Memorandum

Oregon Department of Fish and Wildlife

Marine Resources Program

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Date: August 26, 2010

To: Matt Hunter, Dave Fox, Leslee Parr, and Mitch Vance.

From: Scott Groth, South Coast Shellfish Biologist

Subject: Coos Bay native oyster restoration project updates.

Introduction

The native oyster, *Ostrea lurida*, was extirpated from Coos Bay, Oregon prior to European settlement (Baker.XXXX). In the 1987 it was rediscovered (Baker,xxxx) and subsequently protection recommendations have been incorporated into biological considerations in ODFW comments dealing with activities which occur where beds are known to exist.

In recent years, the scientific community has focused on the value of this geographically rare occurring oyster to the estuarine ecology of the Pacific Northwest. Consequently, this oyster is currently recognized by most federal and state agency either by some special status (e.g. “sensitive species” in WA, “protected” in BC”) or agencies have developed programs (e.g. NOAA native oyster restoration program) focused specifically on the restoration of once great populations.

As a result of this momentum, the first “West Coast native oyster restoration workshop” was held in 2006. Matt Hunter (ODFW Shellfish project leader) and I attended this workshop, where we gained knowledge on restoration strategies which other states have employed.

Soon after this time I began to add salvage and restoration into permitting recommendations in applicable geographic areas (i.e. native oyster presence). Three projects in various stages are presented here as case studies in permitting recommendations. My intention is to get a longer term monitoring result from these sites and make a more conclusive publication to summarize results and future recommendations. In the meantime, it’s good to write up a short placeholder since there is some real-time desire for the update given the current activity on *O. lurida* research at both Oregon State University and University of Oregon.

Projects:

Three projects in Coos Bay have/ or will have restoration efforts, though many other permits have included some language about protection of native oysters. Glenbrook nickel, Rex Miller's property, and Isthmus slough bridge reconstruction are in close geographic proximity (i.e. 0.5 mile radius) centered in the area where native oyster abundances are highest in the state (Groth Rumrill, 2007).

Project Descriptions:

<u>Glenbrook nickel:</u>

Overview:

This native oyster restoration project, which began in 2008, is by far the largest and furthest along amongst Coos Bay mitigation projects. The project has been tremendously successful and an excellent learning experience that will guide future native oyster restoration efforts in Coos Bay.

Figure 1: Glenbrook nickel site

Figure 2: Collaborative poster

Direct work with the builder and environmental contractors resulted in an excellent collaboration which, in turn, resulted in a poster and presentations which were part of many environmental engineering conferences including: Battelle, EPA Brownsfield, Society for Mining, Metallurgy, and Exploration, and Society for Ecological Restoration

Process and timeline:

January 2008:

ODFW worked with builders and contractors to the site to develop a plan for the protection and mitigation of oysters and habitats at the site. The plan includes allowing time for removal and requires the addition of Pacific oyster (*Crassostrea gigas*) shell to be placed at site to enhance larval settlement. Oyster samples were taken and tested to assure the oysters themselves were not harboring excessive nickel (they weren't).

May 2008:

ODFW worked with South Slough National Estuarine Research Reserve (SSNERR) to salvage and survey the undisturbed population which existed at the site prior to work.
Oysters were enumerated and removed then either held nearby or donated to SSNERR concurrent restoration efforts in nearby South Slough.

Figure 3: SSNERR and ODFW work together to survey/ salvage native oysters

Early June 2008:

Construction work on site occurred.

Figure 4: excavation of polluted soils

June 26, 2008:

Oysters held nearby are replaced, lower than low tide line in an area away from the focused survey area (i.e. not intended to be resurveyed).

Figure 5: Return of salvaged oysters to North side of site

Area looked fairly devastated and clearly without a single oyster. Pacific oyster shell was mixed into area roughly evenly:

Figure 6: final substrate layer, including Pacific oyster shell completed

The upper layer of this work, termed the “habitat layer” included larger rock (similar to what was at the site that appeared to be attracting lots of oysters) and oyster shell. It is unknown to me exactly what this percentage was, but I remember it to be roughly 2-3 dump truck loads (~10 cubic yards) of shell distributed amongst the ~850 lineal feet of shoreline affected.

April 2010:

The site was revisited and again surveyed. Oyster populations appeared good, with many juveniles and lots of successful settlement on placed oyster shells. Large rock, the previously preferred settlement substrate appeared not heavily settled, perhaps a reaction to a better substrate, the oyster shell.

Geographic settlement patterns in bivalves is known to be patchy, and was as expected at this site. Densities varied widely in short distances. Large, unbroken, stable oyster shell was a clear preference for settlement and all pieces that met these criteria were loaded with native oysters.

Figure 7: Native oysters recruited on Pacific oyster shell

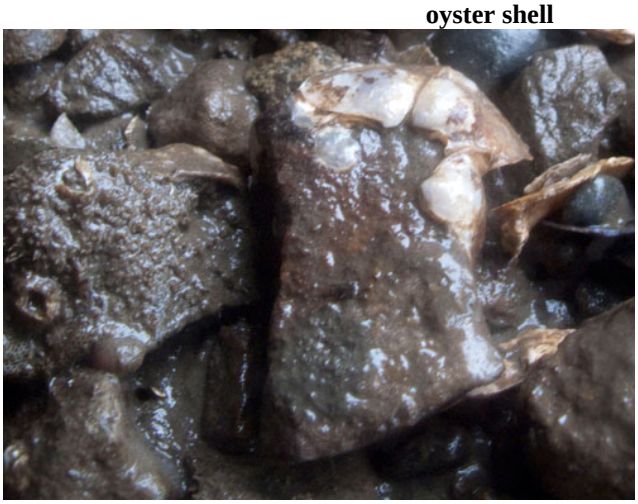

Figure 8: Native oysters on large rock. Rocks did attract some oysters, but not preferred.

Figure 9: Pacific oyster shell covered in recent cohort of native oysters

Survey methods and materials:

Systematic surveys were made before and after substrates (and consequently all existing oysters) were removed. Surveys were performed at 50 foot intervals beginning at an outfall pipe that delineated the southern boundary of the work and moving northward, along the East shore of the site where elevation changes were consistent and as a result oyster populations were uniform, thus making it easier to examine.

Figure 10: Aerial photograph of study site

Pre treatment (2008) work included a series of contiguous 1m² quadrats at 50 foot intervals. Post treatment (2010) work included a ¼ m² quadrats at the same intervals (i.e. at the same sites).

At each site quadrat “adult” oysters (defined as those ≥20 mm shell height) were enumerated (for density estimations) and measured (to assess population structure), at some sites weights were also taken (to assess biomass).

Juvenile oyster (<20 mm shell height) presence was recorded however is a hard number to use given the cryptic nature of juveniles combined with the high percentage which are dead and the difficulty to determine if they are alive.

Substrate/ habitat data was also recorded. Post treatement survey work included percentages of available pacific oyster shell in quadrats (zero was available throughout pre treatment quadrats).

Pre treatment surveys included 6 transects evaluating a total of 31 m², Post treatment surveys included the same transects evaluating a total of 4.25 m².

Results and discussion:

Pre treatment densities of native oysters were fairly high (18 /m² within adult presence) when compared to other areas of adult presence in Oregon. Oysters at the site appeared large (average shell height = 43.4 mm) with a populations structure which was slightly leptokurtic (kurtosis = 0.55). It is my guess that this population structure is a response to the habitat limitations (i.e. no shell and very little large rock).

Treatment included the full removal of all oysters within the study site. Oysters which were previously salvaged were returned away from the area studied.

Post treatment densities were examined approximately 2 years after work was complete. Densities were very high (90 /m² within adult presence) with a population structure was essentially mesokurtic (kurtosis = -0.11) implying the arrival of the first cohort of adult oysters into the study design.

Initial comparison of pre and post treatment populations:

Comparison of population densities and structure are likely to have full value when many cohorts have had a chance to recruit into adult populations and thus are similar excepting available settlement substrates.

However, as a midway look at this study, the following analysis are examined:

- Density:
    - Post treatment survey densities at each observed transect are significantly ($p= 0.03$) greater (18/m² pre treatment and 90 /m² post treatment).
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- Size distribution:

    - Post treatment populations were significantly ($p=<0.001$) smaller than the pre survey population certainly expected given the lack of time to grow to maximum adult size.
    - Both pre and post treatment populations were essentially normally distributed an attribute expected in from the post treatment cohort, however is of interest in the previous population, since this is not necessarily the structure seen in previous established populations... perhaps suggesting a few low recruitment years combined with a full exploitation of suitable substrates.

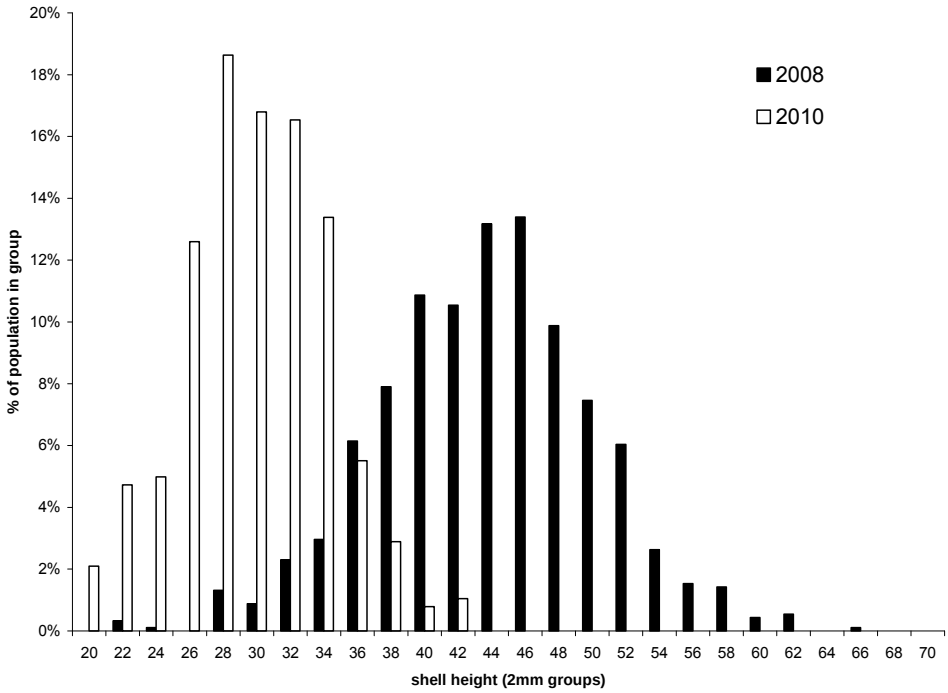

Figure 11: Comparison of pre and post treament size distrubtions

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