March Point Rapid Shoreline Inventory

Skagit County, Washington
2001

Report Prepared for Skagit County Marine Resources Committee

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Executive Summary

During the Spring and Summer of 2001, People For Puget Sound, in cooperation with the Skagit County Marine Resources Committee, trained volunteers and inventoried more than 5 miles of shoreline along March Point on Fidalgo Island. Through this project:

- 44 citizens (27 students and 17 adults) were trained to recognize shoreline features
- 27,750 linear feet (5.24 miles) of shoreline were inventoried

Data collected through this survey were organized into a Geographic Information System which allows users to identify the conditions found at specific locations along the shoreline. These data are available through the shoreline programs portion of People For Puget Sound's website (www.pugetsound.org).

Recommended Actions
Following careful analysis and display of the collected data, several items of conservation and restoration benefit were identified.

Conservation Recommendations:

- Eelgrass beds: The number of beach sections that contained eelgrass and the perceived denseness of those beds suggests several areas that could benefit from protection.
- Forage fish spawning habitat: The inventory identified a total of 31 sections (0.9 miles) of beach that meet our criteria for potential sand lance and/or surf smelt spawning.

Restoration Recommendations:

- Previously documented forage fish spawning areas that coincide with what is now cobble upper intertidal: These are areas where surf smelt were previously found to spawn, but which do not currently meet our criteria for potential spawning habitat. These are logical areas for removal of failing armoring structures (which may be supplying cobble to the upper intertidal), beach nourishment, an/or shoreline re-vegetation.
- Upland invasive species: These species are known to choke out native vegetation, which in turn limits the supply of insects as prey species for salmon. Nearly half of the study area (82 section, or 2.3 miles) is being actively degraded by upland invasive species. Their removal should be accompanied by re-vegetation with native species, monitoring, and stewardship.
- Intertidal invasive species: The inventory located small clones of *Spartina* in 26 sections. While extensive *Spartina* removal efforts have since occurred in the area, we recommend that our location data be taken into the field with an accurate GPS to confirm the removal of all clones in all 26 sections.
- Intertidal structures in poor condition: The inventory classified 64 sections as containing structures in poor (non-functional) condition. Failing intertidal structures should either be removed or repaired so that impacts on the shoreline are minimized.
- Polluted outfalls: The inventory located 39 sections with outfalls that appeared to be polluted. It is beyond the scope of this inventory to positively identify sources of pollution; we recommend that all 39 sections be investigated.

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Introduction

Puget Sound's shorelines provide a highly productive niche because plants and animals thrive in the well-lighted, nutrient-rich shallow nearshore environment. With freshwater inputs entering the Sound along its shorelines, the nearshore environment also offers critical habitat for anadromous fish preparing to enter or leave streams, and it is home for estuarine species that thrive in water of intermediate salinities. With human populations in the central Puget Sound expected to grow by 50% from 2.7 million people in 1990 to more than 4.1 million by 2020, the effect of human development on shorelines throughout Puget Sound is of critical interest. Severe declines documented for several species of forage fish, including Pacific herring and surf smelt, as well as species from higher trophic levels such as Pacific salmon and rockfish, indicate that Puget Sound's shorelines may not be functioning at their historical potential to provide healthy habitat for these species.

The British Columbia/Washington Marine Science Panel (1994) identified the permanent loss of nearshore marine and estuarine habitat as the most threatening problem facing the region. Unfortunately, relatively little is known about shoreline habitat throughout Puget Sound. Due to this and the measured and perceived impacts of upland land use and shoreline structures on the ecological function of shorelines, there is a great deal of interest in accurately identifying and mapping shoreline structures, habitat, and adjacent upland land use so that their interaction can be assessed.

The Northwest Straits represents a uniquely beautiful and ecologically rich area, deserving of national significance and local protection. To help raise public awareness of this region and to generate additional scientific information about this area, the Northwest Straits Marine Conservation Initiative was formed following the Murry-Metcalf report in 1998. This report outlined one of the goals for the Northwest Straits: "to ensure a net gain in highly ecologically productive nearshore, intertidal, and estuarine habitat." This goal is to be achieved, in part, through efforts, "to map, assess and protect nearshore habitat."

Within this context and in response to it, People For Puget Sound developed the Rapid Shoreline Inventory (RSI). Conceptually, one must know where high quality habitat exists, and what features make it highly ecologically productive before one can assess changes to it. RSI helps achieve this first step by reliably mapping the locations of shoreline structures, pollution, habitat, upland land use, and a suite of other shoreline descriptors. Inventories of shoreline characteristics do not stand in isolation and are designed to complement information collected by the Washington Department of Natural Resources (WDNR) and the Washington Department of Fish and Wildlife (WDFW) about shoreline conditions and species occurrence, respectively. A completed RSI can serve many roles including: a baseline to which future surveys can be compared to track changes; forage fish habitat characterization; a tool to identify habitat conservation and restoration projects; a mechanism with which to study the impacts of human pollution, land use, or structures.

Rapid Shoreline Inventory Background

The need for more descriptive information about shorelines led to widespread studies of shorelines in Puget Sound at two different scales. The WDNR developed a descriptive spatial database describing shorelines. These data were collected along the state's shorelines by flying over shorelines at low tide in a helicopter, and defining beach segments based on shoreline substrate. While this study provides valuable information about shorelines throughout Puget Sound, it fails to detect many important shoreline features due to the scale at which shorelines were examined. In response to the continuing need to describe shorelines at the individual parcel scale, People For Puget Sound, in conjunction with partner organizations (including Friends of the San Juans and ReSources), has developed more detailed shoreline inventories. This program is called the Rapid Shoreline Inventory. These inventories are intended to augment the information collected by WDNR, and describe habitat by observing and recording information for contiguous 150-foot shoreline sections from the ground. By collecting data at this scale, a completed RSI can help identify conservation and restoration projects on individual parcels.

Due to the time and cost involved in surveying large amounts of shoreline at a fine scale, People For Puget Sound's survey efforts begin by identifying areas that fit profiles for potentially important shoreline habitat. After highlighting areas that have a high probability of harboring important resources, People For Puget Sound, in consultation with local partners, identifies discrete sections of shoreline for inventory. To further defray the costs associated with collecting such detailed information and to generate knowledge and interest in the public, People For Puget Sound trains and supervises local volunteers as shoreline data collectors.

The primary objectives of the Rapid Shoreline Inventory are to:

- Educate and involve local citizens by training local residents as volunteer stewards that collect accurate data
- Develop an inventory of high quality data useful for assessing the health of Puget Sound and to serve as a baseline for analyzing future change
- Present data that can be used by citizens and public agencies from the local to federal level to conserve, restore, and make informed management decisions for shoreline habitat
- Develop the concept of a "shoreline ecosystem" and the importance of nearshore habitat
- Identify relationships between nearshore habitat conditions and adjacent land uses
- Refine models that identify areas of high resource value

Data Collection

Volunteer stewards attend three training sessions for a total of ten hours of training before they are ready to aid in field data collection. Staff flag and take GPS data for each 150-foot section the day before the inventory. Groups of trained volunteers, supervised by data collection experts, survey these shoreline areas during extreme low tides. Stewards record information for each 150-foot shoreline section including:

1. Section number
2. Characteristics of intertidal zone
3. Characteristics of backshore zone
4. Bluff/bank characteristics
5. Invasive species
6. Adjacent land use
7. Streams, outfalls, and other freshwater discharges
8. Artificial shoreline structures
9. Wildlife
10. Vegetation

Experts check steward data forms for accuracy and completeness on-site. The data are later carefully entered into an *MS Access*[*] database. Once data are collected, checked for accuracy, and entered, a geographic information system (GIS) is developed for the surveyed shorelines. The data are then displayed and analyzed spatially in *Arcview*®[*] using exported *MS Access*[*] records and spatial locations mapped using a *Trimble GeoExplorer III*®[*] GPS unit during the shoreline inventory. This GPS has an average accuracy of 1.5 meters after differential correction.

Mapping the Shoreline

Rapid shoreline inventory projects areas currently range from one to several miles of contiguous shoreline. By marrying GPS data with the descriptive data collected during the shoreline inventory, People For Puget Sound creates strings of points along the shoreline illustrating the precise locations where shoreline data were collected. Data from these shoreline inventories can then be placed into context by combining them with existing base data (e.g., hydrography, transportation, public land surveys, aerial photos, and digital elevation models), and compared with other resource data bases such as WDNR's *Shorezone*.

[*] Specific products are mentioned for informational purposes only. Not a product endorsement.

Surveying Shorelines in Skagit County

In the spring of 2001 People For Puget Sound began planning an RSI project to take place in Skagit County in cooperation with the Skagit County Marine Resources Committee (MRC). Access was a critical component in identifying a specific site for survey because most shorelines are in private ownership, occasionally with as many as 60 different owners along a single mile of shoreline. Coupled with identifying a site for survey that might have favorable access criteria, People For Puget Sound and the Skagit MRC also sought to target shorelines that existing resource information indicates are likely important to the local ecosystem.

A group of 17 adult volunteers, along with 27 students from Anacortes High School and home schools, participated in ten hours of detailed training and education about shoreline features before inventorying the shoreline. Scheduling required that students and adults receive separate trainings, and ultimately eight separate trainings took place to ensure all stewards received the requisite ten hours of instruction.

The site identified for inventory was the isthmus between Fidalgo and Padilla bays, known as March Point. This area fulfilled several survey site goals: 1) it is adjacent to distributions of known valuable ecological resources, 2) it is a potentially important area of shoreline habitat and 3) it is part of the region where there was relatively little knowledge of the natural resources compared to adjacent areas. Shoreline ownership turned out to be an important part of making this survey a success. Shoreline access permissions from a relatively small number of corporate landowners, including Tesoro Petroleum and Equilon Industries, enabled us to exceed our goal of inventorying five miles of shoreline.

The Rapid Shoreline Inventory gathers information that fits into eight categories: general characteristics of intertidal zone; general characteristics of backshore zone; bluff/bank characteristics; invasive species; adjacent land use; description of streams, outfalls, and other discharges; description of shoreline structures; wildlife identification; vegetation identification. While volunteers attempt to assess each shoreline section completely, there are occasionally physical or practical limits to survey efforts that prevent us from identifying certain beach characteristics. Additionally, not all shorelines have all types of shoreline characteristics, in particular backshore zones and bluffs or banks may not be present on all shorelines.

Results

Description of Survey Area

March Point has a highly impacted upland area with oil refineries dominating the upland, land use and oil and gas pipelines criss-crossing much of the land. A minor roadway runs near the shoreline for much of the point and is protected by extensive rip-rap bulkheads. Two large piers in the northwest section of the survey area cross the intertidal zone, and are used by the refineries to dock and unload oil tankers. Most of the eastern side of March Point is “high bank” with the banks adjacent to the shoreline reaching 40 feet or more in height. The northern portion of the point is managed for public access by Tesoro Petroleum and is used heavily by visitors. The seaward extent of the intertidal was often comprised of unconsolidated fine-grained sediments that precluded many subtidal observations.

General Characteristics of Intertidal Zone
The intertidal, the shoreline between the low and high tide lines, is home to many organisms, including dozens of economically valuable shellfish species. While datasets like WDNR's *Shorezone* attempt to describe the intertidal zone as a single unit, different species use distinctly different portions of the intertidal zone. The Rapid Shoreline Inventory records information at both the low tide line, where lower intertidal species can be observed, and near the high tide line where several species of forage fish spawn.

The intertidal zone at March Point illustrates the importance in considering both the upper and lower intertidal zones as separate habitats, as most of the lower intertidal substrate is fine sediments (91% of observed sediments) while the upper intertidal is characterized as being primarily cobble (41%), a mixture of large and small sediments (17%), and gravel (11%). Algae was seen along most (94%) of the shoreline and eelgrass was common when subtidal features could be assessed (49% of all sections had confirmed eelgrass observations).

General Characteristics of Backshore Zone
The backshore or splash zone is an area where salt-tolerant terrestrial vegetation thrives, with marine water inundating the area during extreme high tides and storms. Marine debris is often found at the seaward edge of the backshore zone, and driftwood often delineates the break between the backshore and intertidal zone. The primary interests in assessing backshore zones is to assess both the width of a backshore, since bulkheads and other shoreline structures often compress or eliminate the backshore, and the presence of backshore vegetation.

The majority of sections inventoried on March Point have no backshore (59%), and those stretches of shoreline with backshores are typically vegetated with grasses and other herbaceous plants (74% of sections with backshores). Additionally, relatively little upland vegetation overhangs the backshore zone (26% of sections with backshores).

Bluff/bank Characteristics
Puget Sound shorelines are often adjacent to very steep upland areas with banks rising at a steep incline away from the water. When banks erode, they nourish shorelines by providing sediment input. This inventory assesses both the presence of banks immediately adjacent to the shoreline, as well as features such as whether or not it is being undercut, showing signs of erosion, or vegetated.

Slightly more than half the shoreline has either a natural or artificial bluff or bank adjacent to the shoreline (59%). Bank heights vary from an estimated height of just 2 feet to 50 feet, with most sections having banks that are 10 feet or less in estimated height (59% of observed banks). Bank height is highest just to the south of the area where access was not permitted on the east side of March Point. Few banks showed evidence of unvegetated scars (30% of banks) that are signs of erosion or active bluff sloughing. Despite the small number of signs of erosion, almost half of the banks were being actively undercut by tidal action.

Invasive Species
Non-native plants and animals represent a clear threat to native fauna and flora. They occupy space and consume resources that would normally be used by native organisms. Upland invasive plants and animals are most common in highly or regularly disturbed sites such as roadsides or boat launches, while no such generalization can be made for the intertidal zone. The impacts of invasive species can be mitigated through removal or management of invasive populations. However, management is usually easiest during the establishment phase of invasions when only a few individuals are detected.

In the intertidal, the Rapid Shoreline Inventory detects European green crab, *Spartina*, *Sargassum*, and *Zostera japonica*. European green crab and *Spartina* are known to be invasive and harmful to natives, while information on the impacts of the other two species is inconclusive. In the intertidal zone, *Spartina* and dwarf eelgrass (*Zostera japonica*) were the most common non-native/invasive species observed (14% and 16% of sections, respectively). The macro-algae *Sargassum* was observed only at a single location. Other invasive species may have been present (e.g., purple varnish clam, *Nuttallia obscurata*; Manila clam, *Tapes japonica*), but were not actively sampled for during the RSI.

Several upland invasive plants were identified along March Point, including Himalayan blackberry (31% of sections), Scot's broom (17% of sections), and English ivy (4% of sections). Morning glory was observed at a single section.

Adjacent Land Use
Land use immediately adjacent to the shoreline has a direct impact on shoreline health because intertidal nutrients, pollutants, and substrates are all influenced by the upland. This survey assesses both the land use, placed into one of several generalized categories, and the number of shoreline access points or paths that lead to the shoreline.

On March Point, the road is the dominant adjacent land use for most of the survey area, with 45% of the adjacent land use described as "paved road, path, or lot". Often the adjacent land use was either not visible, due to bluffs adjacent to the shoreline (17% of shoreline), or in a natural condition (18% of shoreline).

Trails or paths lead to the shoreline along much (19%) of the shoreline sections. Access points are concentrated towards the tip of the point where there is little or no adjacent bank and the shoreline is managed for public access.

Description of Streams, Outfalls and Other Discharges
Freshwater inputs along marine shorelines can bring with them sediments, pollutants, and organisms, and can alter shoreline habitat by enabling marshes to develop. This inventory provides information about the number and nature of the dominant freshwater inputs identified along the shoreline, and also indicates whether signs of pollution are present.

A total of 81 outfalls were observed and 71 were fully described, with most of the described outfalls being either drainage pipes (48%) or seeps (37%). A small number of creeks (8) and ditches (3) were also observed. Most outfalls have water flow associated with them (82%). Many are actively eroding (52% of observations), have associated algae (45%), darkened sediment (39%), or oil slicks/sheens (24%). Water discoloration (14%), associated debris (11%), and odor (7%) were also observed.

Description of Shoreline Structures

Shoreline structures are artificial structures built immediately adjacent to, over or on the intertidal. Structures can serve many purposes, from helping protect upland areas from surf energy and flooding to providing a means for launching boats. These structures are by their nature designed to be permanent, and their placement in a dynamic zone like the intertidal can have many unintended effects. Large boulders falling from rip-rap structures alter shoreline sedimentation while piers and docks extending into the subtidal may prevent eelgrass from growing by shading it. Additionally, structures may impact shorelines some distance away by altering nearshore currents and sediment transport. This survey identifies the location of shoreline structures in addition to their condition. Degraded and failing shoreline structures indicate an area of critical concern, since they are no longer serving their intended purpose but continue to affect the beach.

A total of 148 structures were measured, and their condition was assessed. The majority (76%) of the structures observed were characterized as bulkheads or seawalls. Piers and docks (10%), and launch ramps (3%) were the next most common structures. The balance of the structures included a barge partially buried in the intertidal, 3 jetties, and 2 duck blinds. Most structures (53%) were described as being in poor or non-functioning condition, including all three jetties, 64% of the bulkhead structures and 2 of the 4 launch ramps. All piers, docks and structures associated with refinery pipelines were judged to be in either good (functional but not pristine) or excellent (like new) condition.

Wildlife Identification and Vegetation Identification

While volunteers are not explicitly trained to identify wildlife and vegetation beyond a few common or characteristic species, volunteers and staff collecting data often have considerable experience identifying marine life. Species identified during a shoreline inventory are valuable in two senses: they provide a measure of the presence and distribution of species along a surveyed area, and they provide what is often the first species list compiled for an area.

The most common intertidal wildlife sightings were barnacles (99), limpets (84), oysters (50), clams (48), periwinkles (44), and snails (42). The most common algae sightings were sea lettuce (100), rock weed (98), and *Enteromorpha spp*. (40). The most common vascular plant sightings were pickleweed (61), dunegrass (39), saltgrass (29), and gumweed (21). The list of flora and fauna, identified to various levels depending on each volunteer's knowledge, is attached to this report.

Conservation Recommendations

Through critical examination of data collected along March Point, a few conservation recommendations emerged. Areas that deserve conservation consideration include those where ecologically valuable or rare natural conditions exist that should be preserved in their current state.

Eelgrass

The study area is of interest in part because it separates two shallow bays, Padilla and Fidalgo, which are recognized for their eelgrass beds and function as nurseries for many species of fish and shellfish. This survey examined eelgrass at the intertidal/subtidal break point in an attempt to assess the extent of eelgrass along the point. This survey likely failed to recognize the full extent of the offshore eelgrass because much of the eelgrass in these shallow bays is limited to the subtidal elevation range. However, the number of eelgrass bed sightings and the perceived denseness of those beds suggest several areas that could benefit from protection.

Eelgrass is difficult to completely assess from the shoreline, even during the extreme low tides that are chosen for RSI field days. At March Point, the subtidal habitat could not be examined for eelgrass in 78 of the inventoried shoreline sections (42%) due to unconsolidated sediment (mud) at the low tide line that could not support the weight of our volunteers. Eighty-nine shoreline sections (49%) were assessed to have some eelgrass coverage. None of this was identified as *Zostera japonica*. Approximately one-third of those observations were dense beds of eelgrass extending the full length (150 feet) of the surveyed section. We recommend further investigation of the *Zostera marina* located through this inventory to determine which significant areas are appropriate for conservation and which are already in conservation status.

Forage Fish Spawning Habitat

With the recent listing of salmon under the Endangered Species Act (ESA) and the proposed listing of orcas, the decline of predators in Puget Sound has been tied to declines in forage fish towards the bottom of the food web. These species require a narrow range of intertidal conditions for successful spawning and can be heavily impacted by human disturbance.

This survey looked carefully at two characteristics that indicate potential forage fish habitat – vegetation overhanging the intertidal zone, and sand or pea gravel just below the backshore/intertidal break. The survey identified a total of 31 sections (0.9 miles) that meet our criteria for potential forage fish habitat. As illustrated on the attached map, appropriate habitat for surf smelt or sand lance spawning appear in several short stretches. This patchy pattern suggests that land and shoreline management may be having a strong impact on where appropriate habitat is found.

Restoration Recommendations

The Rapid Shoreline Inventory provides critical information for identifying site-specific restoration recommendations. Restoration recommendations are primarily directed towards observed impacts by or related to human activities that are negatively impacting or have the potential to negatively impact shoreline conditions.

Documented Forage Fish Spawning Areas Adjacent to Cobble Upper Intertidal

Forage fish such as sand lance preferentially spawn on substrate within a certain size range, with grain size up to 3 cm in diameter (WDFW 1995). Surf smelt spawn has been documented along the northern half of March Point's shorelines, implying appropriate substrate is present. Our survey indicated that while substrate along this section of shoreline is often appropriate for sand lance spawning, much of the shoreline is being impacted by failing rip-rap bulkheads. Rocks falling from the bulkheads onto the intertidal have covered small grain sediments in many areas. It is also possible that scouring caused by waves deflecting off the structures has eliminated small grain sediments from some areas.

A large amount of the area (50 sections or 1.4 miles) where WDFW has documented historical surf smelt spawn does not appear to have appropriate substrate for forage fish spawn in the upper intertidal zone. This indicates that shoreline condition may have deteriorated to the point that populations of forage fish are no longer able to spawn on many historical spawning sites. While seasonal changes may affect substrate at the survey site, further investigation of the site to look for mechanisms to recreate historical habitat and prevent further degradation of current habitat are needed. The attached map illustrates both where historical spawning has been documented and where substrate appears to be inappropriate for surf smelt spawning.

Upland Invasive Species

Volunteers are trained to detect several upland invasive species that alter vegetation composition of plant communities including: English ivy, morning glory, Himalayan blackberry, Japanese knotweed, Scot's broom and purple loosestrife. Scot's broom and purple loosestrife are the largest management concerns due to their ability to reproduce, spread rapidly, and impact local vegetation. Scot's broom is listed as a class B noxious weed, and as such is given priority for management by Skagit county government. This makes it a good candidate for removal efforts. Any such efforts should be accompanied by re-vegetation with native species, monitoring, and stewardship.

Nearly half of the study site (82 sections or 2.3 miles) are being actively degraded by upland invasive species. The attached map illustrates the locations where upland invasive species were detected and shows that they are ubiquitous at the site.

Intertidal Invasive Species

Intertidal invasive species are poorly documented due to the small number of surveys of subtidal and intertidal areas. Additionally, little is known about the potential impacts of marine invasive species. There are four intertidal species that the Rapid Shoreline Inventory detects: European green crab, *Spartina, Sargassum*, and *Zostera japonica*. Green crabs represent the largest

potential threat as they invade bays and inland waterways and potentially causing precipitous declines in native crab and shellfish populations. *Spartina* is listed as a class B noxious weed by Skagit county and as such is given priority for management by county government. *Sargassum* populations are of concern in part because they are known to be invading shallow subtidal and intertidal portions of Puget Sound's shorelines, but their impacts have yet to be quantified. The impacts of *Zostera japonica*, which seems to colonize the middle intertidal, are also not yet quantified.

Some amount of *Spartina* was located in 26 sections (14%). *Spartina* populations along March Point are mostly concentrated along the southeastern portion of the study area. Because the impacts of *Spartina* are known, we recommend the removal of all *Spartina* located by this inventory. The attached map describes where *Spartina* was detected. While extensive *Spartina* removal efforts have since occurred in the area, we recommend that our location data be taken into the field with an accurate GPS to confirm the removal of all clones in all 26 sections.

Intertidal Structures in Poor condition

Intertidal structures were identified, measured and their condition assessed by volunteers. Structures in poor condition are failing to serve their intended function. Failing structures should either be removed from the intertidal or should be repaired so that impacts on the shoreline are minimized.

The primary structures found in poor condition were bulkheads, boat launches, and jetties. Poor bulkheads were typically supporting the land between the shoreline and March Point road which travels along the point. A total of 64 sections (1.8 miles) of shoreline are being actively impacted by poor shoreline structures. The location and distribution of these structures in need of attention appears on the attached map.

Outflows of Interest

Outfalls deliver water from the upland to Puget Sound. These freshwater inputs can be in several forms including natural streams, ephemeral waterways (ditches), seeps, and pipes. The primary reasons for identifying outfalls are to locate freshwater input that might support wetland vegetation, and outfalls that might be sources of pollution. Outflow impacts can take many forms including nutrient inputs, chemicals, refuse, and excessive sedimentation.

Thirty-nine sections of shoreline (1.1 miles) have characteristics that should be examined. Outflow characteristics that merit further attention include: erosion, discolored water, darkened sediment, associated odor, oil slicks or sheens, the presence of debris or trash or excessive algae growth. Further characterization of these outflows appears in appendix maps. Observed signs of pollution should be investigated to mitigate the source of pollution, which can be distant from the outfall's terminus.

Conclusion

People For Puget Sound would like to thank our project partners, The Skagit County Marine Resource Committee, Anacortes High School, and Beach Watchers, for their participation in this project. We would especially like to thank our hard-working and very knowledgeable volunteers. We hope this report will assist the Northwest Straits Commission and the Skagit County Marine Resources Committee in meeting their benchmarks for the conservation and restoration of marine and nearshore habitats in the Northwest Straits.