County: Whatcom
Grant No: SEANWS-2014-WhCoPW-00008

PROJECT TITLE: Northwest Straits Project: Marine Resources Committee Administration and Operations

TASK NUMBER: 2

DELIVERABLE: No. 3 – Boulevard Park Intertidal Survey Final Report

PERIOD COVERED: September 23, 2014 through September 30, 2015

DATE SUBMITTED: September 30, 2015

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, nor does mention of trade names or commercial products constitute endorsement or recommendation for use.

Intertidal Biota Monitoring at Boulevard Park, Bellingham, WA

Monitoring Report

Prepared for:

Whatcom County Marine Resources Committee

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RE Sources for Sustainable Communities

September 2015

Publication Information

This Monitoring Report describes the research and monitoring study of intertidal biota conducted in the summers of 2013-2015 at Boulevard Park in Bellingham, WA. Training offered to participants of this project was funded by the National Estuary Program (NEP) of the United States Environmental Protection Agency (EPA) under assistance agreement PC-00J29801-0 to the Washington Department of Natural Resources (WDNR). The contents of the report 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. Surveys in 2014 and 2015 and this report were funded by the Whatcom County Marine Resources Committee.

Copies of this Monitoring Report will be available at www.re-sources.org and http://www.mrc.whatcomcounty.org/

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The report template was provided by Jerry Joyce for the Cherry Point and Fidalgo Bay Aquatic Reserves Citizen Stewardship Committees, and adapted here.

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Acknowledgments

Most of the sampling protocol and procedures is based on the work of the Island County/WSU Beach Watchers. We thank them for the use of their materials and assistance. In particular, we thank Barbara Bennett, project coordinator for her assistance.

We also thank our partners at WDNR and especially Betty Bookheim for her assistance in refining the procedures. Finally, we thank Dr. Megan Dethier of University of Washington for her assistance in helping us resolve some of the theoretical issues in the sampling protocol.

Surveys, data entry, quality control assistance and report writing were made possible by a vast array of interns and volunteers. Interns included Monica Tonty, Steve Harvey, Skylar Sumner, Andy Ingram, Ryan Campbell, Christine Hanley, Marissa Mc Bride, Taylor Garrod, and Marika Weber. Additional assistance for quality assurance came from MRC members Atina Casas and Chris Brown, MRC staff Austin Rose, volunteer Michael Kyte, and for editorial assistance from volunteer Bill Beers. On the beach assistance for identification was given by Bob Lemon and MRC member, Doug Stark. These two individuals made all the difference to having a successful program.

Surveys were conducted with trained citizen science volunteers. These included the following persons:

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Ben Albers
Lyle Anderson
Lisa Bolson
John Bremer
Laura-Leigh Brakke
Chris Brown (MRC)
Madison Brunsell
Atina Casas (MRC)
Bob Cecile
Kim Clarkin
Connie Cogburn
Wendy Courtemanche
Suzanne Duscha
Heather Farren
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2013-2015 Monitoring Report

Abstract

The Whatcom County Marine Resource Committee performed intertidal surveys at four sites throughout Boulevard Park during the summers of 2013-2015 to assess the 2013 restoration action on the beach slope, substrate, and diversity of intertidal organisms, as well as to attain a baseline of these factors for the Boulevard Park Beach. At these four sites, the number of individual animals, areal coverage of plants, algae, and colonial animals within four 19.8" X 19.8" (50 cm X 50 cm) quadrats at the +6' ,+4, +1', and -1' tidal elevation were also recorded. Two of these sites underwent a restoration action in 2013, after the survey had taken place, and two did not undergo restoration. The methodology was heavily influenced by Beach Watchers' strategies, with a few noted exceptions.

We found that the type and density of intertidal plants and animals are variable from site to site, year to year and quadrat to quadrat. Predominant species were *Ulva* sp., barnacles, *Littorina* sp., and limpets. The most striking difference in intertidal life occurred in 2014, after the restoration action. Newly placed cobbles and gravel at the +6' and 4' were not recolonized within one year of placement. Some colonization was evident in the 2015 survey, however. Throughout the survey sites, large cobbles and boulders were typically associated with more intertidal life than were small cobbles, gravel, and sand.

Comprehensive listings of species were made for each of the three years. These listings combined with the quadrat data form a solid baseline of the site, with which to compare future changes.

Introduction

Boulevard Park is a city park in Bellingham, WA located on Bellingham Bay along South State Street and Bayview Drive in Bellingham's South Hill neighborhood. A map of the park is included in Figure 1. The beach at Boulevard Park has recently undergone significant modification to reduce shoreline erosion that resulted from ineffective beach armoring. The concrete rubble that had been used for armoring has been removed. The modifications have created a sand and gravel beach with rock revetments. This document reports on surveys to measure the diversity, distribution, and abundance of intertidal species within the park beaches conducted in 2013, prior to the above mentioned modifications, and in 2014 and 2015, after the modifications. Assessment and monitoring methods were based on those established by the Washington State University Beach Watcher Intertidal Monitoring Program. Modifications were made to enhance the representativeness of the data, while retaining key elements such that the studies will be largely comparable to other studies. The monitoring is intended to provide baselines for detection of changes following the beach modifications and include data from a portion of the beach that had not been armored and was not modified. Acquired baseline information can be used to assess the impacts of shoreline modification and for natural resource damage assessment, protection of critical habitats, and management of protected species.

Goals and Objectives

The goals and objectives of this intertidal monitoring are to collect baseline data over time at specific monitoring sites within the park to document changes over time in beach slope, substrate, and biodiversity, using scientifically and statistically sound methods that will provide data comparable across various sites under study and monitoring years.

This data will also indicate the effect of the restoration action on the intertidal life at tidal elevations of +6', +4', +1' and -1'. This data may be used to correlate changes in intertidal life with changing conditions at the beach and park.

Figure 1: Map showing Boulevard Park

Data-collection Methodology

The study used a transect/quadrat model, running a transect line from the high water mark to the water's edge, perpendicular to the shoreline. The methodology is based on protocols developed by the WSU BW Intertidal Monitoring Program (Beach Watchers, 2003). This protocol for selection of sampling locations has been modified from this methodology to improve the statistical robustness of the study. Details of the sampling regime are given in Steffensen and Joyce (2013). Four types of data were collected:

1. Quadrat Data - Percent Cover: Four 19.8" X 19.8" (50cm X 50 cm) quadrats were randomly placed at each of the selected tidal elevations: +6', +4, +1, and -1'. (In other surveys, select tidal elevations are typically +1', 0', and -1'). These tidal elevations were chosen to capture the area in the upper beach that were affected by the restoration action, while still being comparable to many surveys. The coverage of colonial and aggregating animal species, sea grass, and algae cover were estimated in each quadrat, with entire coverage of the area by one species being equal to 100%.

2. Quadrat Data - Individual Species: Using the same quadrats as those used for percent cover, individual animals were counted and totaled.

3. Profile Data: Profile data are taken along a transect perpendicular to the beach face. Data recorded include beach slope and elevation and substrate type.

4. Species Lists: Species lists were compiled for pre-determined linear segments of the beach profile, starting from the backshore and going down to the water's edge. These segments are determined based on biological zonation and are 10' in length or a multiple thereof. They cover a 65.6' (20 meter) wide swath [32.8' (10 meters) on either side of the profile line]. These data are presented as Appendix C.

Narrative of the field research

Basic training was given in Whatcom County, primarily targeting citizen scientist volunteers from the Cherry Point Aquatic Reserve Citizen Stewardship Committee, the Whatcom County Marine Resources Committee, as well as other volunteers.

In each of the three years, RE Sources trained volunteer citizen scientists in three 2 hour classroom sessions and one field training exercise. Trainings included basic protocol for measuring slope, identifying and counting organisms, both plants and animals, estimating percent coverage of plants and colonial animals, and filling out the data sheets. Training was also dedicated to learning the organisms by sight, along with any tell-tale markers, and their common and scientific names. Over the three years, more than 80 citizen scientists were trained.

The Boulevard Park beach was surveyed at 4 locations. Locations were chosen to include 2 areas that had not been armored and were not scheduled for modification (Pete's Beach central and north), and 2 areas where beach modification would occur (Profile Sites 3 and 7, so named for the restoration manager's study areas). Each location indicated in Figure 2 marks where a transect line starts. Transect lines extend out into the water perpendicular from the shore and are constant from year to year.

Table 1: Profile site information. The site location in terms of longitude and latitude marks the origin of the profile on the beach side.

Transect Name	GPS Location	Compass Reading	Location Description
Pete's Beach central	48° 43.860' N -122° 30.190'W	288°T	Southwest corner of blue table, 50 ft. south of Wood's Coffee
Pete's Beach north	48° 43.867'N -122° 30.190'W	274°T	Southwest corner of slab for Ernest Walstrom memorial 15' south of Wood's Coffee
Profile Site 3	48° 43.899'N -122° 30.168'W	312°T	Northwest corner of concrete walkway that surrounds play sets in playground
Profile Site 7	48° 43.922'N -122° 30.143'W	263°T	Nine parking places southwest of cul de sac in northeast corner of parking lot, just southwest of concrete curb with tree and lamppost inside

Declination: 16° 35.1'E
GPS unit: Garmin GPSmap 60CSx

Figure 2: Detailed map of beach and profiles at Boulevard Park.

From left to right, profiles are highlighted and enhanced. Box 1: Pete's Beach North and Central, Box 2: Profile Site 3, Box 3: Profile Site 7.

Results

Results consist of comparisons for each site of aggregating species, individual animals, and slope measurements for the years 2013 to 2015.

In appendix B, individual tables corresponding to the graphs are shown for each site and each year. Appendix C lists species found in the entire profile swath, from the ordinary high water mark to the water's edge, for 10 meters on each side of the profile line.

Results of Aggregating Species, Non restoration sites:

Graphs of aggregating species at Pete's Beach, the non-restoration site, show that there is quite a bit of variability in species coverage from quadrat to quadrat and year to year. Barnacles were a predominant organism at all tidal levels surveyed (+6, +4, +1, and -1) and *Ulva* sp. were predominant at tidal levels +1 and -1. Data for each year are shown in Appendix B.

The substrate found at the different tidal elevations sometimes varied across a transect, and this variation can sometimes account for the different types of life found. Loose gravel and sand are generally poor substrate for intertidal life. The large rock versus gravel found at +6, Quadrats 1 and 3 at Pete's Beach Central provide a good example for this.

Figure 3 . Quadrat 1 at +6', Pete's Beach Central, 06/14/14

Figure 4; Quadrat 3 at +6', Pete's Beach Central, 06/14/14

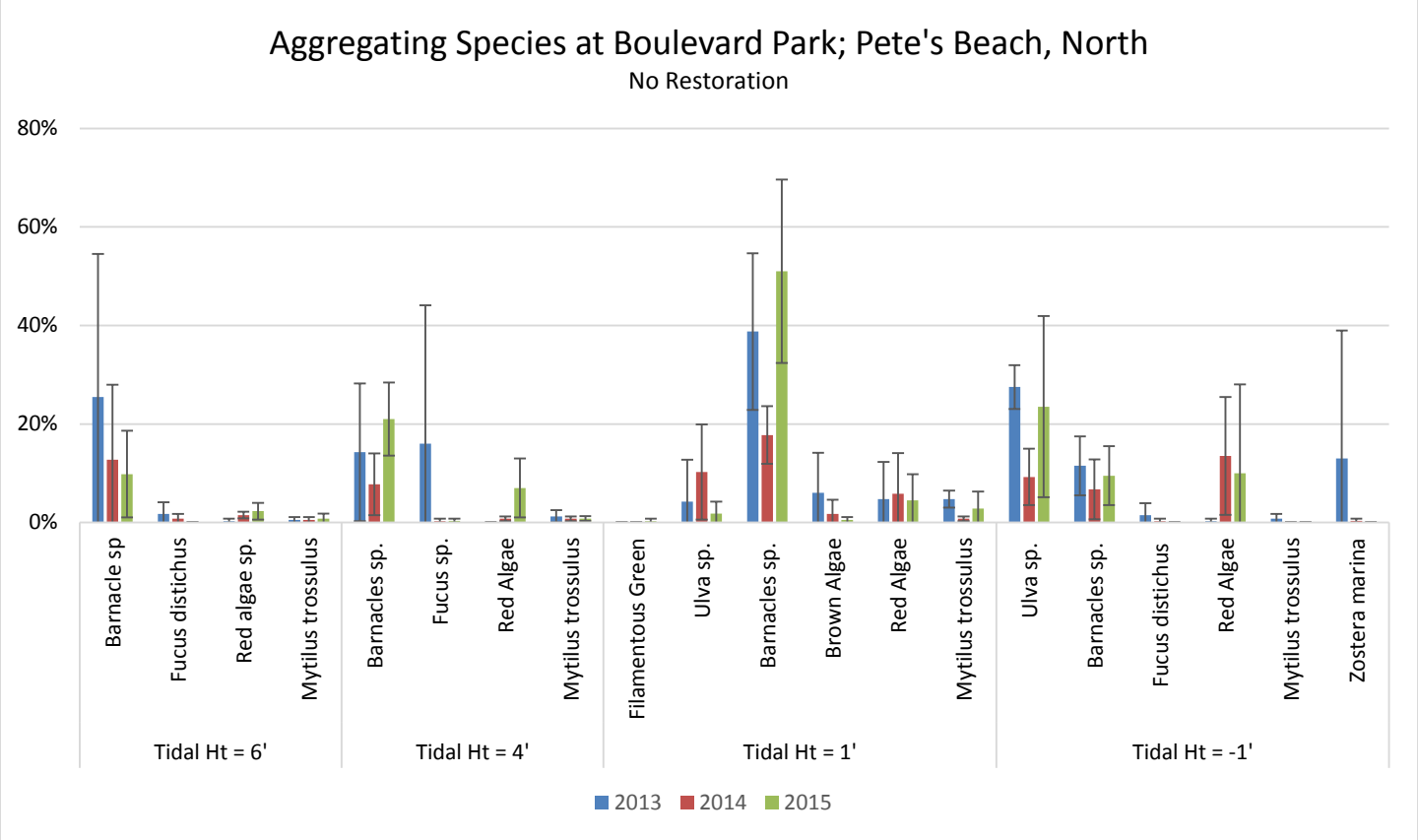

Figure 5; Aggregating Species at Boulevard Park; Pete's Beach North from 2013-2015

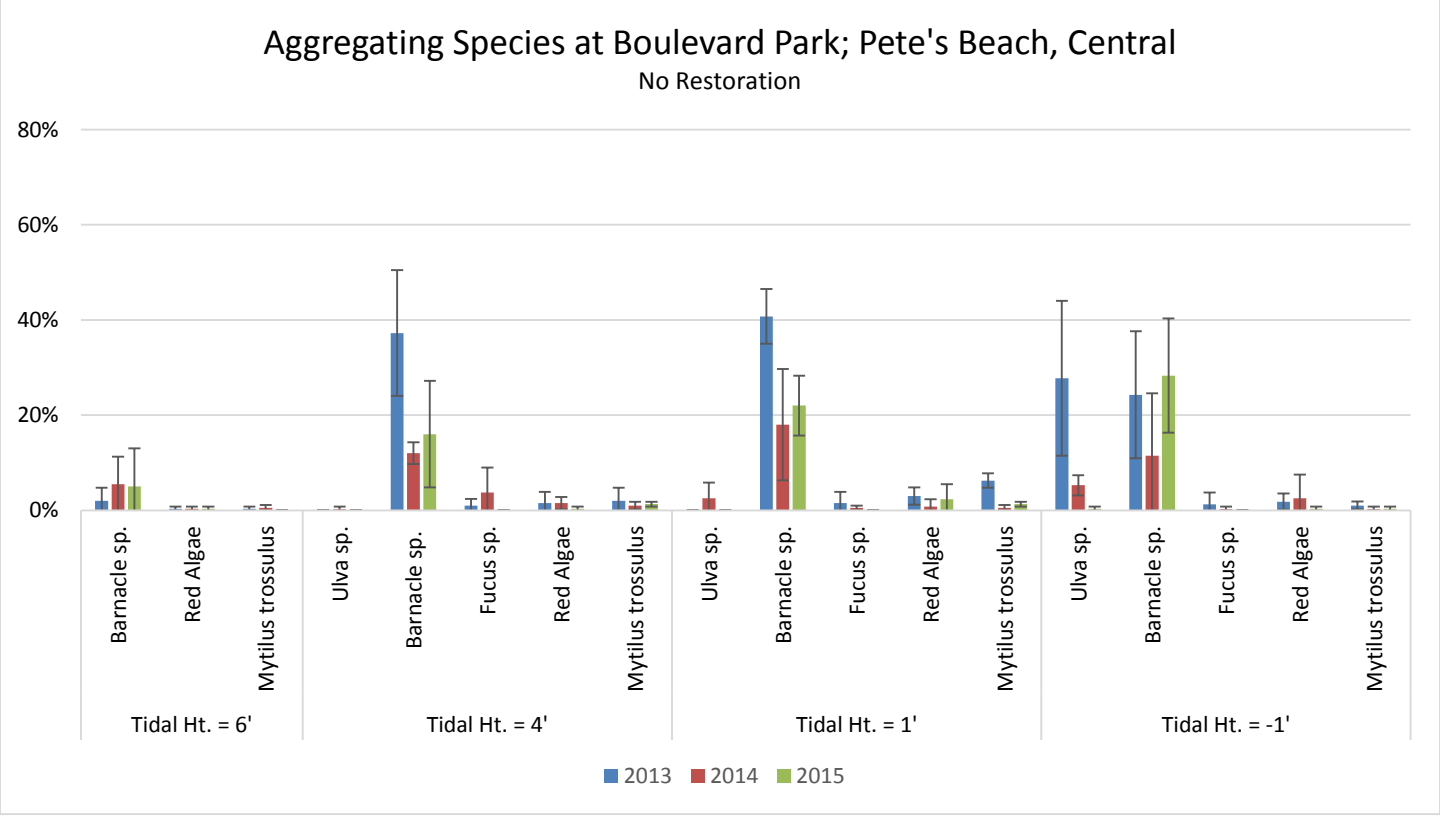

Figure 6: Aggregating Species at Boulevard Park; Pete's Beach Central from 2013-2015.

Graphs of aggregating species at the restoration sites

Graphs of aggregating species at the restoration sites, Profiles Site 3 and 7, also showed quite a bit of variability in species coverage from quadrat to quadrat and year to year.

The 2013 restoration action occurred primarily in the upper intertidal, replacing rip rap with sand and cobble. A portion of Profile Site 3 lay across a rock revetment, giving added substrate diversity to this site.

In 2014, at the +6 and +4 tidal elevations, newly placed cobbles present on the beach for approximately 10-11 months, were nearly entirely devoid of life. In 2015, some colonization of these cobbles was evident, especially at the Profile Site 3, which contained the rock revetment. (See Figure 7 versus Figure 8)

As with the non-restoration sites, barnacles were a predominant organism at all tidal levels surveyed (+6, +4, +1, and -1) and *Ulva* sp. were predominant at tidal levels +1 and -1. Data for each year are shown in Appendix B.

Figure 7: Quadrat 4 at +4', Profile Site 3, 06/05/15

Figure 8: Quadrat 4 at +4', Profile Site 7, 06/05/15

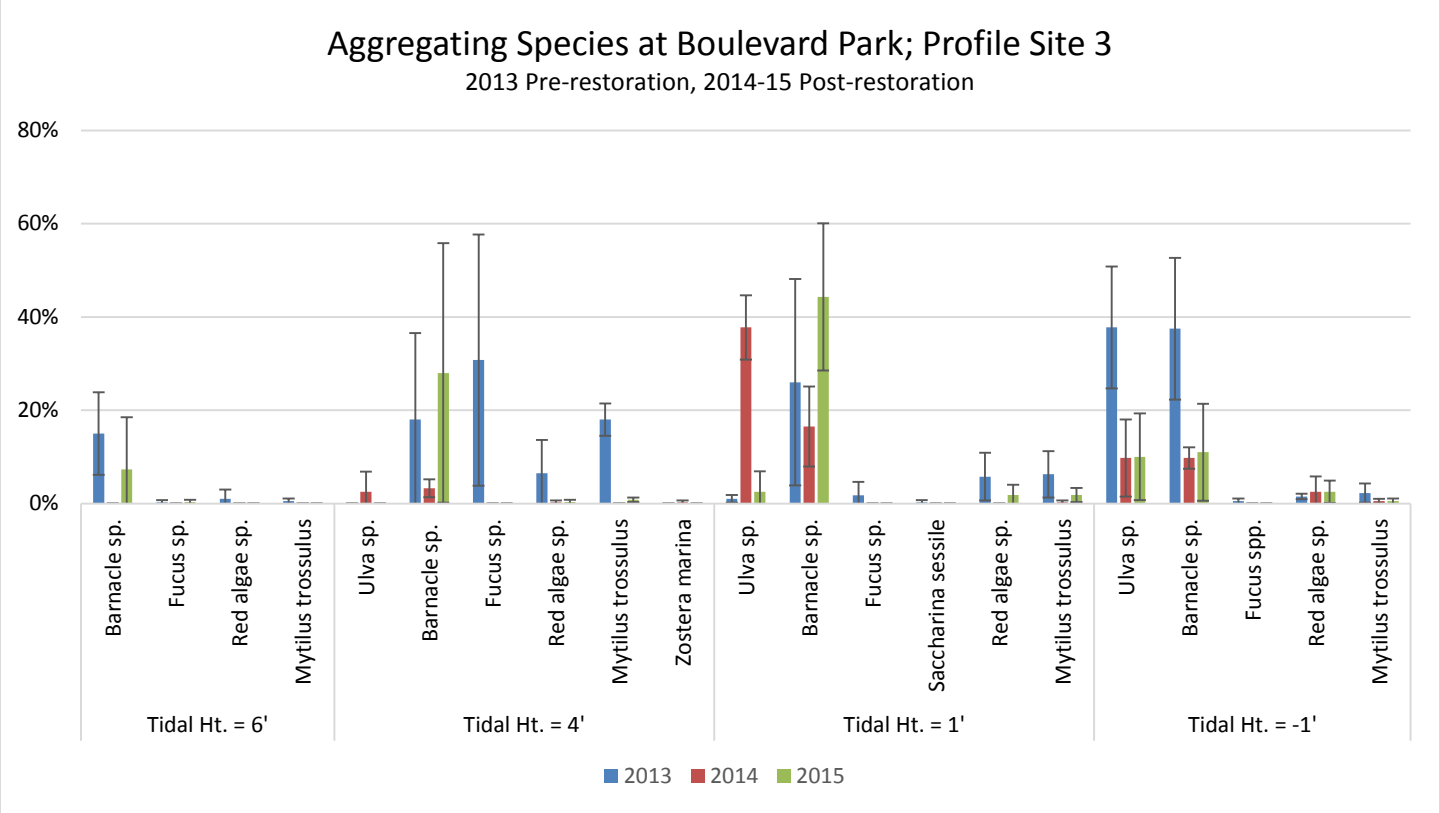

Figure 9: Aggregating Species at Boulevard Park; Profile Site 3 from 2013-201

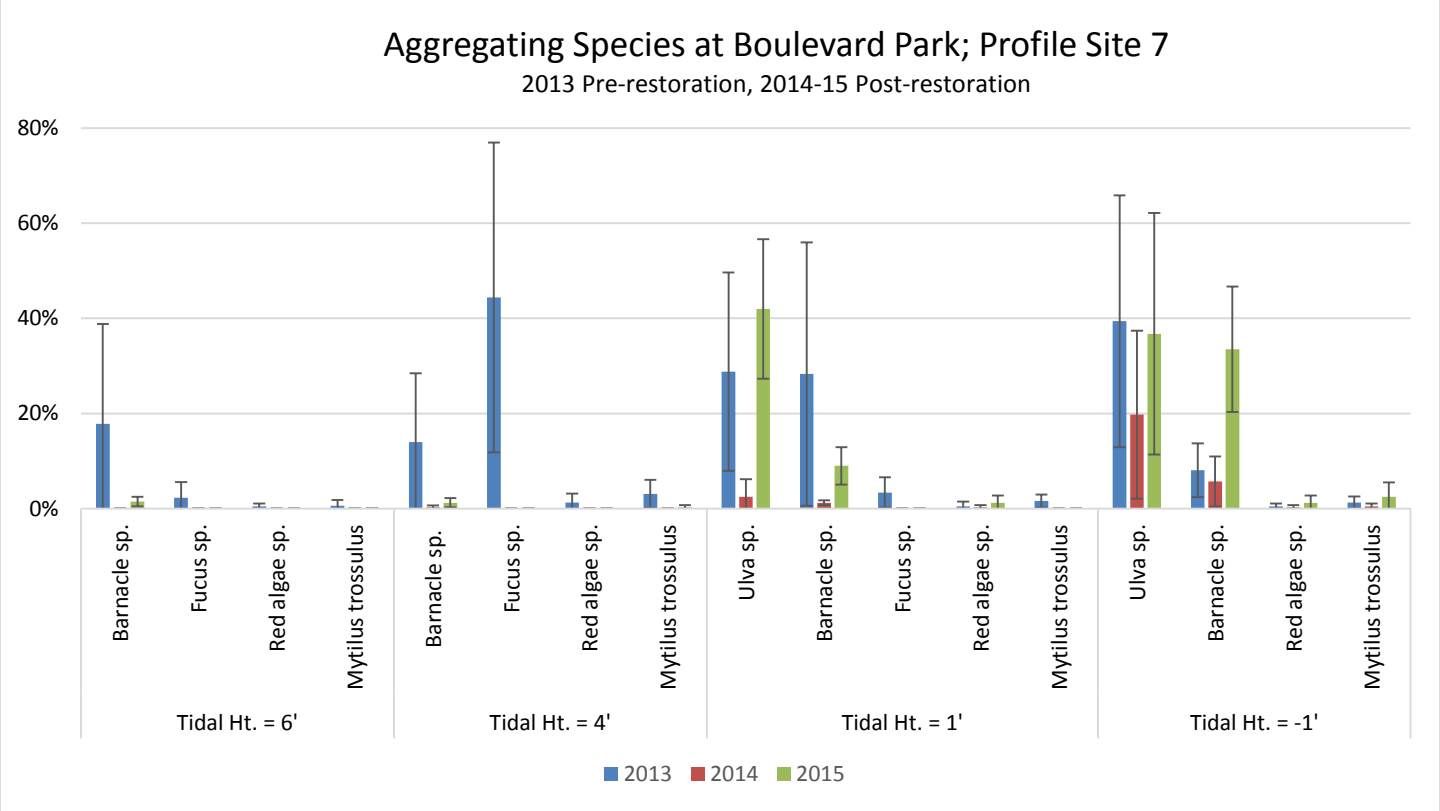

Figure 10:Aggregating Species at Boulevard Park; Profile Site 7 from 2013-2015.

Individual Animals at the Non-Restoration Sites

Limpet and *Littorina* sp., both of which attach to rocks and graze upon algae and diatoms, were the predominant individual species found. Their populations were variable from year to year and quadrat to quadrat.

Figure 11:*Littorina scutulata*.

These organisms are small, usually less than 0.5".
Reprinted with permission, Mary Jo Adams.

Figure 12: Volunteers working to identify small organisms

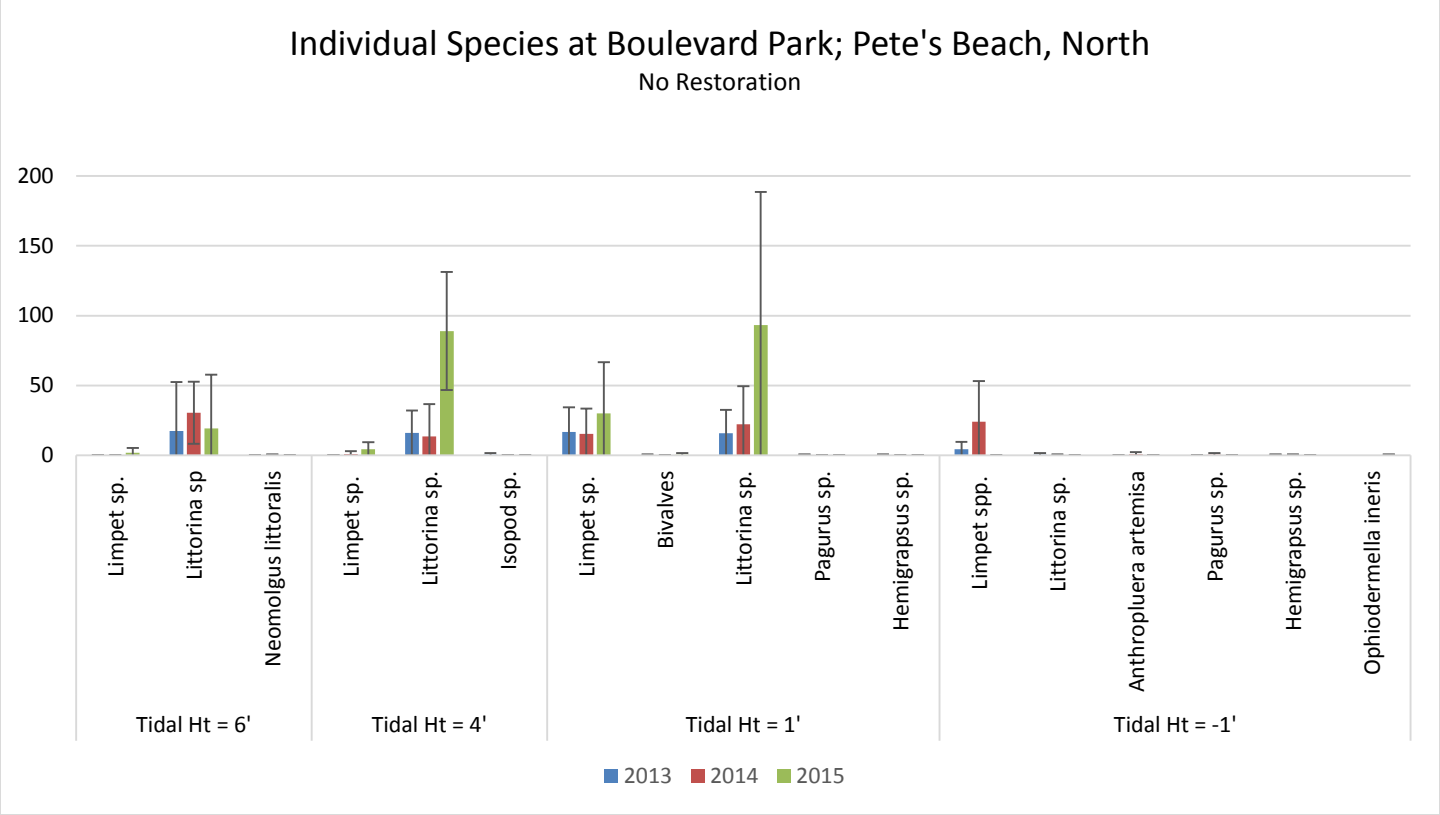

Figure 13: Individual Animals Species at Boulevard Park; Pete's Beach North from 2013-2015.

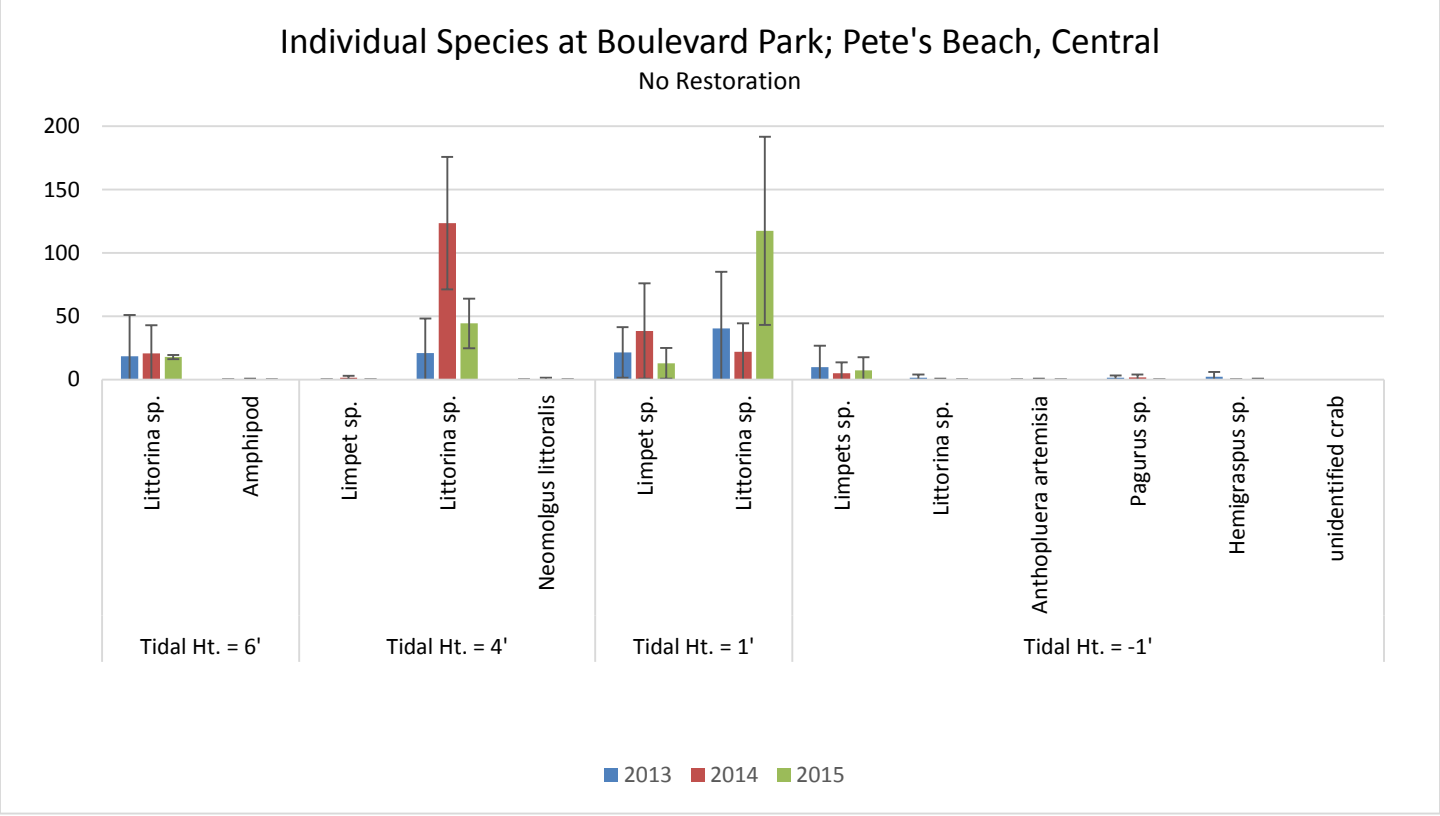

Figure 14. Individual Animals Species at Boulevard Park; Pete's Beach Central from 2013-2015.

Individual Animals at the Restoration Sites

At Profile Site 3, the numbers of individuals are low both pre- and post-restoration. Interestingly, this is the transect that contains the rock revetment. For these animals, however the presence of the rock substrate was not associated with a noticeable increase in individual animals.

At the Profile Site 7, the number of animals was low in 2013, dipped in 2014, and showed an increase in limpets at the -1' elevation. The variability in the numbers of animals in the quadrats is, however, high, and should be treated as an interesting observation until such time as further analysis and survey can be completed.

Figure 15: Boulevard Park before restoration.

Photo by City of Bellingham

Figure 16: Boulevard Park after restoration.

Photo by City of Bellingham

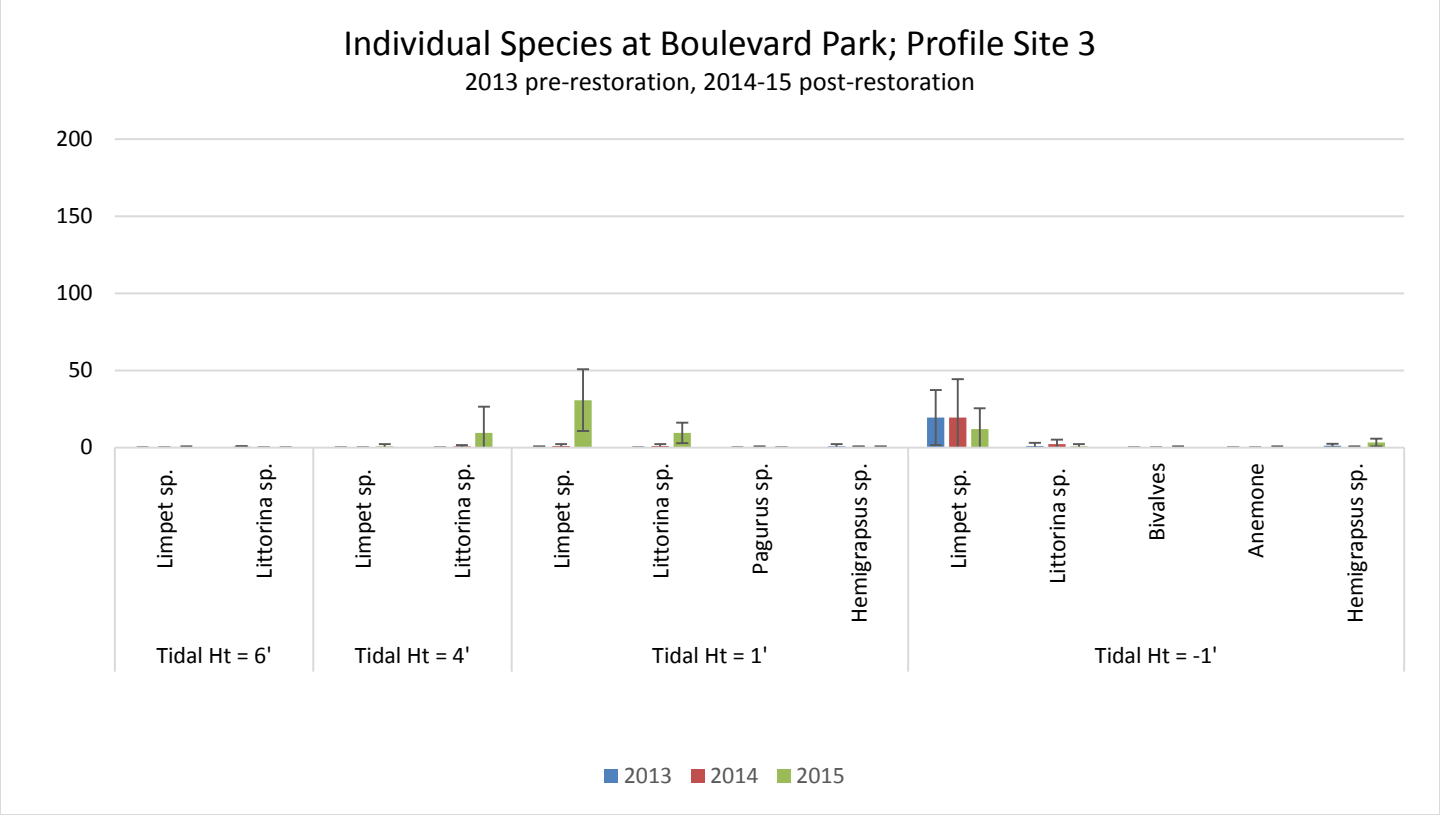

Figure 17. Individual Animals Species at Boulevard Park; Profile Site 3 from 2013-2015.

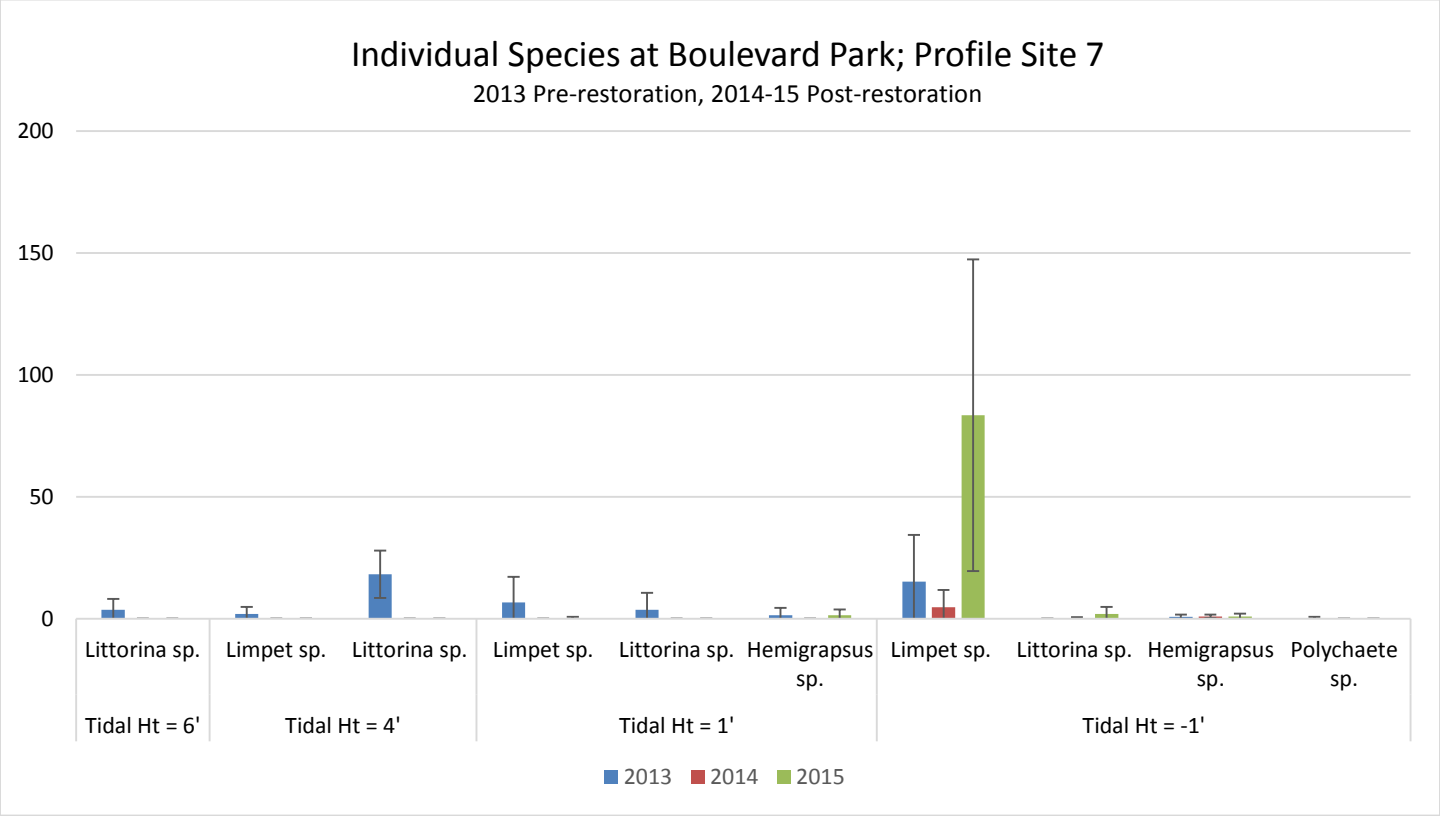

Figure 18: Individual Animals Species at Boulevard Park; Profile Site 7 from 2013-2015.

Slope of Non-restored beach sites from 2013-2015

The slope of the non-restored sites varies somewhat from year to year, but in general decreases in slope about 1 foot for every 10 feet in linear distance from the backshore.

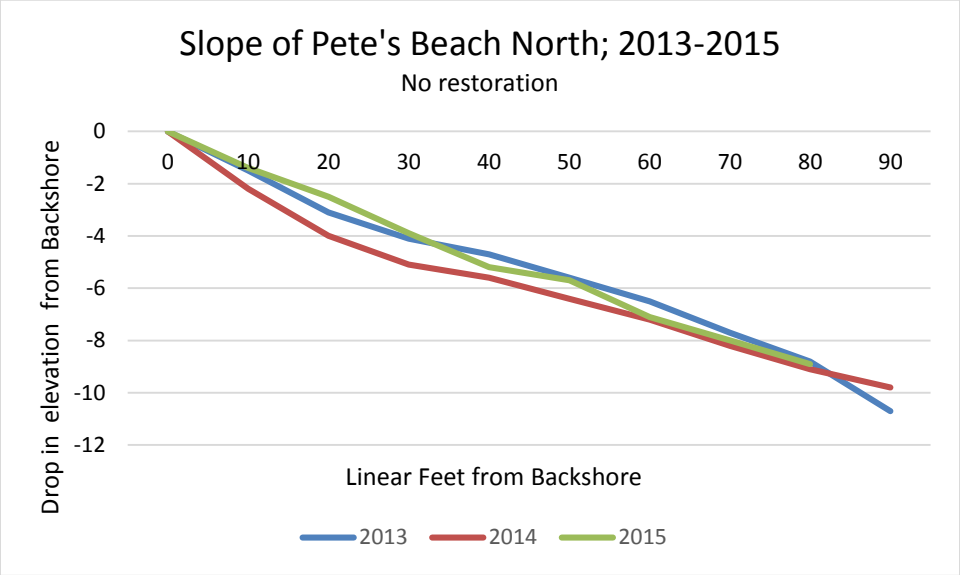

Figure 19: Slope of Pete's Beach North from Ordinary High Water to the water's edge, in years 2013, 14 and 15.

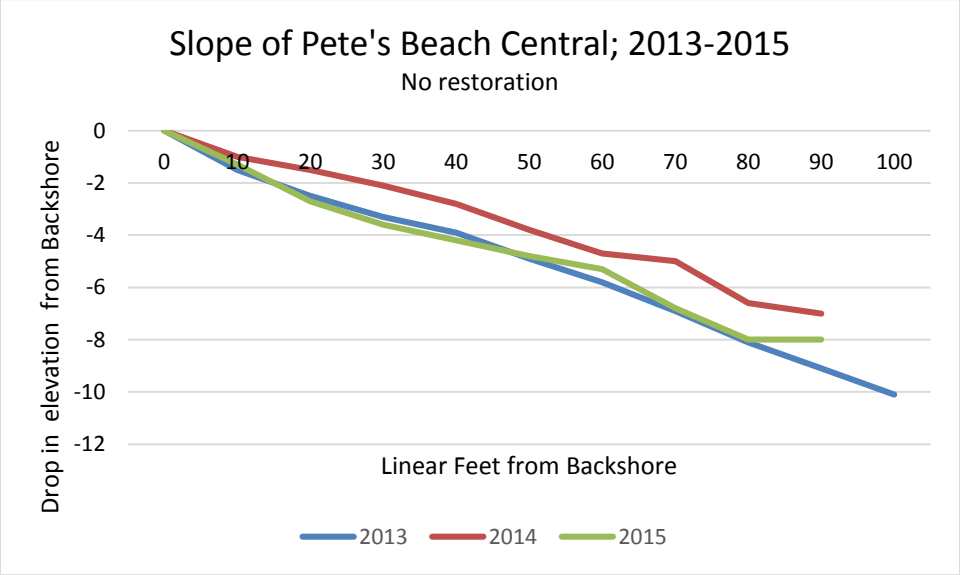

Figure 20: Slope of Pete's Beach Central from Ordinary High Water to the water's edge, in years 2013, 14 and 15.

Slope of Restored beach sites from 2013-2015

The slope of the restored beach at Profile Site 3 shows little variability from pre to post restoration and over the years surveyed. Profile Site 7, on the other hand, may be losing substrate as shown in Figure 22. The beach slope was characterized by an approximate 8' versus 11' elevation drop over 70' a distance of 70 linear feet in 2014 versus 2015.

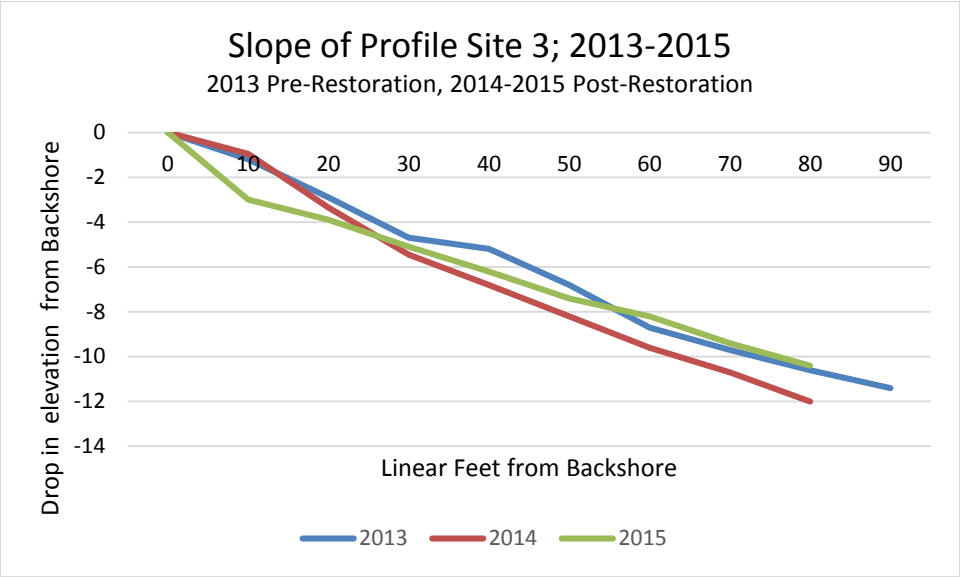

Figure 21: Slope of Profile Site 3 from Ordinary High Water to the water's edge, in years 2013, 14 and 15.

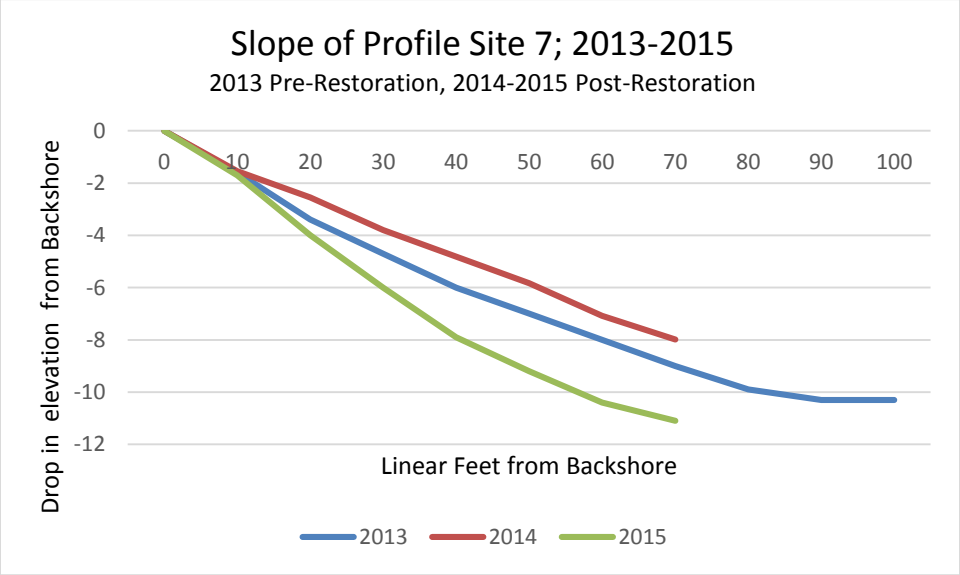

Figure 22: Slope of Profile Site 7 from Ordinary High Water to the water's edge, in years 2013, 14 and 15.

Discussion

The goal of this project is to explore whether any discernable differences were observable at the Boulevard restoration site and further to gather a baseline for detection of any future changes on beach slope, substrate, and intertidal biodiversity at four monitoring sites. The project was completed as intended.

At all of the transects, in 2013, the substrate was composed of a mixture of pebbles, cobbles and boulders. However there were other materials present in several areas. Along the Pete's Beach central transect, increased amounts of gravel were observed at the higher tidal levels, but even at the -1' level some gravel was seen. At Pete's Beach north there was less gravel, but some riprap was present at the +6' level and sand was found at the -1' level. At Profile Site 3, as a result of previous armoring, concrete slabs and rubble were found. No gravel was observed along this transect, but at the lower tidal levels shell was found in some quadrats. The substrate found along Profile Site 7 was similar to that at Profile Site 3, however no shell was observed, and some gravel was found.

In 2014 and 2015, substrate at the non-restoration sites of Pete's Beach remained as before. At Profile Sites 3 and 7, the substrate was altered from previously observed. Sand and cobble were brought in to replace the rip rap and rock groins were anchored on either side of the restoration action to help it stay in place. Profile Site 3 rests partially on the southern groin. In 2014 substrate was comprised of cobble, gravel, boulder and shell with cobble predominant at the higher elevations and boulder apparent at +4' and lower. In 2015, the demarcation of these zones was not as clear, and broken shell became a component of the substrate, also. At Profile Site 7, substrate was composed of cobble, gravel and boulder with gravel and cobble predominating at the upper elevations and boulder becoming more present at -1'. The -1' transect at Profile Site 7 lies upon a ridge of rock extending from the northern groin, after which there is a somewhat steep drop-off to the bay.

Ulva sp. was the predominant alga and was found in greatest abundance at the +1' and -1' tidal level. Barnacles were well represented in most locations examined. Variability of aggregating species was high and may be more associated with substrate present, versus other factors.

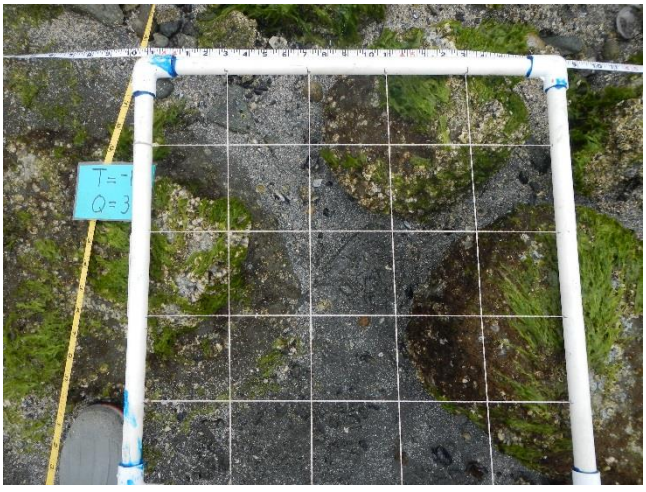

Figure 23: Pete's Beach North, 6/3/15, Transect -1', Q3

Figure 24: Profile Site7, 6/3/15, Transect +1', Q2
Note that the larger cobbles are covered, whereas the smaller cobbles and gravel are not.

Among countable species, *Littorina* sp., and limpet species were generally most abundant. Individual species were generally not detected at +6', +4' and +1' one year after restoration at Profile Sites 3 and 7. At two years after restoration, some colonization of these individual species occurred, but only at Site 3 which contained larger rock substrate as part of the southern groin. Low numbers of *Hemigrapsus* sp. (shore crab) were found at most sites at the +1' and -1' transects.

As discussed, substrate type is correlated with type and diversity of animals found at the sites. There is a well-established positive correlation between substrate composition and intertidal habitat, flora, fauna, and ecology. According to Dethier and Schoch (2005), "In areas where cobbles (>~ 4" or 10 cm diam.) are abundant on the low shore, the substrate is stabilized into a complex mix of cobbles, pebbles, and sand; these habitats harbor a rich flora (on the cobbles) and fauna (both on the cobbles and infauna)."

An additional finding of these surveys is that there appears to be a settling or loss of substrate at Profile Site 7. A need for re-nourishment at gravel beaches has been observed at other sites. (Shipman, 2001).

Extensive species data has also been collected to characterize each site around the profile line, extending 10 meter on either side. When collecting data for the species list, experts identify the organisms both on the surface and under the rocks (This is unlike data collected in the quadrats, where only surficial data is recorded.) Species list data has not been analyzed in great detail, but it is available in Appendix C for further review. Collecting comprehensive species data such as this presents a good way to assess whether new species are coming in to the area and establishing themselves and for monitoring the presence of invasive or non-native species.

At Pete's Beach, the non-native *Nuttalia obscurata* varnish clam was observed in 2013, although not to a large extent as seen in other places. The non-native *Sargassum muticum* or Japanese wireweed was also observed on Pete's Beach in 2013 and 2015. Although Washington Department of Fish and Wildlife does not list either of these species as "invasive", they are both non-native species that have become problematic in some areas. (Britton-Simmons, Washington Department Fish and Wildlife).

Figure 25: Species expert Doug Stark looks under a rock as part of compiling the species list.

Recommendations for any modification of the procedures and the overall program

Overall, we believe we have gathered valuable data and that this data paints an accurate picture of the intertidal life at Boulevard Park. From our experience over the past years, we highlight some things that served us particularly well, along with several recommendations to increase the accuracy of our data.

HIGHLIGHTS:

- Partnership with other like-minded and similarly trained groups helped fill recruitment for our beach days.
- Having experts on the beach was essential for those hard-to-identify organisms.
- Outreach at Boulevard Park helped educate passers-by about the beach and gained some recruits.

Figure 26: Information Station at Boulevard Park.

This station was borrowed from the Fidalgo Bay Aquatic Reserve Citizen Stewardship Group. It was very popular with passers-by.

RECOMMENDATIONS:

- Volunteers identified organisms to the extent possible given conditions and their expertise. As part of our in-field quality control, we will be concentrating on consistency between identifiers.
- Explore the possibility of new sites that are separate from the rip rap at +6' (Pete's Beach North) and the rock groin (Profile Site 3). Excluding those features may lessen the variability and be better able to give a clearer signal of the effect of the restoration.
- Explore ways to mentor individuals to become experts.

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Appendix A: Data Forms

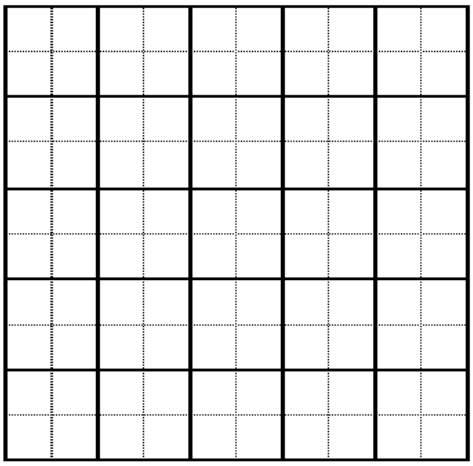
The following data forms were used in this project:

Form	Purpose
Binary method wksht	Assess percentage coverage
Whatcom Quadrat	Quadrat analysis,
Profile data_A	Profile elevation (Beach Watchers form D4, side A)
Species Checklist_latin	Species identification
BW D1	Record start point with multiple readings
BW D2	Record presence and dimensions of structure on or near the profile line
BW D3	Identifies general location of beach and then provides specific information to locate start point

Quadrat Estimation Worksheet

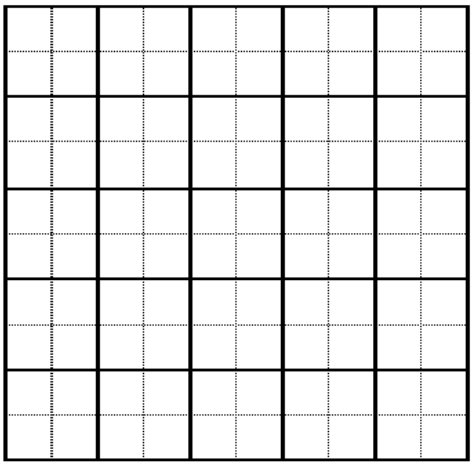
Site_____ Date and Time_____
Identifier:_____ Recorder_____
Other Team members:_____ and _____
Transect Elevation (circle one): +1' 0' -1
Quadrat Number _____, Quadrat Distance along transect line _____

Organism: _____ Row Totals



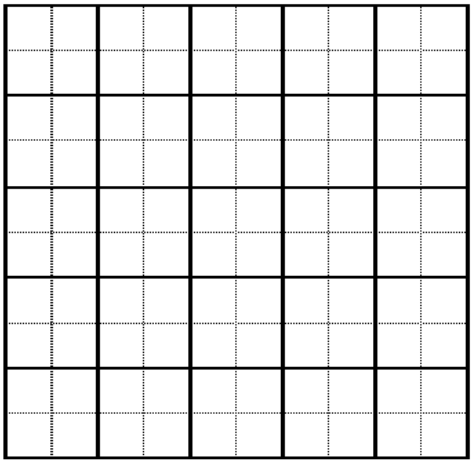
Grand Total:

Organism: _____ Row Totals



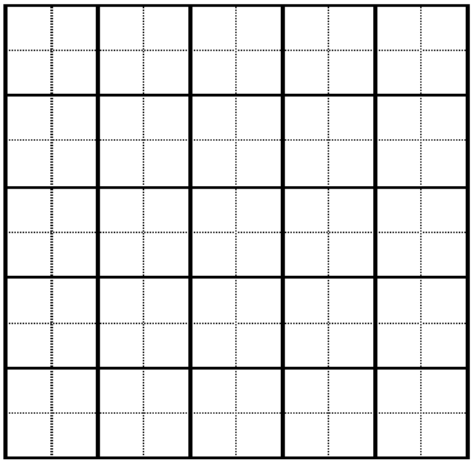
Grand Total:

Organism: _____ Row Totals



Grand Total:

Organism: _____ Row Totals



Grand Total:

Whatcom Quadrat Sheet

Aquatic Reserve Intertidal Biotic monitoring QUADRAT DATA SHEET

LEAD:_____
Team names: _____ and _____
Identifier: _____ Recorder: _____
Site: _____
Date and Time of sampling: _____

OUR QUADRAT DATA:

Transect elevation (circle one): +1' 0' -1'
Quadrat #: _____
Quadrat distance: _____
Substrate in Quadrat: _____

PERCENT COVERAGE ORGANISMS: algae, plants and colonial organisms*:

transferred information from QUADRAT ESTIMATION worksheet

	Organism Name	% Cover		Organism Name	% Cover
1			11		
2			12		
3			13		
4			14		
5			15		
6			16		
7			17		
8			18		
9			19		
10			20		

* Barnacles, mussels, sponge, bryozoans, colonial ascidians, & Anthopleura elegantissima

COUNTABLE ANIMALS:

	Organism Name	Number		Organism Name	Number
1			11		
2			12		
3			13		
4			14		
5			15		
6			16		
7			17		
8			18		
9			19		
10			20		

NOTES AND OBSERVATIONS (i.e weather, dominant vegetation, tide, invasives, etc)

Pg. 1/1

Beachwatcher, Field Data Sheet

SIDE A **Profile data sheet** Page ___of ___ ***** Please complete additional information on the back of this form**

Directions: In column A record the number of feet traveled for each reading. Column B is the running total of column A. Column C is the actual profile reading (be sure to include + or -). Check the substrates, seaweeds, and animals found within each profile section.

	A	B	C	Substrate (check all that apply)							Seaweeds and Invertebrates (check all that apply)																														
Entry (1,2,3, etc.)	Length of survey section	Cumulative Distance (optional)	+ or - Survey Reading	Ground shell debris	Clay/Silt	Sand (.002" - .08")	Gravel (.08" - 2")	Cobbles (2" - 10")	Boulders (>10")	Erratics (BIG ROCKS!)	Amphipods	Anemones	Barnacles	Chitons	Clams	Crabs	Fish	Insects	Isopods	Limpets	Mussels	Nudibranchs	Sand Dollars	Sea Cucumbers	Seastars	Snails	Urchins	W Flat Worms	W Nemerteans	W Polychaetes	Green Seaweeds	Red Seaweeds	Brown Seaweeds	Seagrass	Arachnid	Shrimp	Other
1																																							
2																																							
3																																							
4																																							
5																																							
6																																							
7																																							
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18																																							
19																																							
20																																							
21																																							

Species Checklist – scientific nomenclature

Site:	Date & Time:	Expert & Scribe:					Section along profile line, in feet				
PORIFERA	sponges										
Halichondria sp.	Bread crumb sponge										
PLATYHELMINTHES											
Kaburakia excelsa	"giant flatworm"										
CNIDARIA: Anthozoa	sea anemones										
Anthopleura artemisia	Moonglow or Buried anemone										
Haliplanella (?) lineata	striped anemone										
NEMERTEA											
Paranemertea peregrina	ribbon worm (purple nemertid)										
Carinoma mutabilis	Nemertea - white										
Cerebratulus (?) californiensis	Light-edged Ribbon Worm										
Tubulanus polymorphus	Nemertea - orange										
Carinoma mutabilis	Nemertea - white										
ANNELIDA											
Polychaeta sp.	Polychaete										

Site:	Date & Time:	Expert & Scribe:					Section along profile line, in feet				
Tubiculous polychaete	unidentified tube worm										
Chaetopteridae	Bamboo worm										
Glyceridae	blood worms										
Hesionidae sp.	"bristle worm" Polychaete										
Lumbrineridae	genus/sp. unidentified										
Nephtyidae spp.	Goddess worm										
Nereidae spp. (includes Alitta succinea)	Pile worm										
Polynoidae	scale worms										
Syllidae	?										
Terebellidae	"spaghetti worm"										
MOLLUSCA: Gastropoda	Snails										
Lacuna sp.	"lacuna"										
Littorina sp.	unidentified periwinkle										
Lirabuccinum dirum (Searlesia dira)	Dire whelk										
Littorina scutulata	Checkered Periwinkle										

Site:	Date & Time:	Expert & Scribe:								Section along profile line, in feet	
Littorina sitchana (sitkana)	"Sitka periwinkle"										
Lirabuccinum dirum (Searlesia dira)	Dire whelk										
Nassarius mendicus (?)	"western lean nassa"										
Nassarius fossatus	"channeled nassa"										
Amphissa (?) columbiana	"wrinkled Amphissa"										
Nucella lamellosa	"frilled dogwinkle"										
Nucella ostrina (emarginata)	"emarginate dogwinkle"										
Odostomia tenuisculpta	no common name										
Batillaria zonalis	"Japanese false cerith"										
Haminoea vesicula	" blister glassy-bubble"										
Nudibranch sp.	unidentified nudibranch										
Lottia digitalis (?)	"ribbed limpet" (finger limpet)										
Lottia pelta	"Shield limpet"										
Lottia alveus (parallela)	"Bowl limpet"										
Tectura scutum	"Plate limpet"										

Site:	Date & Time:	Expert & Scribe:								Section along profile line, in feet	
Tectura persona	"Mask limpet"										
Lottia digitalis	Finger limpet										
Lottidae sp.	unidentified limpets										
MOLLUSCA: Bivalvia											
Pododesmus macrochisma	"Alaska jingle"										
Mytilus trossulus	Pacific blue mussel										
Mussel sp.	no common name										
Leukoma staminea	"Pacific littleneck"										
Venerupis philippinarum	"Japanese littleneck"										
Macoma inquinta	"pointed" or "stained" macoma										
Macoma nasuta	"bent-nose macoma										
Nuttallia obscurata	"purple mahogany-clam"										
Clinocardium nuttallii	"Nuttall cockle" (heart cockle)										
Mya arenaria	"softshell clam"										
Crassostrea gigas	"Pacific oyster"										

Site:	Date & Time:	Expert & Scribe					Section along profile line, in feet				
Saxidomus gigantea	Washington butterclam										
Tresus capax	"fat gaper"										
Macoma balthica	"Baltic macoma"										
MOLLUSCA: Polyplacophora	Chitons										
Mopalia muscosa	Mossy chiton										
Mopalia lignosa	Woody chiton										
Lepidochitonidae	chiton										
ARTHROPODA:Crustacea:Malaconstraca											
Neomolgus littoralis	red velvet mite										
Pagurus sp.	Hermit Crab										
Pagurus hirsutiusculus	"hairy hermit"										
Pagurus granosimanus	"grainyhand hermit"										
Amphipoda: Gammaridea	gammarid amphipod										
Caprellidae	caprella amphipod										
Hemigrapsus nudus	"Purple shore crab"										

Site:	Date & Time:	Expert & Scribe					Section along profile line, in feet				
Hemigrapsus oregonensis	"yellow shore crab"										
Hemigrapsus sp.	unidentified shore crab										
Metacarcinus magister	Dungeness crab										
Hapalogaster mertensii	"hairy crab"										
Telmessus cheiragonus	"helmet crab"										
Upogebia pugettensis	"blue mud shrimp" (burrow entrance only)										
Pentidotea (Idotea) wosnesenskii	Rockweed isopod										
Gnorimosphaeroma orgonensis	isopod, Oregon pillbug										
Cirolana harfordia	Harford's isopod										
ARTHROPODA:Crustacea:Maxillopoda											
Balanus glandula	Acorn Barnacle										
Balanus crenatus	Crenate Barnacle										
Semibalanus cariosus	Haystack Barnacle										
Chthalamus dalli	Little brown barnacle										
Balanomorpha	unidentified acorn barnacle										

Site:	Date & Time:	Expert & Scribe					Section along profile line, in feet				
Barnacle sp.	Unidentified Barnacle sp.										
ECHINODERMATA:Asteroidea	sea stars										
Pisaster ochraceus	Ochre (purple) seastar										
Leptasterias hexactis	Six-arm or brooding seastar										
Evasterias troschelli	Mottled seastar										
ECHINODERMATA: Ophiuroidea	brittle star										
Amphipholis squamata (?)	brooding or small brittle star										
PLANTAE											
Fucus distichus	Rockweed "Two-headed Wrack"										
Fucus sp.											
Laminaria saccharina	ribbon kelp										
Sargassum muticum	Japanese wireweed										
Scytosiphon lomentaria	soda straws										
Ulva lactuca	Sea lettuce (foliose)										
Ulva intestinalis	Sea lettuce (filamentous or "tubular")										

Site:	Date & Time:	Expert & Scribe					Section along profile line, in feet				
Ulva (Bladed Form)	Sea lettuce										
Ulva (Tubular Form)	Sea lettuce										
Ulva sp. (form unidentified)	Sea lettuce (form unidentified)										
Filamentous Rhodophyta	filamentous red algae (includes "Endocladia-like")										
Phaeophyta	unidentified brown algae										
Caulacanthus ustulatus	"Endocladia-like"										
Cryptosiphonia woodii ?	"bleached brunette"										
Neorhodomela larix	"black pine"										
Ceramium sp.	"staghorn felt" (filamentous red)										
Hildenbrandia sp.	Rusty rock										
Porphyra sp.	Purple laver										
Polysiphonia complex	filamentous red algae										
Mastocarpus papillatus	Turkish washcloth, tarspot										
Zostera marina	Eelgrass										

Site:	Date & Time:	Expert & Scribe					Section along profile line, in feet				
Distichlis spicata											
Atriplex patula											
Salicornia sp.											
Cakile sp.											

Appendix B: Data Tables

Tables show raw counts and averages of counts for each beach and organism type. Coverage values in bold italic indicate that the estimate was less than the number recorded. Averages were calculated from whole numbers, rounding up for "less than" estimates. Graphically, averages and standard deviation of the surveys are depicted.

Boulevard Park Pete's Beach North	6/23/2013					
Percent Cover of Algae, Plants, and Colonial Animals						
Transect	Species	Quadrat				Average
Elevation		1	2	3	4	percent
6'	*Chthamalus dalli*	12.0%	30.0%	8.0%	0.0%	12.5%
	Balanus glandula	17.0%	35.0%	0.0%	0.0%	13.0%
	Barnacle sp. (SUM)	29.0%	65.0%	8.0%	0.0%	25.5%
	Fucus distichus	5.0%	2.0%	0.0%	0.0%	1.8%
	Mastocarpus sp.	0.0%	1.0%	0.0%	0.0%	0.3%
	Mytilus trossulus	***1%***	***1%***	0.0%	0.0%	0.5%
	Substrate in quadrat:	Rr	C, Rr	G, B, Rr	G	
		1	2	3	4	
4'	*Chthamalus dalli*	0.0%	0.0%	0.0%	10.0%	2.5%
	Balanus glandula	2.0%	6.0%	34.0%	1.0%	10.8%
	Balanus crenatus	***1%***	0.0%	0.0%	3.0%	1.0%
	Barnacle sp. (SUM)	3.0%	6.0%	34.0%	14.0%	14.3%
	Fucus sp.	5.0%	58.0%	1.0%	0.0%	16.0%
	Mytilus trossulus	***1%***	3.0%	0.0%	***1%***	1.3%
	Substrate in quadrat:	C, G	B, C, G	G, C, B	G, B	
		1	2	3	4	
1'	*Ulva* sp.	17.0%	0.0%	0.0%	0.0%	4.3%
	Chthamalus dalli	0.0%	0.0%	0.0%	1.0%	0.3%
	Balanus glandula	54.0%	21.0%	30.0%	45.0%	37.5%
	Balanus crenatus	1.0%	0.0%	0.0%	3.0%	1.0%
	Barnacle sp. (SUM)	55.0%	21.0%	30.0%	49.0%	38.8%
	Fucus distichus	1.0%	***1%***	4.0%	18.0%	6.0%
	Cryptosiphonia woodi (RA	1.0%	0.0%	0.0%	0.0%	0.3%
	Endocladia (RA)	0.0%	0.0%	0.0%	16.0%	4.0%
	Mastocarpus sp. (RA)	1.0%	0.0%	0.0%	0.0%	0.3%
	Microcladia sp. (RA)	0.0%	***1%***	0.0%	0.0%	0.3%
	Red Algae (SUM)	2.0%	***1%***	0.0%	16.0%	4.8%
	Mytilus trossulus	5.0%	3.0%	4.0%	7.0%	4.8%
	Substrate in quadrat:	G, B, Sh	G, C, Sh	G, C, Sh	G, C, Sh, B	
		1	2	3	4	
-1	*Ulva* sp.	29.0%	31.0%	29.0%	21.0%	27.5%
	Chthamalus dalli	3.0%	0.0%	0.0%	0.0%	0.8%
	Balanus glandula	14.0%	0.0%	0.0%	0.0%	3.5%
	Balanus crenatus	0.0%	3.0%	0.0%	13.0%	4.0%
	Balanus sp.	0.0%	0.0%	13.0%	0.0%	3.3%
	Barnacle sp. (SUM)	17.0%	3.0%	13.0%	13.0%	11.5%
	Fucus distichus	1.0%	0.0%	5.0%	0.0%	1.5%
	Microcladia sp. (RA)	1.0%	0.0%	0.0%	0.0%	0.3%
	Mytilus trossulus	0.0%	1.0%	2.0%	0.0%	0.8%
	Zostera marina	0.0%	0.0%	0.0%	52.0%	13.0%
	Substrate in quadrat:	C	B, S, Sh	S, B, C, Sh	C/S, C	
C/S, S, G, C, B, E, Sh=						
Clay/Silt, Sand, Gravel, Cobbles, Boulders, Erratic, Shell Debris						
1% (bold and italicized) =less than 1%						
RA = Red Algae						

Boulevard Park: Pete's Beach North 6/14/2014

Percent Cover of Algae, Plants, and Colonial Animals

Transect	Species	Quadrat, ft.				Average
Elevation		**1**	**2**	**3**	**4**	percent
6'	*Chthamalus dalli*	35%	0%	2%	0%	9.3%
	Balanus crenatus	0%	0%	1%	***1%***	0.5%
	Balanus glandula	0%	4%	7%	1%	3.0%
	Barnacle sp. (SUM)	35%	4%	10%	2%	12.8%
	Fucus distichus	0%	0%	2%	***1%***	0.8%
	Mastocarpus sp. (RA)	2%	***1%***	1%	1%	1.3%
	Filmentous red (RA)	0%	0%	***1%***	0%	0.3%
	Red Algae (SUM)	2%	1%	2%	1%	1.5%
	Mytilus trossulus	0%	0%	1%	***1%***	0.5%
	Substrate	B	G, B	G, C, B	G, C, B	
		1	**2**	**3**	**4**	
4'	*Balanus glandula*	14%	3%	2%	10%	7.3%
	Chthamalus dalli	1%	0%	0%	***1%***	0.5%
	Barnacle sp. (SUM)	15%	3%	2%	11%	7.8%
	Fucus sp.	0%	0%	0%	1%	0.3%
	Mastocarpus sp. (RA)	***1%***	1%	0%	1%	0.8%
	Mytilus trossulus	***1%***	0%	***1%***	***1%***	0.8%
	Substrate	S, G, C, B	G, C, B	G, C	C, B	
		1	**2**	**3**	**4**	
1'	*Ulva sp. (bladed)*	19%	12%	1%	0%	8.0%
	Ulva sp. (tubular)	4%	0%	0%	0%	1.0%
	Ulva sp.	0%	0%	0%	5%	1.3%
	Ulva sp. (SUM)	23%	12%	1%	5%	10.3%
	Balanus glandula	10%	12%	25%	4%	12.8%
	Chthamalus dalli	10%	***1%***	0%	9%	5.0%
	Barnacle sp. (SUM)	20%	13%	25%	13%	17.8%
	Fucus distichus	***1%***	6%	0%	0%	1.8%
	Mastocarpus sp. (RA)	0%	0%	***1%***	***1%***	0.5%
	Filmentous red (RA)	0%	0%	1%	1%	0.5%
	Caulacanthus sp. (RA)	0%	0%	0%	1%	0.3%
	Rhodophyta sp. (RA)	18%	0%	0%	0%	4.5%
	Red Algae (SUM)	18%	0%	2%	3%	5.8%
	Mytilus trossulus	**1%**	***1%***	1%	***1%***	1.0%
	Substrate	Br	G, C, B, Sh	G, C, B, Sh	G, C, B, Sh	
		1	**2**	**3**	**4**	
-1'	*Ulva* sp. (bladed)	8%	0%	0%	0%	2.0%
	Ulva sp. (tubular)	4%	0%	0%	14%	4.5%
	Ulva sp.	0%	10%	***1%***	0%	2.8%
	Ulva sp. (SUM)	12%	10%	1%	14%	9.3%
	Balanus crenatus	0%	12%	0%	12%	6.0%
	Balanus glandula	2%	0%	***1%***	0%	0.8%
	Barnacle sp. (SUM)	2%	12%	1%	12%	6.8%
	Fucus distichus	0%	0%	0%	***1%***	0.3%
	Mastocarpus sp. (RA)	0%	0%	0%	***1%***	0.3%
	Filmentous red (RA)	20%	12%	0%	6%	9.5%
	Rhodophyta sp. (RA)	0%	13%	0%	0%	3.3%
	Polysiphonous algae (RA)	2%	0%	0%	0%	0.5%
	Red Algae (SUM)	22%	25%	0%	7%	13.5%
	Zostera sp.	0%	0%	***1%***	0%	0.3%
	Substrate	S, G, C, B, Sh,	S, G, C, B, Sh,	S, Sh	S, G, C, Sh	

C/S, S, G, C, B, E, S, Br = Clay/Silt, Sand, Gravel, Cobbles, Boulders, Eelgrass, Shell Debris, Bedrock

1% (bold and italicized) =less than 1%

RA = Red Algae

Boulevard Park Pete's Beach North			6/3/2015			
Countable Animals in Quadrat						
Transect	Species	Quadrat				Average
Elevation		1	2	3	4	Count
6'	*Lottia pelta*	0	0	3	0	0.8
	Lottia digitalis	0	0	4	0	1.0
	Limpet sp. (SUM)	0	0	7	0	1.8
	Littorina scutulata	0	0	61	0	15.3
	Littorina sitkana	0	0	11	0	2.8
	Littorina sp. (SUM)	0	0	77	0	19.3
Substrate		B	B	C, B, G, Sh	C, B, G, Sh	
4'	*Lottia digitalis*	7	0	0	0	1.8
	Lottia pelta	0	0	7	0	1.8
	Tectura persona	3	0	0	0	0.8
	Limpet sp. (SUM)	10	0	7	0	4.3
	Littorina scutulata	128	49	123	56	89.0
	Littorina sp. (SUM)	128	49	123	56	89.0
Substrate		C, B, Sh	C, B, G	C, B, G, Sh	C, B, G, Sh	
1'	*Lottia pelta*	0	78	0	3	20.3
	Lottia digitalis	0	0	28	0	7.0
	Tectura scutum	0	0	11	0	2.8
	Limpet sp. (SUM)	0	78	39	3	30.0
	Protothaca staminea	0	2	0	0	0.5
	Littorina scutulata	0	201	172	0	93.3
	Littorina sp.	0	0	0	54	0.0
	Littorina sp. (SUM)	0	201	172	54	93
	Ophiodermella ineris	0	0	1	0	0.3
Substrate		Br	C, B, Sh	C, B, G, Sh	C, B, G, Sh	
-1'	None					
Substrate		C, S, Br	C, B, Sh	S, B, Sh	C/S, C, S, B, Sh	
C/S, S, G, C, B, E, Sh, Br =						
Clay/Silt, Sand, Gravel, Cobbles, Boulders, Erratic, Shell Debris, Bedrock						

Boulevard Park Pete's Beach Central			6/23/2013			
Percent Cover of Algae, Plants, and Colonial Animals						
Transect	Species	Quadrat, ft.				Average
Elevation		1	2	3	4	percent
6'	*Balanus glandula*	***1%***	0.0%	4.0%	0.0%	1.3%
	Balanus crenatus	***1%***	0.0%	0.0%	0.0%	0.3%
	Chthamalus dalli	***1%***	0.0%	2.0%	***1%***	1.0%
	Barnacle sp (SUM)	***1%***	0.0%	6.0%	***1%***	2.0%
	Mastocarpus sp. (RA)	0.0%	0.0%	***1%***	0.0%	0.3%
	Mytilus trossulus	0%	0.0%	***1%***	0%	0.3%
	Substrate in quadrat:	G	G	G, B, C	G, B, C	
		1	2	3	4	
4'	*Balanus glandula*	36.0%	9.0%	31.0%	27.0%	25.8%
	Chthamalus dali	0.0%	0.0%	25.0%	0.0%	6.3%
	Balanus crenatus	***1%***	20.0%	0.0%	0.0%	5.3%
	Barnacle sp. (SUM)	37%	29%	56%	27%	37.3%
	Fucus distichus	0.0%	0.0%	3.0%	0.0%	0.8%
	Fucus spiralis	1.0%	0.0%	0.0%	0.0%	0.3%
	Fucus sp. (SUM)	1.0%	0.0%	3.0%	0.0%	1.0%
	Mastocarpus sp. (RA)	0.0%	0.0%	***1%***	5.0%	1.5%
	Mytillus trossulus	1.0%	0.0%	6.0%	***1%***	2.0%
	Substrate in quadrat:	C, B	B, C	C, B	G, B, C	
		1	2	3	4	
1'	*Balanus glandula*	31.0%	36.0%	38.0%	31.0%	34.0%
	Chthamalus dali	18.0%	0.0%	0.0%	9.0%	6.8%
	Barnacle sp. (SUM)	49.0%	36.0%	38.0%	40.0%	40.8%
	Fucus distichus	5.0%	1.0%	0.0%	0.0%	1.5%
	Mastocarpus sp. (RA)	0.0%	1.0%	***1%***	5.0%	1.8%
	Cryptosiphonia woodi (RA	0.0%	3.0%	0.0%	0.0%	0.8%
	Endocladia muricata (RA)	2.0%	0.0%	0.0%	0.0%	0.5%
	Red Algae (SUM)	2.0%	4.0%	***1%***	5.0%	3.0%
	Mytillus trossulus	5.0%	5.0%	7.0%	8.0%	6.3%
	Substrate in quadrat:	G, C, B, Sh	G, B, S, Sh	C, B, Sh	G, C, Sh	
		1	2	3	4	
-1'	*Ulva sp.*	49.0%	32.0%	16.0%	14.0%	27.8%
	Semibalanus cariosus	15.0%	0.0%	0.0%	0.0%	3.8%
	Balanus glandula	0.0%	27.0%	0.0%	0.0%	6.8%
	Balanus crenatus	0.0%	0.0%	13.0%	42.0%	13.8%
	Barnacle sp. (SUM)	15.0%	27.0%	13.0%	42.0%	24.3%
	Fucus distichus	0.0%	0.0%	0.0%	5.0%	1.3%
	Microcladia borealis (RA)	0.0%	1.0%	4.0%	2.0%	1.8%
	Mytillus trossulus	0.0%	1.0%	***1%***	2.0%	1.0%
	Substrate in quadrat:	B, C, G, S, Sh	S, B, Sh, G	S, B	C, G	

C/S, S, G, C, B, E, Sh=

Clay/Silt, Sand, Gravel, Cobbles, Boulders, Erratic, Shell Debris

1% (bold and italicized) =less than 1%

RA = Red Algae

Boulevard Park Pete's Beach Central			6/14/2014			
Percent Cover of Algae, Plants, and Colonial Animals						
Transect	Species	Quadrat, ft.				Average
Elevation		**1**	**2**	**3**	**4**	percent
6'	*Balanus glandula*	0%	8%	7%	1%	4.0%
	Chthamalus dalli	0%	3%	3%	0%	1.4%
	Barnacles sp. (SUM)	0%	11%	10%	1%	5.5%
	Mastocarpus sp. (RA)	0%	0%	***1%***	0%	0.3%
	Mytilus trossulus	0%	***1%***	***1%***	0%	0.5%
	Substrate	S, G, C	G, C, B	S, G, C, B	G, C, B	
		1	**2**	**3**	**4**	
4'	*Ulva sp.*	0%	***1%***	0%	0%	0.3%
	Balanus glandula	5%	8%	4%	6%	5.8%
	Balanus crenatus	0%	0%	2%	0%	0.5%
	Chthamalus dalli	5%	2%	8%	8%	5.8%
	Barnacles sp. (SUM)	10%	10%	14%	14%	12.0%
	Fucus distichus	0%	11%	0%	4%	3.8%
	Filmentous red (RA)	0%	1%	0%	***1%***	0.5%
	Mastocarpus sp. (RA)	***1%***	2%	0%	***1%***	1.0%
	Red Algae Total	***1%***	***3%***	***0%***	***2%***	1.5%
	Mytilus trossulus	***1%***	2%	0%	***1%***	1.0%
	Substrate	G, C, B,	G, C,	G, C, B	G, C, B	
		1	**2**	**3**	**4**	
1'	*Ulva sp.*	7%	0%	3%	0%	2.5%
	Balanus crenatus	0%	2%	***1%***	0%	0.8%
	Balanus glandula	24%	10%	1%	7%	10.5%
	Chthamalus dalli	10%	5%	4%	8%	6.8%
	Barnacle sp. (SUM)	34%	17%	6%	15%	18.0%
	Fucus sp.	***1%***	0%	***1%***	0%	0.5%
	Filmentous red (RA)	***1%***	0%	0%	0%	0.3%
	Mastocarpus sp. (RA)	2%	0%	0%	0%	0.5%
	Total Red Algae	3%	0%	0%	0%	0.8%
	Mytilus trossulus	1%	***1%***	0%	0%	0.5%
	Substrate	G, C, B, Sh	S,G, C, Sh	G, C, Sh	G, C, Sh	
		1	**2**	**3**	**4**	
-1'	*Ulva sp.*	5%	8%	5%	3%	5.3%
	Balanus glandula	***1%***	0%	16%	***1%***	4.5%
	Chthamalus dalli	***1%***	0%	0%	27%	7.0%
	Barnacle sp. (SUM)	2%	0%	16%	28%	11.5%
	Fucus distichus	0%	0%	0%	***1%***	0.3%
	Filamentous red (RA)	0%	0%	10%	0%	2.5%
	Mytilus trossulus	***1%***	0%	0%	0%	0.3%
	Substrate	S, C, Sh	S, G, C. Sh	S, C, B, sh	S, G, C, Sh	
C/S, S, G, C, B, E, Sh=						
Clay/Silt, Sand, Gravel, Cobbles, Boulders, Erratic, Shell Debris						
1% (bold and italicized) =less than 1%						
RA = Red Algae						

Boulevard Park Pete's Beach Central		6/5/2015					
Percent Cover of Algae, Plants, and Colonial Animals							
Transect	Species	Quadrat, ft.				Average	Standard
Elevation		**1**	**2**	**3**	**4**	percent	Deviation
6'	*Balanus glandula*	1%	**1%**	0%	6%	2.0%	2.7%
	Chthamalus dalli	0%	0%	0%	11%	2.8%	5.5%
	Barnacle sp.	0%	0%	**1%**	0%	0.3%	0.5%
	Barnacle sp. (SUM)	1%	1%	1%	17%	5.0%	8.0%
	Mastocarpus sp. (RA)	0%	0%	0%	**1%**	0.3%	0.5%
	Substrate	C, B, G	C, B, G, Sh	C, G, Sh	B, G		
		1	**2**	**3**	**4**		
4'	*Balanus glandula*	23%	13%	21%	1%	14.5%	10.0%
	Balanus crenatus	0%	0%	0%	1%	0.3%	0.5%
	Chthamalus dalli	5%	0%	0%	0%	1.3%	2.5%
	Barnacle sp. (SUM)	28%	13%	21%	2%	16.0%	11.2%
	Mastocarpus sp.	***1%***	0%	0%	0%	0.3%	0.5%
	Bladed Red Algae (SUM)	***1%***	0%	0%	0%	0.3%	0.5%
	Mytilus trossulus	1%	**1%**	2%	**1%**	1.3%	0.5%
	Substrate	C, B, G, Sh	C, B,G	C, B, G	C, G, Sh		
		1	**2**	**3**	**4**		
1'	*Balanus crenatus*	0%	0%	6%	0%	1.5%	3.0%
	Balanus glandula	13%	20%	13%	26%	18.0%	6.3%
	Chthamalus dalli	1%	0%	7%	2%	2.5%	3.1%
	Barnacle sp. (SUM)	14%	20%	26%	28%	22.0%	6.3%
	Caulacanthus sp. (RA)	1%	**1%**	6%	0%	2.0%	2.7%
	Mastocarpus sp. (RA)	0%	**1%**	0%	0%	0.3%	0.5%
	Red Algae total	1%	2%	6%	0%	2%	3%
	Mytilus trossulus	1%	1%	2%	1%	1.3%	0.5%
	Substrate	C, Sh	C, G, Sh	C, G, Sh	S,B, Sh		
		1	**2**	**3**	**4**		
-1'	Ulva sp.	0%	0%	1%	0%	0.3%	0.5%
	Balanus crenatus	12%	29%	30%	4%	18.8%	12.8%
	Balanus glandula	0%	0%	11%	1%	3.0%	5.4%
	Chthamalus dalli	0%	0%	0%	26%	6.5%	13.0%
	Barnacle sp. (SUM)	12%	29%	41%	31%	28.3%	12.0%
	Mastocarpus sp. (RA)	1%	0%	0%	0%	0.3%	0.5%
	Mytilus trossulus	**1%**	0%	0%	0%	0.3%	0.5%
	Substrate	G	C/S, C, S, B, G	C, S, Sh	C, B, Sh		
C/S, S, G, C, B, E, Sh=							
Clay/Silt, Sand, Gravel, Cobbles, Boulders, Erratic, Shell Debris							
1% (bold and italicized) =less than 1%							
RA = Red Algae							

Boulevard Park Pete's Beach North			6/22/2013			
Countable Animals in Quadrat						
Transect	Species	Quadrat				Average
Elevation		1	2	3	4	Count
6'	*Littorina scutulata*	0	20	0	0	5.0
	Littorina sitkana	0	50	0	0	12.5
	Littorina sp. (SUM)	0	70	0	0	17.5
	Substrate in quadrat:	Rr	C, Rr	G, B, Rr	G	
4'	*Littorina scutulata*	3	25	0	34	15.5
	Littorina sitkana	1	0	0	0	0.3
	Littorina sp.	0	0	1	0	0.3
	Littorina sp. (SUM)	4	25	1	34	16.0
	Idotea wosnesenskii	0	2	0	0	0.5
	Substrate in quadrat:	C, G	B, C, G	G, C, B	G, B	
1'	*Lottia pelta*	5	0	0	0	1.3
	Tectura persona	1	7	30	0	9.5
	Tectura scutum	0	8	16	0	6.0
	Limpets (SUM)	6	15	46	0	16.8
	Clinocardum nuttali	1	0	0	0	0.3
	Littorina scutulata	5	16	39	0	15.0
	Littorina sitkana	3	0	0	0	0.8
	Littorina sp. (SUM)	8	16	39	0	15.8
	Pagurus sp.	1	0	0	0	0.3
	Hemigraspus nudus	1	0	0	0	0.3
	Substrate in quadrat:	G, B, Sh	G, C, Sh	G, C, Sh	G, C, Sh, B	
-1'	*Lottia pelta*	0	5	0	0	1.3
	Tectura persona	0	6	0	0	1.5
	Tectura scutum	6	0	0	0	1.5
	Limpets (SUM)	6	11	0	0	4.3
	Littorina sp.	0	2	0	0	0.5
	Hemigraspus nudus	0	0	1	0	0.3
	Substrate in quadrat:	C	B, S, Sh	S, B, C, Sh	C/S, C	
C/S, S, G, C, B, E, Sh=						
Clay/Silt, Sand, Gravel, Cobbles, Boulders, Erratic, Shell Debris						

Boulevard Park Pete's Beach North			6/14/2014			
Countable Animals in Quadrat						
Transect	Species	Quadrat				Average
Elevation		1	2	3	4	Count
6'	*Littorina scutulata*	0	33	51	31	28.8
	Littorina sitkana	0	0	2	5	1.8
	Littorina sp. (SUM)	0	33	53	36	30.5
	Neomolgus littoralis	0	0	1	0	0.3
Substrate		B	G, B	G, C, B	G, C, B	
4'	*Lottia pelta*	0	0	0	4	1.0
	Limpet spp. (SUM)	0	0	0	4	1.0
	Littorina scutulata	0	48	0	0	12.0
	Littorina spp.	0	0	0	6	1.5
	Littorina sp. (SUM)	0	48	0	6	13.5
Substrate		S, G, C, B	G, C, B	G, C	C, B	
1'	*Lottia pelta*	40	1	0	2	10.8
	Tectura persona	0	0	14	0	3.5
	Tectura scutum	0	0	4	0	1.0
	Limpet spp. (SUM)	40	1	18	2	15.3
	Littorina scutulata	60	5	24	0	22.3
	Littorina sp. (SUM)	60	5	24	0	22.3
Substrate		Bedrock	G, C, B	G, C, B	G, C, B	
-1'	*Lottia pelta*	4	0	0	41	11.3
	Tectura scutum	33	0	0	18	12.8
	Limpet spp. (SUM)	37	0	0	59	24
	Littorina scutulata	0	0	0	1	0.3
	Littorina sp. (SUM)	0	0	0	1	0.3
	Anthopluera artemisia	3	0	0	0	0.8
	Pagurus sp.	2	0	0	0	0.5
	Hemigrapsus sp.	0	1	0	0	0.3
Substrate		S, G, C, B	S, G, C, B	S	S, G, C	
C/S, S, G, C, B, E, S, Br =						
Clay/Silt, Sand, Gravel, Cobbles, Boulders, Erratic, Shell Debris, Bedrock						

Boulevard Park Pete's Beach North			6/3/2015			
Countable Animals in Quadrat						
Transect	Species	Quadrat				Average
Elevation		1	2	3	4	Count
6'	*Lottia pelta*	0	0	3	0	0.8
	Lottia digitalis	0	0	4	0	1.0
	Limpet sp. (SUM)	0	0	7	0	1.8
	Littorina scutulata	0	0	61	0	15.3
	Littorina sitkana	0	0	11	0	2.8
	Littorina sp. (SUM)	0	0	77	0	19.3
Substrate		B	B	C, B, G, Sh	C, B, G, Sh	
4'	*Lottia digitalis*	7	0	0	0	1.8
	Lottia pelta	0	0	7	0	1.8
	Tectura persona	3	0	0	0	0.8
	Limpet sp. (SUM)	10	0	7	0	4.3
	Littorina scutulata	128	49	123	56	89.0
	Littorina sp. (SUM)	128	49	123	56	89.0
Substrate		C, B, Sh	C, B, G	C, B, G, Sh	C, B, G, Sh	
1'	*Lottia pelta*	0	78	0	3	20.3
	Lottia digitalis	0	0	28	0	7.0
	Tectura scutum	0	0	11	0	2.8
	Limpet sp. (SUM)	0	78	39	3	30.0
	Protothaca staminea	0	2	0	0	0.5
	Littorina scutulata	0	201	172	0	93.3
	Littorina sp.	0	0	0	54	0.0
	Littorina sp. (SUM)	0	201	172	54	93
	Ophiodermella ineris	0	0	1	0	0.3
Substrate		Br	C, B, Sh	C, B, G, Sh	C, B, G, Sh	
-1'	None					
Substrate		C, S, Br	C, B, Sh	S, B, Sh	C/S, C, S, B, Sh	
C/S, S, G, C, B, E, Sh, Br =						
Clay/Silt, Sand, Gravel, Cobbles, Boulders, Erratic, Shell Debris, Bedrock						

Boulevard Park Pete's Beach Central			6/23/2013			
Countable Animals in Quadrat						
Transect	Species	Quadrat				Average
Elevation		1	2	3	4	Count
6'	*Littorina scutulata*	6	1	29	0	9.0
	Littorina sitkana	0	0	38	0	9.5
	Littorina sp. (SUM)	6	1	67	0	18.5
	Substrate in quadrat:	G	G	G, B, C	G, B, C	
4'	*Littorina scutulata*	0	0	27	0	6.8
	Littorina sitkana	27	0	30	0	14.3
	Littorina sp. (SUM)	27	0	57	0	21.0
	Substrate in quadrat:	C, B	B, C	C, B	G, B, C	
1'	*Lottia pelta*	53	5	0	23	20.3
	Tectura persona	0	5	0	0	1.3
	Limpets (SUM)	53	10	0	23	21.5
	Littorina scutulata	93	5	0	59	39.3
	Littorina sitkana	0	2	0	3	1.3
	Littorina sp. (SUM)	93	7	0	62	40.5
	Substrate in quadrat:	G, C, B, Sh	G, B, S, Sh	C, B, Sh	G, C, Sh	
-1'	*Lottia pelta*	0	0	3	1	1.0
	Tectura persona	0	0	1	34	8.8
	Limpets (SUM)	0	0	4	35	9.8
	Littorina sitkana	0	1	0	0	0.3
	Littorina scutulata	0	4	0	0	1.0
	Littorina sp. (SUM)	0	5	0	0	1.3
	Pagurus sp.	0	3	0	3	1.5
	Hemigraspus sp.	1	0	0	0	0.3
	Hemigraspus nudus	0	0	0	8	2.0
	Hemigraspus sp. (SUM)	1	0	0	8	2.3
	Substrate in quadrat:	B, C, G, S, Sh	S, B, Sh, G	S, B	C, G	
C/S, S, G, C, B, E, Sh=						
Clay/Silt, Sand, Gravel, Cobbles, Boulders, Erratic, Shell Debris						

Boulevard Park Pete's Beach Central			6/14/2014			
Countable Animals in Quadrat						
Transect	Species	Quadrat				Average
Elevation		1	2	3	4	Count
6'	*Littorina scutulata*	1	2	15	25	10.8
	Littorina sitkana	0	0	26	14	10.0
	Littorina sp.(SUM)	1	2	41	39	20.8
	Amphipod	1	0	0	0	0.3
Substrate		S, G, C	G, C, B	S, G, C, B	G, C, B	
4'	*Lottia pelta*	0	0	1	3	1.0
	Tectura persona	0	0	2	0	0.5
	Limpet sp. (SUM)	0	0	3	3	1.5
	Littorina scutulata	140	65	116	70	97.8
	Littorina sitkana	53	1	5	44	25.8
	Littorina sp. (SUM)	193	66	121	114	123.5
	Neomolgus littoralis	0	0	2	0	0.5
Substrate		G, C, B,	G, C,	G, C, B	G, C, B	
1'	*Lottia pelta*	86	8	0	43	34.3
	Tectura scutum	2	13	0	1	4.0
	Limpet sp. (SUM)	88	21	0	44	38.3
	Littorina scutulata	59	7	0	19	21.3
	Littorina sitkana	0	3	0	0	0.8
	Littorina sp. (SUM)	59	10	0	19	22.0
Substrate		G, C, B, Sh	S,G, C, Sh	G, C, Sh	G, C, Sh	
-1'	*Lottia digitalis*	2	0	0	0	0.5
	Lottia pelta	18	0	0	0	4.5
	Limpet sp. (SUM)	20	0	0	0	5.0
	Littorina sitkana	0	0	0	1	0.3
	Littorina spp. (SUM)	0	0	0	1	0.3
	Anthopluera artemisia	1	0	0	0	0.3
	Pagurus granosimanus	2	0	5	0	1.8
	Unidentified crab	0	0	0	1	0.3
Substrate		S, C, Sh	S, G, C. Sh	S, C, B, sh	S, G, C, Sh	
C/S, S, G, C, B, E, Sh=						
Clay/Silt, Sand, Gravel, Cobbles, Boulders, Erratic, Shell Debris						

Boulevard Park Pete's Beach Central			6/3/2015				
Countable Animals in Quadrat							
Transect	Species	Quadrat				Average	Standard
Elevation		1	2	3	4	Count	Deviation
6'	*Littorina scutulata*	19	12	9	0	10.0	7.9
	Littorina sitkana	1	5	7	0	3.3	3.3
	Littorina sp.	0	0	0	18	4.5	9.0
	Littorina sp.(SUM)	20	17	16	18	17.8	1.7
Substrate		C, B, G	C, B, G, Sh	C, G, Sh	B, G		
4'	*Littorina scutulata*	0	17	0	64	20	30
	Littorina sp.	50	0	46	0	24	28
	Littorina sp. (SUM)	50	17	46	64	44.3	19.7
Substrate		C, B, G, Sh	C, B,G	C, B, G	C, G, Sh		
1'	*Lottia digitalis*	7	0	0	0	1.8	3.5
	Lottia pelta	0	7	31	0	9.5	14.7
	Tectura scutum	0	0	0	4	1.0	2.0
	Tectura persona	0	0	0	2	0.5	1.0
	Limpet sp. (SUM)	7	7	31	6	12.8	12.2
	Littorina scutulata	127	0	219	59	101.3	94.1
	Littorina sp.	0	65	0	0	16.3	32.5
	Littorina (SUM)	127	65	219	59	117.5	74.3
Substrate		C, Sh	C, G, Sh	C, G, Sh	S,B, Sh		
-1'	*Lottia pelta*	7	0	21	0	7.0	9.9
	Tectura scutum	0	0	1	0	0.3	0.5
	Limpet sp. (SUM)	7	0	22	0	7.3	10.4
	Hemigraspsus oregonens	1	0	0	0	0.3	0.5
Substrate		G	C/S, C, S, B, G	C, S, Sh	C, B, Sh		
C/S, S, G, C, B, E, Sh=							
Clay/Silt, Sand, Gravel, Cobbles, Boulders, Erratic, Shell Debris							

Boulevard Park Transect 3		6/23/2013				
Countable Animals in Quadrats						
Transect	Species	Quadrat				Average
Elevation		1	2	3	4	Count
6'	*Littorina sp.*	0	1	0	0	0.25
	Littorina sitkana	0	0	0	1	0.25
	Littorina sp. (SUM)	0	1	0	1	0.50
	Substrate in quadrat:	Rr, G, C	Rr, G	Rr	Rr, G, C	
4'	none					
	Substrate in quadrat:	Rr	Rr	C, G, Sh	Rr,C	
1'	*Lottia pelta*	1	0	0	0	0.25
	Hemigraspus nudus	3	0	0	0	0.75
	Substrate in quadrat:	C, G	B, C, G, Sh	Rr, C, G, Sh	C, G, Sh	
-1'	*Tectura persona*	9	1	15	0	6.25
	Lottia pelta	1	1	1	49	13.00
	Lottia digitalis	0	0	1	0	0.25
	Limpets (SUM)	10	2	17	49	19.5
	Littorina scutulata	0	0	0	4	1.00
	Hemigraspus sp.	1	0	0	0	0.25
	Hemigraspus nudus	0	0	1	3	1.00
	Hemigraspus sp. (SUM)	1	0	1	3	1.25
	Substrate in quadrat:	C, G, Sh	B, C, G, Sh	Rr, B, G	Rr, B	
C/S, S, G, C, B, E, Sh=						
Clay/Silt, Sand, Gravel, Cobbles, Boulders, Erratic, Shell Debris						
1% (bold and italicized) = less than 1%						
RA = Red Algae						

Boulevard Park Transect 3		6/15/2014				
Percent Cover of Algae, Plants, and Colonial Animals						
Transect	Species	Quadrat				Average
Elevation		1	2	3	4	Count
6'	None					
Substrate		C	C	C	C	
4'	*Littorina scutulata*	0	0	1	2	0.75
Substrate		C, B	G, C	G, C	C, B	
1'	*Lottia pelta*	0	1	0	0	0.3
	Tectura persona	0	0	3	0	0.8
	Limpet sp. (SUM)	0	1	3	0	1
	Littorina scutulata	0	0	0	4	1.0
	Hemigrapsus oregonensis	0	0	0	1	0.3
	Pagurus sp.	0	0	0	1	0.3
Substrate		C, B	G, C, B	G, C, B	G,C	
-1'	*Lottia pelta*	0	16	0	58	18.5
	Tectura scutum	0	0	0	3	0.8
	Limpet spp.	0	0	1	0	0.3
	Limpet spp. (SUM)	0	16	1	61	19.5
	Littorina scutulata	0	1	0	7	2.0
	Littorina sp.	0	0	1	0	0.3
	Littorina sp. (SUM)	0	1	1	7	2.3
	Hemigrapsus sp.	0	0	0	1	0.3
Substrate		S, G, C, B	S, G, C, B	G, C, B	S, G, C	
C/S, S, G, C, B, E, Sh=						
Clay/Silt, Sand, Gravel, Cobbles, Boulders, Erratic, Shell Debris						

Boulevard Park Transect 3		6/5/2015				
Percent Cover of Algae, Plants, and Colonial Animals						
Transect	Species	Quadrat				Average
Elevation		1	2	3	4	Count
6'	*Lottia pelta*	1	0	0	0	0.25
	Limpet sp. (SUM)	1	0	0	0	0.25
Substrate		C, B	C	C	C	
4'	*Tectura persona*	0	0	0	3	0.75
	Limpet sp. (SUM)	0	0	0	3	0.75
	Littorina scutulata	3	0	0	35	9.50
	Littorina sp. (SUM)	3	0	0	35	9.50
Substrate		C.B	C, G	C, G	C, B, G	
1'	*Lottia pelta*	0	4	62	0	16.5
	Tectura scutum	42	15	0	0	14.3
	Limpet sp. (SUM)	42	19	62	0	31
	Littorina scutulata	11	15	12	0	9.5
	Littorina sp. (SUM)	11	15	12	0	9.5
	Hemigrapsus nudus	0	0	0	1	0.3
	Hemigrapsus sp. (SUM)	0	0	0	1	0.3
Substrate		C,B	C, B, Sh	C	C, B, Sh	
-1'	*Lottia pelta*	0	0	26	20	11.5
	Tectura scutum	1	0	1	0	0.5
	Limpet sp. (SUM)	1	0	27	20	12.0
	Clinocardium nuttallii	0	0	0	1	0.3
	Littorina scutulata	0	0	1	0	0.3
	Littorina sitkana	0	0	2	0	0.5
	Litorina sp. (SUM)	0	0	3	0	0.8
	Unidentified anemone	1	0	0	0	0.3
	Hemigrapsus oregonensis	3	0	6	0	2.3
	Hemigrapsus sp.	0	4	0	0	1.0
	Hemigrapsus sp. (SUM)	3	4	6	0	3.3
Substrate		C, G, Sh	C, S, G, Sh	C, B, Sh	C, B, Sh	
C/S, S, G, C, B, E, Sh=						
Clay/Silt, Sand, Gravel, Cobbles, Boulders, Erratic, Shell Debris						
1% (bold and italicized) =less than 1%						
RA = Red Algae						

Boulevard Park Transect 7		6/23/2013				
Countable Animals in Quadrats						
Transect	Species	Quadrat				Average
Elevation		1	2	3	4	Count
6'	*Littorina scutulata*	0	0	5	2	1.75
	Littorina sitkana	0	0	2	6	2.00
	Littorina sp. (SUM)	0	0	7	8	3.75
	Substrate in quadrat:	G, C	Ims, R	B, Co, C, G, Br	B, C, G	
4'	*Tectura persona*	0	0	7	0	1.75
	Lottia digitalis	0	0	0	1	0.25
	Limpets (SUM)	0	0	7	1	2.00
	Littorina scutulata	10	6	23	4	10.75
	Littorina sitkana	5	21	2	2	7.50
	Littorina sp. (SUM)	15	27	25	6	18.25
	Substrate in quadrat:	Co, B, G, R	Cs	B, C, G	Co, Br, R	
1'	*Lottia pelta*	22	0	0	5	6.75
	Littorina scutulata	3	0	0	0	0.75
	Littorina sitkana	11	0	0	1	3.00
	Littorina sp. (SUM)	14	0	0	1	3.75
	Hemigrapsus nudus	4	0	0	0	1.00
	Hemigrapsus oregonensis	2	0	0	0	0.50
	Hemigrapsus sp. (SUM)	6	0	0	0	1.50
	Substrate in quadrat:	Br, R, C, Sh, G	B, Br	C	G, C	
-1'	*Tectura persona*	1	0	48	0	12.25
	Lottia pelta	8	0	0	4	3.00
	Limpets (SUM)	9	0	48	4	15.25
	Hemigrapsus nudus	0	0	0	2	0.50
	Hemigrapsus oregonensis	0	0	1	0	0.25
	Hemigrapsus sp (SUM)	0	0	1	2	0.75
	Polychaete sp.	0	0	1	0	0.25
	Substrate in quadrat:	B, Sh, M	C, G, B, Br	B, S, Co, G	Co, G, S, B, Sh	

Boulevard Park Transect 7		6/15/2014				
Individual Animals in Quadrats						
Transect	Species	Quadrat				Average
Elevation		1	2	3	4	Count
6'	None					
Substrate		G, C	G, C	G, C	C	
4'	None					
Substrate		G, C	G, C	G, C	G, C	
1'	None					
Substrate		G, C	G, C	C	G,C	
-1'	*Lottia pelta*	2	0	1	0	0.75
	Tectura persona	0	0	0	1	0.25
	Tectura scutum	15	0	0	0	3.75
	Limpet sp. (SUM)	17	0	1	1	4.75
	Littorina scutulata	0	0	0	1	0.25
	Hemigrapsus nudus	1	0	0	1	0.50
	Hemigrapsus oregonensis	1	0	1	0	0.50
	Hemigrapsus sp. (SUM)	2	0	1	1	1.00
Substrate		C, B	C, B	G, C, B	G, C	
C/S, S, G, C, B, E=						
Clay/Silt, Sand, Gravel, Cobbles, Boulders, Erratic						

Boulevard Park Transect 7		6/5/2015				
Counts of Animals in Quadrats						
Transect	Species	Quadrat				Average
Elevation		1	2	3	4	Count
6'	None					
Substrate		C	C	C	C	
4'	None					
Substrate		C	C	C, B, G	C, G	
1'	*Tectura scutum*	0	0	0	1	0.3
	Limpet sp. (SUM)	0	0	0	1	0.3
	Hemigrapsus nudus	1	0	0	5	1.5
	Hemigrapsus sp. (SUM)	1	0	0	5	1.5
Substrate		C	C	C, B, G, Sh	C	
-1'	*Lottia pelta*	39	20	0	0	14.8
	Lottia digitalis	6	0	0	0	1.5
	Tectura persona	0	5	81	0	21.5
	Tectura scutum	10	0	0	0	2.5
	Limpet sp.	0	0	0	173	43.3
	Limpet sp. (SUM)	55	25	81	173	83.5
	Littorina scutulata	6	0	0	2	2.0
	Littorina sp. (SUM)	6	0	0	2	2.0
	Hemigrapsus oregonensis	2	0	2	0	1.0
	Hemigrapsus sp. (SUM)	2	0	2	0	1.0
Substrate		C, B	C, B	B, E	C, B	
C/S, S, G, C, B, E, Sh=						
Clay/Silt, Sand, Gravel, Cobbles, Boulders, Erratic, Shell Debris						

Appendix C: Species Lists

The species list from 2013 is attached. Species lists from 2014 and 2015 are available electronically as they are too extensive to be easily formatted and used in paper copy.

2013 Boulevard Park Species List

Key
1=Species found along a single transect
2=Species found along both transects

Animals – Pete's Beach

Common Name	Genus/Species	Distance from Back Shore 10-20	20-30	30-40	40-50	50-60	60-70	70-80
ANTHROPODA								
Acorn Barnacle	*Balanus glandula*	2	2	2	2	2	2	2
Amphipod	Unknown	1		1	1	1	1	1
Beach Hopper	Unknown			1	1	1		
Crenate Barnacle	*Balanus crenatus*	1	1	1	1	1		
Graceful Crab	*Cancer gracilis*						1	1
Grainy Hand Hermit	*Pagurus granosimanus*				1	1	1	1
Hairy Shore Crab	*Hemigraspus oregonensis*		1	2	2	2	2	1
Hermit Crab	*Pagurus sp.*							1
Little Brown Barnacle	*Cthamalus dalli*	2	2	1	1	1	1	
Pillbug Isopod	*Gnorimosphaeroma oregonensis*					1		2
Purple Shore Crab	*Hemigraspus nudus*	2	2	2	2	2	2	2
Rockweed Isopod	*Idotea wosnesenskii*			1	1	2	1	1
ANNELIDA								
Goddess Worms	*Nephytidae sp.*				1	1	1	1
Iridescent Worms	*Lumbrineridae sp.*						1	
NEMERTEA								
Purple Ribbon Worm	*Paranemertes peregrina*							1
MOLLUSCA								
Checkered Periwinkle	*Littorina scutulata*		1	1	1	1	1	1
Japanese Littleneck	*Venerupis phillipinarum*						1	1
Mask Limpet	*Tectura persona*	1	2	2	1			
Pacific Blue Mussel	*Mytilus trossulus*		2	2	2	2	2	2
Pacific Oyster	*Crassostrea gigas*							1
Plate Limpet	*Tectura scutum*			1	1	2	1	1
Shield Limpet	*Lottia pelta*	1	1	1	2	2	2	2
Sitka Periwinkle	*Littorina sitkana*		2	2	2	2	1	1
Varnish Clam	*Nuttallia obscura*				1			

Plants – Pete's Beach

CHLOROPHYTA								
Sea Lettuce	*Ulva lactuca*							2
Unknown	*Ulva sp. (tubular)*							1
ORCHOPHYTA								
Rockweed	*Fucus distichus*		2	2	2	2	2	2
Japanese Wireweed	*Sargassum muticum*							1
RHODOPHYTA								
Turkish Washcloth	*Mastocarpus sp.*		2	2	2	1	2	
Bleached Brunette	*Cryptosiphonia woodii*							2
Sea Moss	*Endocladia muricata*			1			1	

Animals - Restored Beach

Common Name	Genus/Speces	Distance from Back Shore 10-20	20-30	30-40	40-50	50-60	60-70	70-80	80-90	90-100[1]
ANTHROPODA										
Acorn Barnacle	*Balanus glandula*	1	2	2	2	2	2	2	2	
Amphipod	Unknown	1	2	2	2	1	1	1		
Crenate Barnacle	*Balanus crenatus*		2	2	2	1	2	2	1	1
Grainyhand Hermit	*Pagurus granosimanus*							1	1	
Hairy Hermit Crab	*Pagurus hirsutiusculus*								1	
Hairy Shore Crab	*Hemigraspus oregonensis*	1	1	1	1	1	2	1	1	1
Hermit Crab	*Pagurus sp.*				1			1		
Isopod	*Idotea sp.*						1	1		
Little Brown Barnacle	*Chthamauls dalli*		2	2	2		1			
Pill Bug Isopod	*Gnorimosphaeroma oregonesis*		1		1	2	1	1	1	
Purple Shore Crab	*Hemigrasphus nudus*	1	2	2	2	2	2	2	2	1
Rockweed Isopod	*Idotea wosnesenskii*	1		1			1			
NEMERTEA										
Purple Ribbon Worm	*Paramertes peregrine*				1		1	2	1	
ANNELIDA										
Nephtyidae	*Nephtys ferruginea*							1		1
NEREIDAE										
Pile Worm	*Allita succinea*				1	1	1	1		1
MOLLUSCA										
Checkered Periwinkle	*Littorina scutulata*	1	2	2	2	2	2	2		
Eelgrass Limpet	*Lottia alveus parallela*								1	1
Heart Cockle	*Clinocardium nutalli*					1		1		1
Japanese Littleneck	*Venerupis phillipinarum*			1	1	1				
Mask Limpet	*Tectura persona*	1	1	1	1	2	2	1	1	
Pacific Blue Mussel	*Mytilus trossulus*	1	2	2	2	2	2	2	1	1
Pacific Oyster	*Crassostrea gigas*					1	1	1		
Plate Limpet	*Tectura scutum*		1	2	2	1				
Shield Limpet	*Lottia pelta*		1	1	2	2	2	1		1
Sitka Periwinkle	*Littorina sitkana*	1	2	2	2	1				
CNIDARIA										
Moonglow Anemone	*Anthopleura Artemisia*							1	1	
ECHINODERMATA										
Ochre Star	*Pisaster ochraceus*							2		

Plants-Restored Beach

CHLOROPHYTA										
Sea Lettuce	*Ulva lactuca*	1		1	2	2	2	2	2	1
Sea Lettuce	*Ulva sp. (tubular)*							2		
ORCHOPHYTA										
Rockweed	*Fucus distichus*	1	2	2	2	2	1			
RHODOPHYTA										
Turkish Washcloth	*Mastocarpus sp.*	1	1	2	1	2	2	1		
Unknown	*Ceramium sp.*							1		
Filamentous Red.	Unknown		1	1	1	1	1	1		
MONOCOTS										
Native Eelgrass	*Zostera marina*							1	1	1

[1] 0-10' and 90-100' segment was only recorded along Transect 7