

Intertidal Biota Monitoring in the Cherry Point and Fidalgo Bay Aquatic Reserves

2013-2018 Monitoring Report



Prepared for:

Washington Department of Natural Resources

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November 2018

Publication Information

This Monitoring Report describes the research and monitoring study of intertidal biota conducted in the summers of 2013-2018 in the Cherry Point and Fidalgo Bay Aquatic Reserves.

Copies of this monitoring report will be available at <https://www.aquaticreserves.org/resources/>.

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Acknowledgments

Most of the sampling protocols and procedures are based on the work of the Island County/Washington State University Beach Watchers (currently known as the Sound Water Stewards). 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 the Washington State Department of Natural Resources and especially Betty Bookheim for her assistance in refining the procedures. 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 and Dr. Jason Toft of University of Washington more recently for also lending his expertise in looking for ways to improve this study, particularly with a regional scale in mind.

Surveys, data entry, quality control assistance and report writing were made possible by a vast array of interns and volunteers over the years. Interns contributing to this report include Evona Cole, Kaylene Riehle, and Katie Ayres. AmeriCorps member Natalie Lord contributed to leading and collecting data for 2017 and 2018. AmeriCorps member Lilya Jaeren contributed greatly to data management, graphs, tables, and some of the report. Additional assistance for quality assurance came from volunteer marine biologist Michael Kyte. On the beach assistance for identification was given by Bob Lemon, Doug Stark, Linda Schroeder, Lynn Givler, Glen “Alex” Alexander, Marie Hitchman, and Michael Kyte. These individuals made all the difference to having a successful program.

This project has been funded in part by the United States Environmental Protection Agency under assistance agreement PC-00J90701 through the Washington Department of Fish and Wildlife. The contents of this document do not necessarily reflect the views and policies of the Environmental Protection Agency or the Washington Department of Fish and Wildlife, nor does mention of trade names or commercial products constitute endorsement or recommendation for use.

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Intertidal Biota Monitoring in the Cherry Point and Fidalgo Bay Aquatic Reserves

2016-2018 Monitoring Report

Abstract

The Cherry Point and Fidalgo Bay Aquatic Reserves Citizen Stewardship Committees and RE Sources for Sustainable Communities conducted intertidal surveys seasonally beginning in 2013 through 2018 in the Cherry Point and Fidalgo Bay Aquatic Reserves to document beach conditions including slope, substrate, and intertidal animals and plants along profiles at each of the four sites at each aquatic reserve (8 total sites). On each profile, the number of individual animals and areal coverage of plants, algae, and colonial and aggregating animals within four 50 cm X 50 cm (1.6 ft x 1.6 ft) quadrats at the +1 foot (ft), 0 ft, and -1 ft (+0.3 m, 0 m, and -0.3 m) mean lower low water (MLLW) tidal elevations were recorded. Methods were modified from those of the Sound Water Stewards of Island County, formerly the Washington State University Island County Extension Beach Watchers (Beach Watchers 2003). The purpose of the monitoring was to collect data to establish a robust baseline for detecting trends and changes while engaging citizen science volunteers.

Introduction

The Cherry Point Aquatic Reserve (CPAR) and Fidalgo Bay Aquatic Reserve (FBAR) are two of seven aquatic reserves in Puget Sound managed by the Washington Department of Natural Resources (WA DNR). While extensive historic data exists on the flora and the fauna of the intertidal zone of the CPAR and FBAR (e.g., Kyte 2012, Sylvester and Wennekens 1956), data gaps still exist. This intertidal monitoring project is intended to provide a baseline for detection of changes and trends. Acquired baseline information can be used for natural resource damage assessment, reserve management, serve as early detection of invasive species, and protection of critical habitats and protected species. This document reports on six years of the monitoring program conducted by the CPAR Citizen Stewardship Committee (CPAR CSC) and FBAR Citizen Stewardship Committee (FBAR CSC), and provides a comparison of years 2013-2018. The project included training citizen scientists to identify intertidal species and to measure species distribution and abundance within the aquatic reserve along with capturing elevation profiles at each site.

Cherry Point Aquatic Reserve

CPAR (Figure 1) is designated by the WA DNR as an Environmental Reserve. An environmental reserve is an area of biological importance requiring special protective management where continued monitoring is a priority. The main purpose for establishing Cherry Point as a reserve was to preserve critical spawning habitat for a late-spawning stock of Pacific herring (*Clupea pallasii*). A broader purpose was to continue to conserve and enhance native habitats and associated plant and wildlife species, with special emphasis on herring, salmon, resident and migratory birds, Dungeness crab, groundfish rearing areas, and marine mammals (WA DNR 2010).

Most of the uplands adjacent to the Reserve are privately owned by five entities: BP, Pacific International Terminals, Alcoa-Intalco, Phillips 66, and Cherry Point Industrial Park. North of the industrial area are private residential lots and a small county-owned public access area south and east of Point Whitehorn. Birch Bay State Park adjoins the aquatic reserve to the north and east. The Lummi Indian Reservation is adjacent to the south boundary of the reserve. The

Lummi, Nooksack, Swinomish, Squamish, and Tulalip Tribes are federally recognized tribes with usual and accustomed areas at CPAR.

Fidalgo Bay Aquatic Reserve

The FBAR (Figure 2) is also designated by the WA DNR as an Environmental Reserve. One of the primary reasons for establishing a reserve in Fidalgo Bay is the preservation of critical habitat for forage fish spawning. A broader purpose is to conserve and enhance native habitats and associated plant and wildlife species, with a special emphasis on forage fish, salmonids, and migratory birds (WA DNR, 2008).

In the FBAR Management Plan, the Swinomish, Tulalip, Suquamish, Nooksack, and Lummi Tribes have asserted claim to usual and accustomed areas in Fidalgo Bay. The Swinomish and Samish Tribes have properties adjacent to the reserve. The Swinomish Tribal Community is located southeast of Fidalgo Bay with some land holdings on the east side of the bay. Samish Tribe properties are located on the western shore of FBAR. Andeavor (formerly Tesoro and soon to be Marathon Petroleum Corp. in 2019) and Shell refineries own properties on March Point, on the eastern shore of the reserve. Other property owners adjacent to the reserve include the City of Anacortes as well as smaller landholders. The area of the reserve south of the trestle was transferred from the Skagit Land Trust to WA DNR, with the condition that it is a conservation easement. The easement requires that the area be used for fish and wildlife enhancement while limiting human activities.

Goals and Objectives

The goal of this project is to provide a baseline for detection of changes. The specific objective is to collect baseline data on beach slope, substrate, and intertidal biota at eight monitoring sites, four in each reserve. The monitoring provides a baseline for detecting changes in intertidal habitats, species composition, and species abundance due to natural or human-caused events including the appearance of invasive species. Intertidal monitoring data are also intended to potentially aid in natural resource damage assessment in the event of an oil spill or other event, and to reserve management.

Methods

This project documents a fixed list of marine animals and plants living on the beach surface sediments (epibiota) as well as those animals living within the sediment (infaunal species). Monitoring methods were based on those established by the Sound Water Stewards of Island County, formerly Washington State University (WSU) Beach Watchers, Intertidal Monitoring Program (Beach Watchers 2003). Modifications were made to enhance the representativeness of the data, while retaining key elements aimed to keep monitoring data comparable to other intertidal studies similarly based on the Beach Watchers original protocol. A Quality Assurance Project Plan (QAPP) was created and updated to ensure that data are comparable across monitoring sites, monitoring studies in other reserves, and monitoring years. The protocols used for this project are detailed by Steffensen and Joyce (2013). Quality assurance and quality control measures are implemented in all project steps.

Citizen Science Training

RE Sources, WA DNR, CPAR CSC, FBAR CSC, the Northwest Straits Foundation, and knowledgeable citizen scientists provided trainings in Whatcom and Skagit counties to volunteers from local and regional communities and from the CPAR CSC, FBAR CSC, the Whatcom and Skagit County Marine Resources Committees, Salish Sea Stewards, North Sound

Stewards, and Anacortes High School. Similar trainings were held in Whatcom and Skagit counties, and volunteers could attend either training and be qualified to conduct surveys in either county.

In Whatcom County in 2016, citizen scientists were trained in a 2-hour classroom session on April 5th followed by a 6-hour combined classroom and field training on April 10, 2016. In Skagit County in 2016, citizen scientists were trained in a 4-hour classroom session during a Salish Sea Stewards class on March 22nd, followed by a 6-hour combined classroom and field training on April 9, 2016. A total of about 70 volunteers were trained in 2016. In 2017 the trainings were changed to better suit volunteers' interests and learning needs. In both counties, the training consisted of a 4-hour training with a combination of classroom and field sessions, which worked well with about 20-25 participants at each training. Training session time was also decreased as the need to learn to identify to species level for quadrats was eliminated. After positive feedback in 2017, the new training curriculum was used for 2018 and will be used in the future. Training included protocols for measuring slope, identifying and counting plants and animals, estimating percent cover of plants and certain animals, and completing data sheets while following quality assurance and quality control measures.

Field Data Collection

The study used a transect/quadrat model with a profile line from approximately ordinary high water to one foot below mean lower low water (-1 ft MLLW) or lower, if the tide allowed (Figure 3). The Beach Waters (2003) protocols were modified to include four randomly placed quadrats on each transect.

Five types of data were collected:

1. **Profile Data-** Elevation profile data was taken along a transect across the beach face perpendicular to the shoreline (see Figure 4 for typical beach morphology). Data recorded include beach slope and presence/absence of substrate type.
2. **Quadrat Data: Percent Cover-** Four randomly placed 50 cm X 50 cm (1.6 ft x 1.6 ft) quadrats were located at each of three tidal elevations: +1 ft, 0 ft, and -1 ft MLLW. The first quadrat was placed randomly between 0-16.5 ft to the nearest half a foot. Each quadrat was then placed 16.5 ft away from the previous quadrat on the transect (Figure 3). Colonial and aggregating animal species, sea grass, and macroalgae cover were estimated in each quadrat. Species were identified in groups as shown on the data sheets in Appendix E.
3. **Quadrat Data: Individual Species-** Individual epifauna species were counted within the same quadrats as those for percent cover. Organisms smaller than 3 mm (0.04 inches) in their longest dimension were not counted. Species were identified in groups as shown on the data sheets in Appendix E.
4. **Core Data-** A core of 15 cm (6 inches) width X 30 cm (12 inches) depth was taken at the upper right of each quadrat (relative to the beach slope) and species caught on about 1 sq. cm mesh sieve were identified and counted. Core data were only collected at FBAR sites because there is too much cobble at CPAR sites to feasibly take these samples. Species were recorded to the species level when possible.
5. **Species Lists-** Knowledgeable citizen scientists (i.e., "Lead Naturalists") compiled species lists along each profile by sections. Each section was 10-feet (3 m) or longer and 66 feet (20 m) wide along the profile line. Complete lists of species found are presented in Appendix D. The lists reflect only species observed present.

In 2015, a new protocol was added after discussion about usefulness of collected data. This new protocol included counting species individually and by percent cover in each quadrat with minor removal of debris; the same as was done in 2013 and 2014. Next, citizen scientists removed all *Ulva* sp., a green alga that often covers large portions of the beach

substrate when present. *Ulva* removal was added to assess if species were being missed because they were covered by this ephemeral algae.

In 2016, an additional modification was made to the protocol where species identified in quadrats by volunteer citizen scientists were lumped into general groups (see field sheets in Appendix E for groups of species identified). For example, instead of volunteers being expected to correctly identify between the barnacles *Balanus crenatus*, *B. glandula*, *Semibalanus cariosus*, *Chthamalus dalli*, the percent cover of all barnacles was estimated as the group “Barnacles”. This increased the confidence in our quadrat results as well as increased citizen science volunteer recruitment and retention due to a more reasonable expectation.

Survey Site Locations

Four sites were monitored each year in the CPAR (Figure 1) and four in the FBAR (Figure 2). See the *Results and Discussion* section below for descriptions of each site. These sites were chosen based on representativeness and accessibility. Table 1 (Appendix B) contains details of site locations. Surveys were limited to tides lower than -1.5 ft during daylight hours and were scheduled as close as possible to within two weeks of the previous year’s survey.

The Birch Bay State Park site was discontinued in 2015 due to lack of valuable information as very few species were observed and counted, while Point Whitehorn Point was added with the intention to improve the use of limited monitoring resources. However, this site was dropped the following year as too much biota was present to accurately count within any given tide window. Barnacle Rock was selected in 2016 and remained as one of the four monitoring sites for Cherry Point through 2018.

Custom Plywood was added to Fidalgo Bay surveys in 2015 after the sites was restored under the Puget Sound Initiative. Otter was considered a reference site for Custom Plywood because the two sites are relatively close together.

Results and Discussion

Results and discussion for each survey site are presented below, starting from the furthest north site and ending with the most southerly site (Figure 1 and 2). Results for the quadrat and core data from 2013-2018 and profile results for 2016-18 are shown in figures in Appendix A. Profile data from 2013-2015 were omitted because this data was inconsistent for the start point at each site for those years. Permanent markers were better established for each site in 2016 with rebar and rock paint and alleviated much of the previous uncertainty. Graphs for quadrats depict averages of species by general groupings among quadrats for each tidal-height transect. Data are presented for counts after green algae removal, except for green algae. Core data only shows the most frequently found species. Data from 2013 - 2015 were presented in earlier reports and are available electronically from <https://www.aquaticreserves.org/resources/>. Appendix C contains photos of each survey site. The 2016-2018 species lists for each site are in Appendix D. Examples of field sheets are shown in Appendix E.

All the monitoring sites exhibited variations of typical beach morphology (Figure 4). In some cases where riprap was present, little or no backshore, high tide berm, or beach face was present and the low tide terrace began at the toe or bottom of the riprap.

Birch Bay, CPAR

The Birch Bay survey site was located south-west of Birch Bay State Park (Table 1, Photo 1). This site was surveyed in 2013 and 2014. The CPAR CSC decided to not survey Birch Bay in 2015 due to the minimal occurrence of species at the site and

difficulty in determining tidal elevation. The survey effort outweighed the need to continue surveys at this location. Point Whitehorn Point was added in 2015 to replace the Birch Bay survey site, but was later replaced with the Barnacle Rock site in 2016. The results from Birch Bay can be found in the 2013-2014 Cherry Point report, available online: <https://www.aquaticreserves.org/resources/>.

Barnacle Rock, CPAR

Site description: Barnacle Rock (Figure 1, Table 1, Photo 2) was added in 2016. Barnacle Rock is located approximately 330 feet northeast of the former monitoring site Point Whitehorn Point, which was discontinued after the 2015 monitoring season. The new location had been studied in the past, and was chosen due to its shorter profile, and adequate variety of biota for monitoring.

The Barnacle Rock site was studied from 1969-1984 by various scientific contractors for the Ferndale Refinery. A detailed database for this site already exists and may be used to compare with our newly collected data in the future. (Personal communication with Michael Kyte, June 28, 2016.)

Beach profile and substrate: Barnacle Rock has a somewhat moderate slope (Figure 5) with a mixed-coarse substrate of gravel, cobble, boulders, and shell debris. The start point for this profile line is at the toe of a sandy feeder bluff mixed with piles of driftwood, which can make the start point determination difficult, though the 2016-2018 profiles do not differ too greatly.

Species by percent cover: Green algae were the dominant species for all tide heights for each year (Figure 6), followed by barnacles.

Individual species counts: Averages of counts of individual species varied across species and year (Figure 7). Limpets were especially high counts on +1 ft transects in 2018. Non-aggregating anemones were among the most abundant species for +1 ft and 0 ft transect for all three years. Shelled snails were in higher abundance than other species for -1 ft transects for 2016 and 2018.

Point Whitehorn Point, CPAR

Site description: Point Whitehorn Point (Table 1, Photo 3) was surveyed in 2015 when the Birch Bay site was discontinued. The site was on the tip of Point Whitehorn northeast of Point Whitehorn Marine Park and southwest of Birch Bay State Park. This site is different from Point Whitehorn Marine Park, which has been also known as “Point Whitehorn” in 2013 and 2014 reports. The CPAR CSC decided to not survey this site after 2015 due to the extreme diversity of microhabitats, relatively high abundances of epifauna individuals and species, and the profile length, making this site difficult to accurately survey within available tide windows. Barnacle Rock was added in 2016 to replace this survey site. Barnacle Rock is located approximately 330 ft to the northeast of Point Whitehorn Point. The results from the 2015 Point Whitehorn Point are found in the 2013-2015 Cherry Point report, available online at <https://www.aquaticreserves.org/resources/>.

Point Whitehorn Marine Park, CPAR

Site description: The Point Whitehorn Marine Park site (Figure 1, Table 1, Photo 4) is located in the northern third of the CPAR, in the Whatcom County Point Whitehorn Marine Reserve, northwest of the industrial Cherry Point piers and southeast of private property. The monitoring site is accessed using a trail through the reserve to shoreline.

In past reports, this site may have been referred to as “Point Whitehorn”; however, with the addition of the site “Point Whitehorn Point”, the change in name to “Point Whitehorn Marine Park” was made for better distinction between the two sites.

Beach profile and substrate: Gravel, cobbles, boulders, and large woody debris characterized the narrow backshore, high tide berm, and beach face. The low tide terrace consisted mostly of sand with occasional boulders. The elevation profiles (Figure 8) are moderately sloped for this beach with some consistent boulders shown as bumps in all three years. 2018 experienced some extra debris on the beach shown by spikes lower on the profile.

Species by percent cover: Percent cover (Figure 9) varied from year to year. Common species included green algae (including *Ulva* sp.), red algae, barnacles, and the aggregating anemone *Anthopleura elegantissima*. These annual variations may be due to changes in substrate composition, however quadrat substrate type was collected as simple presence/absence data until 2017 when it was collected as percent cover. Discerning clear differences in the presence/absence data was not possible in this case.

Individual species counts: The average number of individual species (Figure 10) were relatively low and varied from year to year, with more individuals and species found in 2018. Both Point Whitehorn Marine Park and Barnacle Rock, which is the closest site to Point Whitehorn Marine Park, experienced a spike in limpets in 2018. In addition to limpets, the most common species included shelled snail species, isopods, and hermit crabs.

Intalco, CPAR

Site description: Intalco (Figure 1, Table 1, Photo 5) is located southeast of Point Whitehorn Marine Park and north of Neptune Beach. The property on which the site is located and the access to it is owned by Alcoa-Intalco and Petrogas and can only be used with permission from the landowner. In 2016 and 2017, Alcoa-Intalco personnel provided a trail that avoided the marine terminal and associated safety concerns as well as an escort from the plant entrance to the head of the trail. In 2018, the monitoring team accessed the site by walking from Gulf Road. Permission to access the property was still needed. Both Alcoa-Intalco and Petrogas were interested in these study results.

Beach profile and substrate: The elevation profiles from 2016-2018 are in Figure 11. The Intalco beach is subject to high wave energy, and the profile at this beach changed more than any other site. Signs of a berm previously seen in the 2013-2015 profiles can still be seen in the profile, which shifts before reaching 40 ft distance. The dominant substrate at Intalco was sand and gravel in the beach face with occasional embedded boulders at and below -1 foot tidal height. The backshore is vegetated.

Species by percent cover: Percent cover (Figure 12) was characterized by the presence of algae and barnacles at -1 ft tidal elevation every year except 2014, but had a complete absence of percent cover species in 2014, 2015, 2017 and 2018 for +1 and 0 ft transects. While this may be explained by change in substrate, data collected was not enough to

determine this. Green algae was highest in abundance in 2018 at +1 ft. Common percent cover species included green, red, and brown algae and barnacles. Greater cover and diversity was observed at -1 ft because of the presence of boulders on the transect. The abundance of species likely was in relation to the substrate found at that elevation.

Individual species counts: The average numbers of species counted as individuals (Figure 13) was also low at Intalco across all years and transect elevations. In the previous 2013-2015 report, a greater diversity and number of species was observed at -1 foot likely due to the of the presence of boulders. However, a greater variety of species was seen at +1 ft in 2016 and 2017 while 2018 again saw the most species in the lower quadrats.

Neptune Beach, CPAR

Site description: Neptune Beach (Figure 1, Table 1, Photo 6) is the furthest south of the CPAR survey sites and is south of all the industrial piers. The site was accessed with the permission of the Lummi Indian Tribe, which owns the tidelands at the access point, and Phillips 66 Ferndale Refinery, owner of the tidelands and adjacent uplands at the monitoring site.

Beach profile and substrate: Elevation profile transects for Neptune Beach were moderately sloped (Figure 14). A high tide berm was present approximately 20 feet from the start of the profiles in 2013. Since then, the berm has moved and become more or less pronounced, depending on the year. The start of the survey was located at the bottom of a feeder bluff and was difficult to locate, even with rebar to mark to starting location, which gets buried. More permanent markers were established to aid in determining the start location in addition to rebar. 2018 experienced some shifts as the beach slope changed most at the top with the most pronounced berm. The relatively pronounced berm and steeper beach face conditions were similar to but reduced in degree from the situation at Intalco because of less wave exposure. The profiles do not line up exactly, which may be due to human sampling error, accretion or erosion of the beach, or a combination of both.

The upper beach face, especially shoreward of the high tide berm was notably sandy. The amount of gravel increased with decreasing elevation to the toe of the beach face. The low tide terrace was covered with cobble and small and medium boulders laying on a matrix of sandy gravel. Interspersed among the boulders below -1 foot MLLW were sand bars.

Species by percent cover: In order of percent cover (Figure 15), green algae, barnacles, and red algae were the dominant species. Over the last three years, the diversity and species averages has remained relatively constant across all tidal elevations compared to other sites at Cherry Point.

Individual species counts: Neptune Beach also had the highest number of individual species groups (Figure 16) recorded of the Cherry Point sites. Non-aggregating anemones (*A. elegantissima*) occurred at each of the three tidal heights and were a dominant species in each of the six years. Other common species included limpets, particularly at +1 and 0 ft in 2013, 2014, and 2016. It is notable that Neptune Beach has the most abundant biota of the four CPAR sites surveyed for 2016-2018. This circumstance may be attributed to its diverse substrate, which contains cobble, sand, boulders, and shell debris at all three tidal elevations.

Custom Plywood, FBAR

Site description: The site, the Custom Plywood Mill (Figure 2, Table 1, Photo 7), was originally a waterfront mill and box

factory. Extensive cleanup-up under the state's Puget Sound Initiative was conducted. Custom Plywood was a shoreline enhancement project as a Phase II interim remedial action during 2013. A new aquatic jetty/spit extension was built to prevent erosion from waves, tripling the habitat-friendly shoreline (<https://fortress.wa.gov/ecy/gsp/Sitepage.aspx?csid=4533>). Custom Plywood was established as a monitoring site in 2015 to document colonization by intertidal species in this newly created habitat. Otter serves as a reference site. Washington Department of Ecology and the current landowner are interested in the monitoring data from this site.

Beach profile and substrate: The beach had a very uniform slope (Figure 17) that was maintained until about 120 feet from the backshore for 2016-2018, which was consistent with the 2015 profile. The beach flattened out for about 20 feet before making a slight dip and leveling off again. The substrate was mostly a mixture of sand, gravel, and cobbles.

Species by percent cover: Green algae followed by barnacles had the highest percent covers at Custom Plywood. (Figure 18). Both 2016 and 2017 had higher overall percent cover counts than 2018.

Individual species counts: The highest counts observed overall were for shelled snails and occurred in 2017 (Figure 20). Species observed varied year to year. For example, at tide height +1 ft, shelled snails, limpets, crabs, and polychaetes were observed only in 2016.

Infaunal species counts: Polychaete sp. and *Macoma* sp. were the only species found in cores (Figure 23). *Macoma* sp. was the only species found at each tidal height every year.

Otter, FBAR

Site description: The Otter site (Figure 2, Table 1, Photo 8) was named for the Otter sculpture on the Tommy Thompson trail in Fidalgo Bay, south of the Custom Plywood Site. This site served as a reference site for Custom Plywood. Because this site was very visible to the public during surveys, Friends of Skagit Beaches provided an education and outreach pop-up display and volunteers took advantage of this opportunity to educate the public.

Beach profile and substrate: Beach elevation profiles were similar for 2016-2018, though an apparent dip occurred around 90 ft from the profile start in 2018 (Figure 21). Substrate was characterized by silty sand, gravel, cobble, boulders, and shell debris along the profile. Riprap and boulders were primarily found at the upper elevations while silt and clay were predominantly found at the lower end of the elevation profile.

Species by percent cover: Green algae had the most percent coverage at each height for every year but was highly variable being less than 10 percent some years and greater than 90 percent other years (Figure 22). Barnacles were also found every year.

Individual species counts: The individual organisms recorded at Otter were highly variable from year to year (Figure 23). Many of the organisms were found with varying frequencies at different tidal heights. Limpets were counted very high at tide height +1 ft in 2013 with 22 individuals averaged, while all other average counts per quadrat were less than 4 individuals.

Infaunal species counts: Infauna samples displayed a greater amount of diversity (Figure 24) in comparison to the other FBAR sites. *Macoma* sp. were most commonly found, followed by *Leukoma staminea*, *Venerupis philippinarum*, and *Saxidomus giganteus*.

Fir, FBAR

Site description: The Fir site (Figure 2, Table 1, Photo 9), was named for the large Douglas fir tree immediately inland from the profile line starting point. This site is located in the Fidalgo Bay Resort at the base of Weaverling Spit. It is notable that Anacortes High School students with an instructor assisted in monitoring each year.

Beach profile and substrate: The elevation of the beach apparently shifted upward while maintaining its general profile in 2018 (Figure 25). According to the profile data, the shift occurred seaward of approximately 30 to 50 ft from the '0' point. Despite the elevation shift, the slope was maintained. The substrate is mostly by clay/silty sand with gravel, cobbles and larger rocks on the beach face.

Species by percent cover: Percent cover was dominated by green algae species (Figure 26). 2013 and 2017 were notably higher than the other years. Cover by other organisms were recorded, however was minimal.

Individual species counts: Polychaetes and shelled snails dominated the number of individuals with polychaetes especially numerous in 2014, 2016, and 2017 (Figure 27).

Infaunal species counts: Infauna were variable from year to year (Figure 28). *Macoma* sp. were consistently the most abundant each year. *Leukoma staminea* and *Venerupis philippinarum* were the second most common species. 2018 had the highest infaunal core species counts data.

Trestle, FBAR

Site description: The Trestle site (Figure 2, Table 1, Photo 10) is located at the west end of the trestle connecting the east end of Weaverling Spit to the shore of March Point on the Tommy Thompson trail. Because this site is visible from the trail, Friends of Skagit Beaches provided an education and outreach opportunity with a pop-up display for volunteers to educate the public during surveys.

Beach profile and substrate: The beach profile was relatively consistent among years (Figure 29). The slope of the beach was measured from the steel pole marker at the west end of the trestle on the NW side of the walkway. The start of the beach elevation profile starts in the midst of riprap. The beach substrate can be most characterized by a mix of substrate types, though primarily muddy were the quadrats fall, progressively becoming muddier towards the -1 ft tide height so that below this point has been decided unsafe for volunteers.

Species by percent cover: Most of the cover at Trestle was Green Algae sp. at all transect heights (Figure 30). Green algae varied over the years at each tidal height. Barnacles were consistently found at +1 ft, except in 2016.

Individual species counts: Shelled snails were the only organisms that occurred consistently across all years and on each transect at all tidal heights (Figure 31). In addition, Limpets were found most years at +1 ft, Polychaetes were present in each year of monitoring at the 0 ft tidal height, and Hermit crabs were found most years at -1 ft.

Infaunal species counts: *Macoma inquinata* was the most commonly identified infaunal species at Trestle (Figure 34).

General Discussion

The goal of this project is to provide a baseline for detection of future changes and the objective is to collect baseline data on beach slope, substrate, and intertidal biota abundance and diversity at eight monitoring sites at Cherry Point and Fidalgo Bay Aquatic Reserves. The project was continued annually as intended, building on the previous three years of data. The data presented in this report adds to a total of six years of a baseline data for most sites. It is hoped that baseline data will continue to be collected such that a robust baseline is generated, and that trends will be detectable in the future.

According to the QAPP, “The goals and objectives of the intertidal monitoring in the two reserves [Cherry Point and Fidalgo Bay] are to collect baseline data over time at specific monitoring sites and to document changes over time in beach slope, substrate, and biodiversity, using scientifically and statistically sound methods that will provide data comparable across reserves and monitoring years.” After six years, we have collected data on beach slope, substrate, and biodiversity at ten separate sites in the Cherry Point and Fidalgo Bay Aquatic Reserves. With continued sampling, we may be able to compare changes in these parameters over time. An initial conclusion is that there appears to be much variability in these systems, so defining trends and changes may be difficult.

Across all sites monitored, the percent cover and epifauna species abundance was highest at Neptune. This was consistent with other findings that indicate that areas with a mixed substrate consisting of cobbles, gravel, and sand provide habitats that support more abundance and diversity (Dethier and Schoch 2005).

For Fidalgo Bay, the predominant substrate on the low tide terrace at all sites was sandy mud, although it appeared qualitatively finer with more clay at the Trestle site.

Recommendations

In Years 1 (2013) and 2 (2014), a number of recommendations were made to improve the training, data collection, and quality control for the monitoring. Implementation of some of these recommendations provided a better-trained cadre of volunteers and a more efficient and accurate quality control process. There remain some recommendations to be better implemented or considered, and some clarifications to be made.

Implemented Recommendations from Years 1 and 2

The following recommendations and changes were implemented:

YEAR 1

- Training: Identification emphasis was placed on common organisms.
- Training: Emphasis was placed on identification of invasive species, such as European Green Crab (*Carcinus maenus*), *Spartina* sp., and tunicate species like *Didemnum vexillum*.
- Photographing quadrats: Photos were taken after removing debris and unattached algae.
- Data management: Each quadrat had at least one data sheet; quadrats were not pooled on 1 sheet.
- Data collection: The distance along the profile line was noted for each transect level.
- Quality Control: The on-the-beach portion included:
 - Ensuring that all blanks were filled out;
 - Ensuring that animals and plants were placed in correct categories (percent cover vs. countable species);
 - Asking that participants total the entire percent cover—and having them assess whether that was reasonable (some previous estimates were greater than 100%);
 - On-site QC specialist reviewed estimates and verified that these seemed reasonable.

YEAR 2

- Training clarified what debris should be removed: Debris was defined as all dead/ unattached algae and litter if it did not have attached life and/or appeared as drift.
- When a quadrat lands on uneven surfaces/rocks, estimates will be made using a strictly vertical view.
- When a quadrat lands on a boulder such that the elevation is not representative of the transect line, the quadrat will be moved to a more representative spot on the transect line. Determination of this is somewhat subjective. If the boulder raises the elevation by more than 6 inches, it can be considered non-representative. If the substrate is very rocky and the substrate is uneven, then 6 inches tidal elevation likely is not great enough to be non-representative. In the event that a quadrat lands on a non-representative boulder, reorder the entire quadrat series using a new series of random numbers.
- The general species list (Beach Watcher D-4, Field data sheet) does not need to be filled out when expert identifiers are compiling species on the detailed species list (Species Checklist_latin, 2p). Data were transferred where appropriate from the detailed list to the general list.
- The use of scientific names and the practice of identifying organisms down to species or lowest practical level (i.e., genus and species where possible), was emphasized in training of volunteers to decrease confusion stemming from the use of common names.
- Birch Bay in CPAR as a survey beach was discontinued because there were relatively few organisms on the beach and tidal elevation was difficult to ascertain: This beach was replaced by Point Whitehorn Point.
- A procedure to remove *Ulva* sp. where present, in accordance with practices by Dr. Megan Dethier, University of Washington, Friday Harbor Laboratories, was implemented to ascertain how many additional organisms might be covered by *Ulva* sp. We did this because some intertidal specialists do this as a routine practice because *Ulva* growth can cover all other species present. Our work did uncover additional species; we continued this practice for an additional year, and then decided to permanently adopt into a standard part of the protocol.

The following recommendations were made at the end of Year 3 (2015) and were implemented in Year 4 (2016):

- While analyzing the beach profile data, the amount of associated uncertainty indicated that the protocol and training for beach profiles needs to be more rigorous. Adding in room for deflections along profile transects was suggested and implemented. This means that where there is a bump up and not a constant slope downward, this needs to be accurately captured in the beach profile data by adjusting interval lengths. Permanent markers for profile starting points were also installed in 2016. This cleared up issues surrounding clearly defined starting points, although sites at the toe of feeder bluffs still remain, and likely will continue to remain, a challenge.
- Assessing the same swaths, with the same swath distance, each year was recommended and implemented. This means looking at historical swaths, preparing guidelines for determining swaths that allows some flexibility given dynamic field conditions, although having set species swath intervals had made these easier in the field and may be interesting to look at how the species in each interval change over time.
- The decision to keep the protocol to first count and estimate percent cover for species with *Ulva* sp. and then without, was retained indefinitely. There were considerable differences seen in comparison between with and without *Ulva* sp. counts.
- It was recommended that some species could be lumped. The lumped species are the species most difficult to identify quickly and accurately (e.g., barnacles, limpets, *Ulva* sp.) to reduce identification errors. Species lumped into single categories together have to be similar enough that no valuable data will be lost. For example, barnacles may be lumped together simply as barnacles rather than by species. This practice was started in 2016 and was refined in subsequent years and will remain as part of the current protocol.
- In terms of counting eggs, the following changes were suggested, but not made to the protocols in terms of counting eggs- eggs and egg masses may be added to the notes section of the field sheet instead of being counted:

- Nudibranch eggs and *Nucella* egg masses will be counted by percent cover (these are accounted for in the notes)
- *Lacuna* eggs will be counted individually because these egg masses occur discretely (these also are accounted for in the notes)
- Counting bivalves. Bivalves are infauna and should not be counted when below the surface and only a hole or siphon may be seen that indicates, but does not confirm, that a bivalve is present or specifically what species is present. When live bivalves are found on the surface, they will be noted as individual species (with the exception of mussel species, which are recorded as percent cover). Holes or sightings of siphons can be noted in the comments section, but will not be counted. There is some discussion on whether or not to count bivalves on the surface and this protocol should be reviewed next year.

Moving into year seven (2019), one additional change we may consider instead of surveying each site on an annual basis, we may sample two sites per year for each Aquatic Reserve. This will help retain volunteers year to year while reducing the resources needed annually. Collecting annual data at the beginning of this study proved useful, though now that year six has been completed, sampling less often should not impact the quality of the data and is a common practice in other monitoring programs (e.g., eelgrass restoration programs).

These changes remain final through 2018 and are planned for 2019, though the shifted sampling schedule still remains to be determined. Updates continue, but remain less major, such as reformatting data sheets and creating better documentation for locating the start point and setting up the profile line for each site. Species lumping may also be further refined to better reflect functional groups.

Possible Future Uses of This Data

Ongoing bi-annual surveys will allow regular comparisons. In this way, changes in overall species abundance and assemblage composition may be detected. After detection, causes may be evaluated and potentially investigated or remedied. These surveys may also be used in any Natural Resources Damage Assessment in the event of an oil spill or other event, and to identify invasive species presence. Additionally, these surveys may fill in existing data gaps. The CPAR and FBAR CSCs should review the results to evaluate what value the data may have for future CPAR or FBAR management. Additionally, a more comprehensive analysis comparing the present study to historical data may be useful. For example, if the trestle that crosses the middle of Fidalgo were to be removed, monitoring data could provide a baseline for documenting effects of the removal. Lastly, there are several other organizations doing the same or very similar intertidal monitoring throughout the Puget Sound. Efforts should be made to ensure that these data are comparable to define regional trends over time.

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