MRC member
Heather Spore	MRC informational alternate
Ryan McLaughlin	MRC member
Jenna McLaughlin	Volunteer
Bob Cecile	MRC member
Bob Lemon	Volunteer
Rachel Dalthrop	Volunteer/North Sound Steward
Kristin Murray	MRC member
Paul Troutman	MRC member

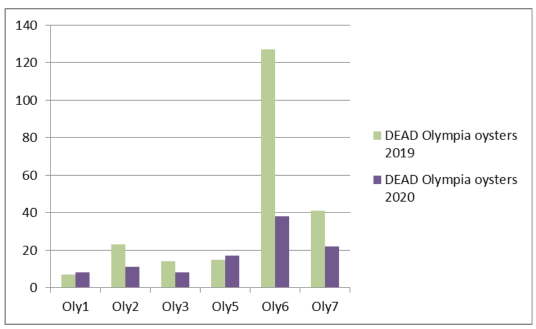
Data

Data will be shared with WDFW staff and shellfish restoration specialist, Paul Dinnel. It is hoped that these shellfish restoration experts are able to speak to the MRC about the data and provide suggestions on any changes to monitoring protocols.

No oysters were found in the reference plot (Oly 4). There were significantly more Olympia oysters found (dead or alive) within the test plots in 2019, as compared to 2020. However, the live Olympia oysters found in 2020 are larger than those found in 2019. This data reflects that there may be no Olympia oyster recruitment at this time and that the live oysters found are growing.







Summary

There is currently no Whatcom MRC member with shellfish restoration expertise. The committee has discussed gathering local experts to form a technical advisory committee that could help with the development of this project, or help determine that there is no potential for Olympia oyster restoration in North Chuckanut Bay. The MRC will continue to safely include local volunteers (citizen scientists) to help with monitoring, and will also continue connections with students and teachers from the Bellingham Technical College Fisheries and Aquaculture program.

Attachments

- Quality Assurance Project Plan: North Chuckanut Bay Pilot Olympia Oyster Restoration Project
- Shellfish Transfer Permit No. 20-111

QUALITY ASSURANCE PROJECT PLAN: North Chuckanut Bay Pilot Olympia Oyster Restoration Project

Prepared by: Austin Rose and Allie Simpson

Prepared for:
Washington Department of Ecology

May 2020
Based on EPA guidance CIO 2106-G-05 (2012)

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Publication Information

This study has been funded in part by the United States Environmental Protection Agency (EPA) through the Puget Sound Partnership National Estuary Program, via Interagency Agreement Number 2020-19 with the Department of Ecology/Northwest Straits Initiative, of which the Marine Resources Committees are a member. The Northwest Straits Commission is comprised of seven Marine Resources Committees in Northwest Washington. The Marine Resources Committees were established by county governments in 1999, as an advisory body to county government, and are part of the regional coordinating organization, the Northwest Straits Initiative.

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 program will be available on the Northwest Straits Commission website in the resource library for different counties and in the annual report. 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 May 2025 [five years from the date of approval].

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For more information see: Whatcom County Marine Resources Committee:
http://www.whatcomcountymrc.org/

Quality Assurance Project Plan
North Chuckanut Bay Olympia Oyster Pilot Restoration Project

May 2020

By: Austin Rose and Allie Simpson

Approved by

Signature:	Date:
Dana Oster, Marine Program Manager, Northwest Straits Commission	
Signature:	Date:
Austin Rose, Whatcom Marine Resources Committee	
Signature:	Date:
Jennifer Grimm, EPA Grants Coordinator, Puget Sound Partnership	
Signature: AKaza	Date: 6/3/2020
Arati Kaza, Quality Assurance Officer, Department of Ecology	
Signature:	Date:
Allie Simpson, Ecosystem Project Coordinator, Northwest Straits Commission	

EPA: Environmental Protection Agency

1.0 Table of Contents

Acronyms

BTC – Bellingham Technical College

COB – City of Bellingham

EPA – Environmental Protection Agency

GPS – Global Positioning System

JST – Jamestown S'Klallam Tribe

MLLW – Mean Lower Low Water

MRC – Marine Resources Committee

NOAA – National Oceanic and Atmospheric Administration

NWSC – Northwest Straits Commission

NWSF – Northwest Straits Foundation

PSRF – Puget Sound Restoration Fund

QAPP – Quality Assurance Project Plan

WDFW – Washington Department of Fish and Wildlife

2.0 Abstract

The Olympia oyster (*Ostrea lurida*), Washington's only native oyster, forms three-dimensional biogenic habitat extensively used by fish, invertebrates and other marine organisms (Blake & Bradbury 2012). However, extensive overharvesting led to large declines in Olympia oyster populations throughout Puget Sound. The Washington Department of Fish and Wildlife (WDFW) identified North Chuckanut Bay as a potential Olympia oyster restoration site (Blake & Bradbury 2012). The Whatcom County Marine Resources Committee (MRC) began an Olympia oyster restoration pilot project to determine the restoration potential in North Chuckanut Bay. This QAPP will serve as a guide to collect a baseline of biological data and will put forward a set of guidelines for current and future MRC members or staff on steps to quantify ecological parameters, evaluate restoration success, and facilitate adaptive management practices. Components of the QAPP include pilot project duration, monitoring methodology, and monitoring frequency. Implementation of this plan will inform restoration potential in North Chuckanut Bay, as well as planning, research, project development, and implementation of future Olympia Oyster Restoration projects.

3.0 Background

3.1 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 extensively used by fish, invertebrates and other marine organisms (Blake & Bradbury 2012). Olympia oysters once thrived in coves, inlets and other protected tidelands across 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 & Bradbury 2012). Two broad geographic areas in Whatcom County were identified as having suitable conditions for Olympia oyster restoration:

1. Drayton Harbor
2. Bellingham Bay (South), Shoreline, Portage Island, and Chuckanut Bay.

Efforts to restore Olympia oyster populations in Drayton Harbor were initiated in 2013 and show promise for expansion. Within the Bellingham Bay (South), Shoreline, Portage Island, and Chuckanut Bay geographic area, the desire is to establish at least one viable self-sustaining population. North Chuckanut Bay appeared to offer the most promising opportunity.

Despite no Olympia oysters being present, North Chuckanut Bay has potential to be a successful restoration site as historic middens found indicated past populations of Olympia oysters (Blake & Bradbury 2012, Campbell et al. 2010). Protecting the rich diversity of native marine life and restoring the sustainability of local shellfish populations is a high priority for the Whatcom MRC. To achieve this goal, the Whatcom MRC implemented an on-going Olympia oyster pilot restoration project led by citizen scientists in North Chuckanut Bay during 2016. This project is also part of a larger goal of restoring 100 acres of Olympia oyster habitat in Puget Sound by 2020 (PSRF 2012).

The intertidal landscape of North Chuckanut Bay appears particularly well suited for sustaining an Olympia oyster population, though unseen natural recruitment appears restricted by lack of oyster shell substrate and absence of a nearby population source. To address the lack of substrate and recruitment, the Whatcom MRC added 35 bags of seeded Pacific oyster shells in 6 test plots at the site in 2018. Each bag contained a minimum of 250 shells and 3-5 spat (or seed) per shell. Before spreading the cultch in each plot, MRC members recorded Olympia oyster spat count and spat size from randomly selected seeded Pacific oyster shells. To estimate spat count, MRC members subsampled 10 randomly selected seeded Pacific oyster shells from two bags at each plot and recorded the total number of spat counted. MRC members then measured the height, using dial calipers, of the first 20 Olympia oysters counted on the randomly selected Pacific oyster shells. After measurements were recorded, seeded cultch was spread throughout 6 of the 7 test plots. In five of the test plots, six bags of seeded cultch were added and in one test plot five bags were added. No seeded cultch or clean shell was added to one plot in order for it to be used as a reference site. In 2019, MRC members and Bellingham Technical College (BTC) Fisheries and Aquaculture students conducted the first Olympia oyster population survey in North Chuckanut Bay, though more monitoring will be needed before transitioning this site into a full scale restoration project. In addition to surveying the test plots, BTC students and MRC members added one bag of clean cultch, with approximately 50-60 shells per bag, in three of the test plots to be used for recruitment monitoring.

3.2 Study Area

This QAPP only includes the North Chuckanut Bay restoration test site in Whatcom County. North Chuckanut Bay, locally referred to as Mud Bay, is a small embayment located in south Bellingham. In 2016, six test plots were established across North Chuckanut Bay to determine the potential for establishing a self-sustaining Olympia oyster bed (Figure 1). Oly 4 is a reference site left as is to compare with the six test plots with added shell and Olympia oyster seeds. Oly 1, Oly 2, and Oly 3 each have one bag of clean cultch added for recruitment monitoring. The coordinates for the center of each test plot are summarized in Table 1. The plots that show the most restoration potential will be where concerted efforts to establish a full scale Olympia oyster restoration project will begin.

Figure 1. Map of pilot study plots in North Chuckanut Bay. Yellow points indicate plot center.

Table 1. The GPS coordinates for each test plot center recorded in June 2016.

Test Plot	Coordinates (Longitude, Latitude) decimal degrees
Oly 1	-122.50375, 48.69894
Oly 2	-122.50408, 48.69914
Oly 3	-122.50586, 48.69859
Oly 4 (reference site)	-122.50607, 48.69877
Oly 5	-122.50255, 48.69933
Oly 6	-122.50143, 48.69944
Oly 7	-122.50208, 48.70068

3.2.1 History of study area

Historical middens presence indicates populations of Olympia oysters grew in North Chuckanut Bay and were used by local tribal communities (Campbell et al. 2010). Anthropogenic land disturbances in Chuckanut Bay, such as local extirpation of native oysters and construction of a railroad causeway, significantly altered the intertidal habitat of this area by restricting tidal circulation and increasing sedimentation (Campbell et al. 2010). The altered intertidal landscape appears particularly well suited for sustaining an Olympia oyster population. Though unseen natural recruitment appears restricted by lack of oyster shell substrate and absence of nearby source population for natural seed – factors that would be addressed by restoration as studied in this pilot project. The tidelands where the Olympia oyster restoration will occur are owned by the City of Bellingham (COB).

The primary freshwater discharge into Chuckanut Bay is Chuckanut Creek which has a seven-square mile watershed. Current land uses in the Chuckanut Creek watershed include a residential area (Chuckanut Village), a forested park with hiking and biking trails (Arroyo Park), and rural residential and forested areas in the upper watershed. There are also smaller drainages from the residential area on the northwest side of the bay and a seasonal creek that runs through the COB's Woodstock Farm.

3.2.2 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 (Puget Sound Restoration Fund 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 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).

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).

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).

3.2.3 Parameters of Interest

The parameters of interest to this monitoring include:

- Recruitment, growth, and survival of Olympia oysters at plots with seeded cultch.

- Natural recruitment of Olympia oyster spat in bags of clean shell placed within the restoration area of Chuckanut Bay (includes reference site and stream channel).

Recruitment refers to the presence of newly settled juvenile Olympia oysters and the presence of multiple age 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.

3.2.4 Regulatory criteria or standards
Not applicable. Does not assess compliance or regulatory criteria.

3.3 Water quality impairment studies
Not applicable.

3.4 Effectiveness monitoring studies
Not applicable.

4.0 Project Description
4.1 Project Goals
The Whatcom MRC is pursuing this pilot project to inform Olympia oyster restoration potential in North Chuckanut Bay. The long-term goal of this project is to reestablish a self-sustaining population of native oyster species in Chuckanut Bay while enhancing habitat complexity and diversity.

4.2 Project Objectives
The objectives of this project are to:
1. Quantify the survival and growth of the out-planted seed in the test plots to determine the feasibility of Olympia oyster restoration.
2. Determine if natural recruitment is occurring in Mud Bay by 1) monitoring added bags of clean Pacific oyster shell in Oly 1, Oly 2, Oly 3, and the creek channel and 2) monitoring seeded shells and other hard substrate at all the test plots for signs of natural recruitment be documenting the presence and size of juvenile Olympia oysters that established during the previous winter (meaning not from seeded shells placed as part of the pilot restoration).
3. Train and empower citizen scientists to conduct surveys using standardized methods.

4.3 Information needed and sources
This pilot project is designed to collect baseline data to determine the status of restoration potential in North Chuckanut 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 Whatcom County. The test plots are not intended as restoration themselves but only to provide information on feasibility of restoration in the seven habitat patches identified.

4.4 Project Tasks

Project tasks include:

- Train new volunteers on oyster sampling methods.
- Review previous season's data and discuss lessons learned and strategies for upcoming survey season.
- MRC project lead schedules annual sampling event and communicates schedule to participating volunteers
- MRC project manager receives data and raw datasheets and provides report and data to NWSC.
- NWSC reviews data and checks quality.

4.5 Systemic planning process

Not applicable.

5.0 Organization and Schedule

5.1 Key individuals and their responsibilities

The Whatcom 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 NWSC. Key staff with the Whatcom MRC are identified below in Table 2.

Table 2 Organization of Project Staff

Role	Position Who is Responsible	As of 5/1/2020
Manages volunteer coordination, coordinates with MRC project lead, and tracks training needs. Creates MRC reports and manages data.	MRC PM	Austin Rose
Sets surveying dates, manages volunteer coordination, and leads data collection following protocols and QAPP.	MRC Project Lead	Paul Troutman
Assists MRC project lead with surveying.	Whatcom volunteers	MRC Volunteers and Bellingham Technical College students
Provide technical assistance when needed	Project advisors	Paul Dinnel (Skagit MRC), Brady Blake (WDFW), Brian Allen (PSRF), Dana Oster

		(NWSC), Allie Simpson (NWSC)

MRC: Marine Resources Committee
NWSC: Northwest Straits Commission
PM: Project manager
WDFW: Washington Department of Fish and Wildlife
PSRF: Puget Sound Restoration Fund

5.2 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 properly complete field data sheets to report whole and accurate data.

The Project Manager, Project Lead and other participating MRC members received training from Dr. Paul Dinnel, a specialist in marine ecology and toxicology with a special interest in shellfish resources and restoration of native oysters. The Project Manager and Project Lead also are in communication with fish and wildlife biologist Brady Blake (WA Department of Fish and Wildlife), and Olympia oyster program director, Brian Allen (Puget Sound Restoration Fund) who provide 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. In the field, 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.

5.3 Organization Chart

Not applicable. See Table 2 for roles and responsibilities

5.4 Project Schedule

Table 3 Project Schedule from March 2020 to September 2021

Date	**Event**
Ongoing	Recruit and train citizen scientists

March 2020, March 2021	Review previous season's data and discuss lessons learned and strategies for upcoming survey season.
August 2020, May 2021	Population survey within test plots, including reference plot. Survey of natural larvae recruitment on clean shells placed in 2019.
September 2020, September 2021	Report findings

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

5.5 Budget and funding

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

Table 4 Estimated Project Budget

Staff Support	**Estimated Cost**
MRC Project Manager support (2020-2021)*	$7,000.00
Supplies and Materials	$0.00
TOTAL	$7,000.00

*2020-21 funding comes from EPA NEP program through the Northwest Straits Commission to Whatcom County MRC.

6.0 Quality Objectives

6.1 Data Quality Objectives

The overall quality objective for this project is to provide high quality data on Olympia oyster populations for North Chuckanut Bay as part of the pilot 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 pilot project duration, 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 (≤ -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 (Appendix A).
- Return fully completed data sheets to MRC Project Manager.
- Submit annual project reports to NWSC.

6.2 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 pilot project are provided in Appendix A.

Specific steps taken to assure measurement quality are as follows. Dial calipers will be used to accurately and consistently collect oyster height and length measurements to the nearest mm. A standard 0.10 m^2 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 A). First time citizen scientists will be accompanied by an MRC member who has previously conducted Olympia oyster sampling.

6.2.1Target for precision and sensitivity

Measurements for height and length will be taken to the nearest mm and considered accurate within ± 1mm. 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 ± 1mm. 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.

Table 5 Targets for size estimates during population surveys. From the literature, the maximum height is the largest Olympia oyster recorded and the minimum height refers to the height when larvae are first found attached to hard substrate.

	Scientific literature	Year 1 Population Survey
Maximum height	75 mm[1]	45 mm
Minimum height	0.3 mm[2]	7 mm
Median height	35 – 45 mm[1]	18 mm

[1] Couch and Hassler 1989
[2] Baker 1995

6.2.2 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.

6.3 Acceptance criteria for quality of existing data
Not applicable.

6.4 Model quality objectives
Not applicable.

7.0 Study Design

7.1 Study Boundaries
This QAPP only includes the area encompassing North Chuckanut Bay. The shoreline creates the north, east, and west boundaries and the southern boundary is designated by the railroad trestle (See section 3.2).

7.2 Field Data Collection
See section 3.2 Study area for field locations. The sampling frequency is one population survey annually during the summer season, from May through August. The field protocols are described in Appendix A and are 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 et al. 2018, Jefferson MRC 2019).

7.3 Modeling and analysis design
Not applicable.

7.4 Assumptions of study design
The study design assumes the survey event would occur during a ≤ - 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.

7.5 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.

8.0 Field Procedures

8.1 Invasive species evaluation

Samples are not collected so deliberate transfer of invasive species is not possible by 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.

8.2 Measurement and sampling procedures

The number and size of Olympia oysters in 7 test plots will be measured annually using haphazard quadrat monitoring until North Chuckanut Bay's potential as a restoration site is determined.

Within each plot, volunteers will haphazardly toss five 0.1m^2 quadrats from approximately 2 feet outside of the plot boundary. To ensure a fully haphazard design, volunteers will arbitrarily choose which side of the plot to toss quadrats from.

In each quadrat, volunteers will record the number of Pacific oyster shells present, the number of living and dead Olympia oysters attached to the pacific oyster shell, and the height and length of each Olympia oyster found. Pacific oyster shells will be counted only if at least 50% of the shell is within the quadrat. Height and length will be measured to the nearest mm using dial calipers. The height is the distance from the umbo to the distal margin of the shell and the length is the widest distance perpendicular to the height (Figure 2). In addition, qualitative observations will be made regarding overall plot appearance, such as loss of shell, the presence of detached Olympia oysters within the plot, and any obvious signs of predation.

A detailed protocol for the test plot surveys is found in Appendix A.

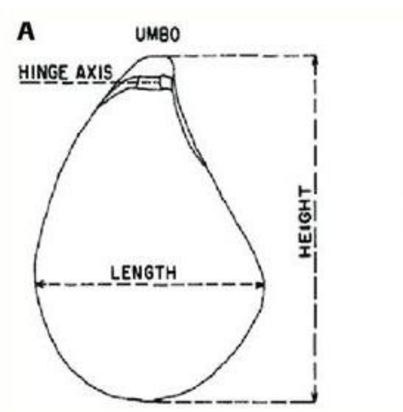


Figure 2. Diagram detailing how oyster measurements are conducted.

8.3 Containers, preservation methods, holding times
Not applicable.

8.4 Equipment decontamination
Not applicable.

8.5 Sample ID
Not applicable.

8.6 Chain of Custody
Not applicable.

8.7 Field log requirements
Each sampling event will include the completion of the Olympia oyster Restoration Project data sheet included in Appendix A.

8.8 Other activities
Not applicable

9.0 Laboratory Procedures
Not applicable.

10.0 Quality Control Procedures
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 MRC project leads or site leads who have successfully led previous surveys and are familiar with the protocol will serve as Field Lead, and be responsible for the integrity of the sampling.

4. Location of five subsamples within plots (i.e. quadrats) will be recorded from a hand-held GPS unit that has been calibrated to manufacturer specifications.

5. 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, (e.g., oyster measurements beyond those listed in Table 5 or repeat GPS

measurements), 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.

6. Data sheets and GPS data are provided by the Field Lead to the MRC Project Manager for data storage and reporting.

10.1 Table of field and laboratory quality control

See steps listed above.

10.2 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 correctly document that year's results.

11.0 Data Management Procedures

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.

12.0 Audits and Reports

12.1 Audits

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

12.2 Responsible personnel

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

12.3 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

12.4 Responsibility for reports

The MRC project manager (see Table 2) is responsible for annual report submission to the NWSC.

13.0 Data Verification

13.1 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.

13.2 Laboratory data verification

Not applicable.

13.3 Validation requirements, if necessary

Not applicable.

13.4 Model quality assessment

Not applicable.

14.0 Data Quality (Usability) Assessment

14.1 Process for determining project objectives were met

The sampling objectives were met if all samples are submitted to NWSC. The objective is to successfully collect Olympia oyster population surveys from all test plots.

14.2 Treatment of non-detects

Not applicable.

14.3 Data analysis and presentation methods

Not applicable.

14.4 Sampling design evaluation

Not applicable.

15.0 References

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

Baker, P. 1995. Review of Ecology and Fishery of the Olympia Oyster, Ostrea lurida with Annotated Bibliography. Journal of Shellfish Research. 14(2):501-518. https://www.biodiversitylibrary.org/item/28580#page/520/mode/1up

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

Campbell, S.K., D. Barg, B.N. Meidinger, T.A. Koetje. 2010. Report of 2005 field investigations at Woodstock Farm, Chuckanut Bay, Washington. Conducted under Permit #05-11 Office of Archaeology and Historic Preservation. https://www.cob.org/documents/parks/development/projects/woodstock-charrette/6.9-archeological-field-investigation-report-wwu.pdf

Clallam Marine Resources Committee. 2019. Final Olympia Oyster Restoration Report. Prepared for the Northwest Straits Commission. 16 pp. https://www.nwstraits.org/media/2905/cla-2019olympiaoysterrestoration.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://salishsearestoration.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/skag_finalnativeoysterreport_2018.pdf

Jefferson 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

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

Whatcom MRC. 2019. Pilot Olympia oyster Restoration in North Chuckanut Bay: 2019 Final Report. Prepared for the Northwest Straits Commission. 8 pp. https://www.nwstraits.org/media/2940/wha-2019_olympiaoyster.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

Appendix A: Test Plot Sampling Protocol for Olympia Oysters

Goal: To monitor for Olympia oyster recruitment, oyster size, and spatial extent to assess the basic performance of the pilot restoration using a haphazard sampling design.

Equipment:

- GPS
- Waterproof notebook for notetaking
- Data sheets on waterproof paper, pencils, and clipboards
- Volunteer sign-in forms
- Dial calipers
- Stakes, flags or flagging to mark center and edges of each plot for reference
- Quadrats ($0.1m^2$)
- Gloves
- Mud boots
- Safety review and first aid kit

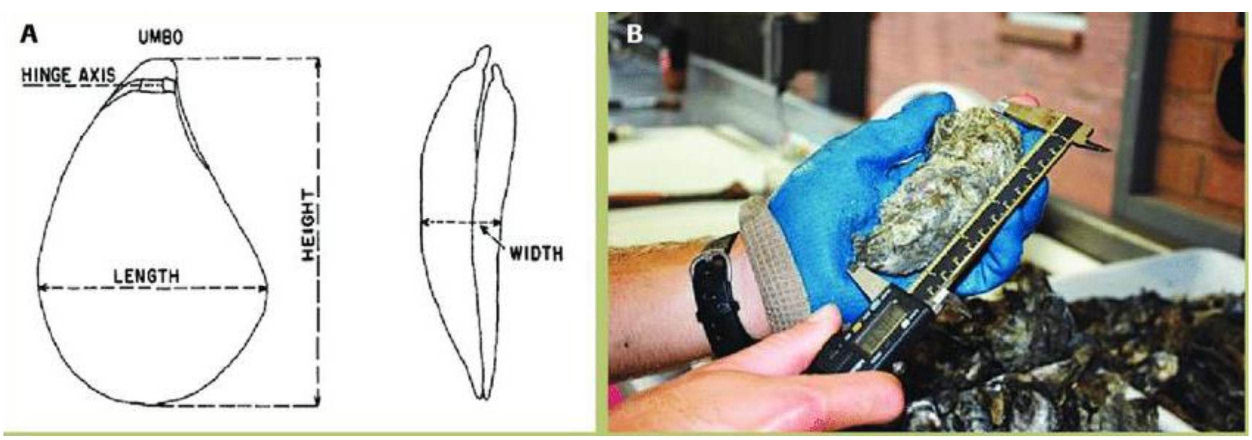
Protocols:

1. Before starting the population survey, new volunteers will receive a quick training on the protocol including what data is collected, how to use calipers, how to use the GPS units, and how to properly fill out the data sheet. The MRC coordinator will give a brief safety review.
2. The group will be divided into teams where at least 1 MRC member who has conducted sampling before is part of each team. Each team will be provided data sheets, quadrats, and calipers.
3. Starting with the plot at the lowest tidal elevation, use the GPS unit to locate plot centers and corners of the plot. Mark each corner with a stake or flagging for plot boundary reference.
4. At the start at each plot survey, record the time, date, plot number, and who was surveying on the data sheet.
5. Each test plot will be subsampled 5 times using 5 different haphazard quadrat placements. While holding a quadrat, stand approximately 2 feet away from the edge of one side of the plot. Any side is fine as this is a haphazard design. With eyes closed, toss the quadrat haphazardly into the plot. Repeat for the other 4 quadrats for a total of 5 quadrat placements per test plot. Ensure all the quadrats remain in the plot boundary. If a quadrat exceeds the plot boundary, toss it again. If there is a limited number of quadrats available, toss one quadrat and record all oyster measurements for that subsample before tossing the quadrat again.
6. Mark the location of each quadrat using a flag. This helps the person using the GPS to easily find and mark the coordinates of the quadrat. If limited quadrats are available, this ensures subsamples are not overlapping.
7. Record which quadrat you are surveying on the datasheet.
8. Count the number of Pacific oyster shells present in the quadrat. To ensure shells are not counted twice put the Pacific oyster shells into one corner of the quadrat

after it has been counted. Shells under the quadrat frame or partially outside the quadrat will be counted if at least 50% of the shell is within the quadrat.

9. Going one shell at a time, fully inspect the Pacific oyster shell for Olympia oyster adults and spat. Count the number of each living and dead Olympia oysters. Depending on the density of Olympia oysters on the shell it might be easiest for the shell inspector to call out Live or Dead for the note taker to tally.
10. For the first 100 live Olympia oysters counted, record the height and length of the oyster to the nearest mm using calipers. The height is the distance from the umbo to the distal margin of the shell and the length is the widest distance perpendicular to the height (See diagram on next page).
11. Make any additional observations about the quadrat. Observations might include if eelgrass is present, if there were obvious signs of predation, or if any Olympia oysters were found detached from the shell.
12. Repeat steps 7 – 11 for quadrats #2 – 5.
13. After the data collection for all quadrats within the plot is completed, take additional notes about the plot in general. Some things to observe and consider are if there is loss of shell or shell has moved outside of the plot boundary, if there are signs of predation, or if anything unusual is seen like large amounts of algae or an invasive species found.
14. Before moving on to the next plot, double check that all sections of the data sheet have been completed and are accurate to the best of your knowledge.
15. Repeat steps 3 – 14 for plots #2 – 7.

Diagram of oyster measurements.



Whatcom MRC Pilot Olympia Oyster Restoration Project

Year 1 population monitoring post- deployment of seeded cultch

Date:	**Site and Plot Name** *(if monitoring within channel include GPS Coordinates)*:
Time of survey:	**Tide Height at Time of Survey:**
Surveyors:	

Quadrat	Number of Pacific Oyster Shell	Number of LIVE Olympia oysters	LIVE Olympia oyster height (mm)	LIVE Olympia oyster Length (mm)	Number of DEAD Olympia oysters	Additional Observations

State of Washington

DEPARTMENT OF FISH AND WILDLIFE

Mailing Address: Post Office Box 43200 Olympia, WA 98504-3200 • (360) 902-2200 • TDD (360) 902

NEW ☒ RENEW ☐

Prev. Permit #NA

SHELLFISH TRANSFER PERMIT NO. **20-1110**

Company Name: **Whatcom County Marine Resources Committee**
Address: **322 N. Commercial Street**
Telephone No: **360-778-6231**

Applicant **Austin Rose**
City, State, Zip: **Bellingham, WA 98225**
Email: **ARose@co.whatcom.wa.us**

Transfer is for (species and life stage): **Pacific oyster (*Crassostrea gigas*), shell**

Equipment type used in transfer: **Vehicles and vessels owned or leased by the permit holder or employee**

FROM: Property from which applicant will make transfer: General Area: **South Puget Sound**
Specific Area: **Shelton, WA; Taylor Shellfish Co. upland storage**

Pest or Disease Classification: RESTRICTED ☐ UNRESTRICTED ☒ UNDESIGNATED ☐

TO: Property to which applicant will make transfer: General Area: **North Puget Sound**
Specific Area: **Chuckanut Bay (parcel #3702131514090000)**

Pest or Disease Classification: RESTRICTED ☐ UNRESTRICTED ☒ UNDESIGNATED ☐

Information on WDFW Restricted Areas, including maps, can be found at https://wdfw.wa.gov/licenses/fishing/shellfish-import-transfer#.

Conditions of Transfer: **Permit applies only to species, life stages and source/destination locations listed. All vessels, vehicles, and equipment to be cleaned and maintained free of debris, oyster drills, and egg casings. Source of shell is a WDFW-approved source.**

THIS PERMIT IS VALID FROM: **20 July 2020** TO: **31 December 2020**

It is the responsibility of the permit holder *to have obtained the legal right to possess and transfer the shellfish covered by this permit. A copy of this permit must be carried on each conveyance used during transfers. Failure to comply with the terms of this permit, in whole or in part, shall be considered to constitute a significant threat to the State's shellfish stocks and industry. Due to the threat represented to public health, safety, or welfare, this permit will be summarily suspended if the holder fails to comply with its terms, in whole or in part, subject to the opportunity for the holder to contest this action afforded by the Administrative Procedures Act (Chapter 34.05, RCW). If the holder requests review of this suspension of permit, a proceeding to do so shall be promptly instituted and the validity of the suspension determined. If review is not requested, suspension of this permit shall be considered final and irrevocable. This permit does not authorize relay of shellfish under chapter 69.30 RCW relating to human health and safety, which must be obtained from the Washington Department of Health (https://www.doh.wa.gov/communityandenvironment/shellfish).*

Kelly Cunningham
Director, Fish Program

7/14/2020
Date

cc: Enforcement, Region 4/Region 6

RCW 77.60.060 and WAC 220-340-150 require all transfers to be accompanied by a permit issued by the Director of Fish and Wildlife or his agent.

State of Washington
DEPARTMENT OF FISH AND WILDLIFE
FISH PROGRAM, FISH MANAGEMENT DIVISION, PUGET SOUND SHELLFISH UNIT
Mailing Address: 375 Hudson Street, Port Townsend WA 98368
Phone Number: (360) 302-3030 * FAX Number (360) 302-3031

1 December 2011

TO: Shellfish import or transfer permit holders

FROM: Brady Blake
WDFW Fish and Wildlife Biologist

SUBJECT: NEW SHELLFISH ENHANCEMENTS TO TIDELANDS IN WASHINGTON STATE

In accordance with the federal court ordered Revised Shellfish Implementation Plan section 8.1.1, (pursuant to U.S. vs. Washington State, Case No. 9213, subproceeding 89-3) any new enhancements to tidelands in Washington State identified through the issuance of Washington Department of Fish and Wildlife Import or Transfer Permits need to be reported to the treaty tribes. If you know of any new shellfish enhancements created as a result of your permit, please notify me at the address above as soon as possible. Thank you for your cooperation.