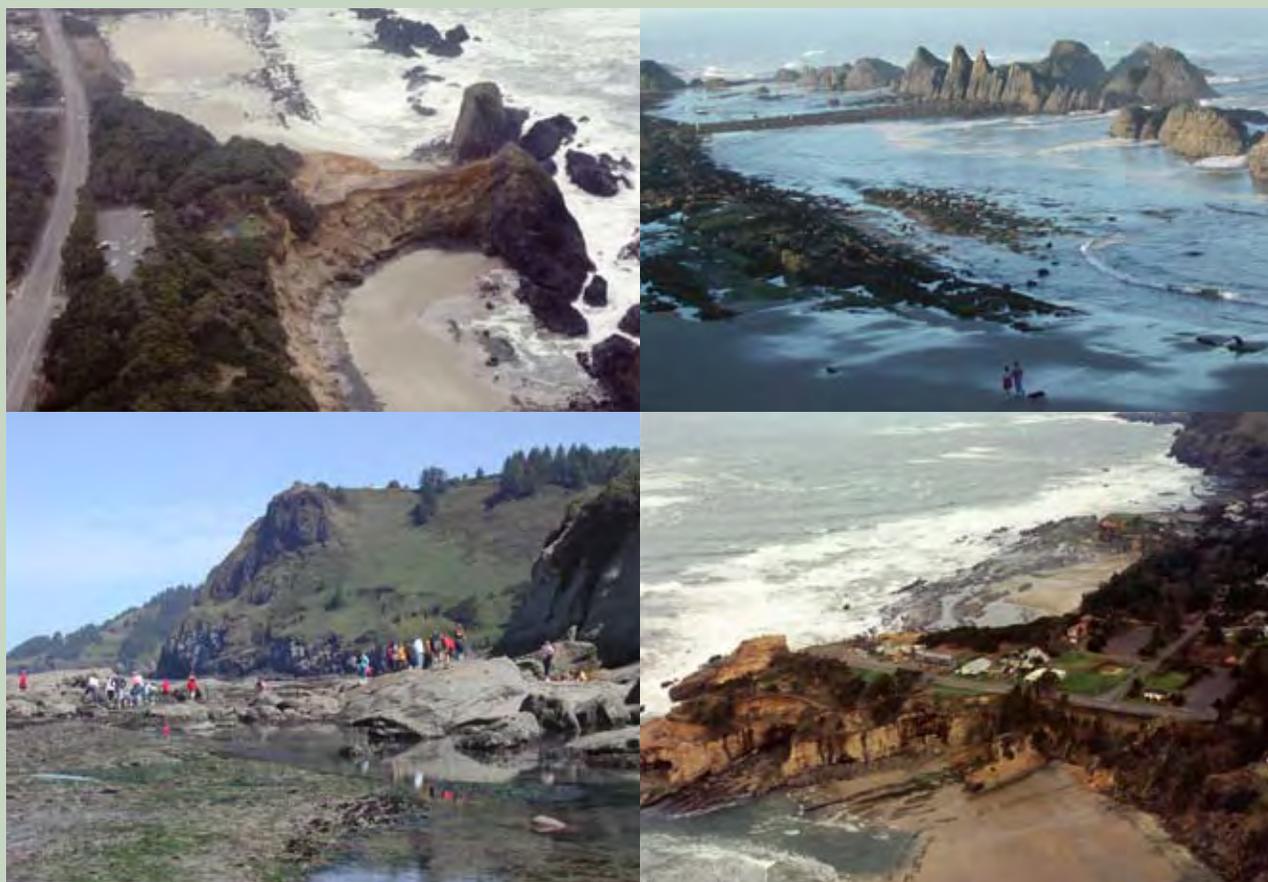


Rocky Shoreline Site Management Plan

Devil's Punchbowl State Natural Area and Seal Rock State Recreation Site

October 2008



Please note: This is a low resolution document for web-use.



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INTRODUCTION

Oregon's rocky intertidal areas are subject to increasing human disturbance as population and interest in coastal recreation in these areas grows. Tidepools, cliffs, rocks, and submerged reefs support an ecologically rich and diverse ecosystem at the boundary of the land and sea along 161 miles (41%) of Oregon's shoreline. These rocky shore areas, particularly the 82 miles (21%) of rocky intertidal habitat (fig. 1), attract thousands of visitors annually. Rocky shores are thus resources of high ecologic, economic, and social value to a wide range of stakeholders from local communities to state agencies and citizens of the world at large.

Oregon Parks and Recreation Department (OPRD) is charged with overseeing the management of Oregon's Ocean Shore Recreation Area, which includes beaches and rocky intertidal areas along the coast. However, there is very little information about visitor use of Oregon's rocky shores and what impact visitors are having. OPRD recently completed a survey of Oregon's sandy beaches, however, the

rocky shore segments of the coast were not covered (Shelby and Tokarczyk, 2002; OPRD, 2005). General day-use figures at coastal state parks indicate that use of rocky intertidal areas is likely increasing with the possibility of hundreds of thousands of people visiting these areas annually (figure 2).

People use the rocky shores to play, conduct scientific research, supplement their livelihoods, perform traditional tribal activities, harvest food, and to teach and learn about nature. From exploring the unique creatures of the rocky intertidal to fishing from rocky outcroppings and observing marine mammals, activities on Oregon's rocky shores are diverse. The rocky shores have ecologic, economic, and social value to a wide range of stakeholders, from local communities to citizens of the world.



Visitors learn about tidepools at Neptune State Scenic Viewpoint on Oregon's central coast

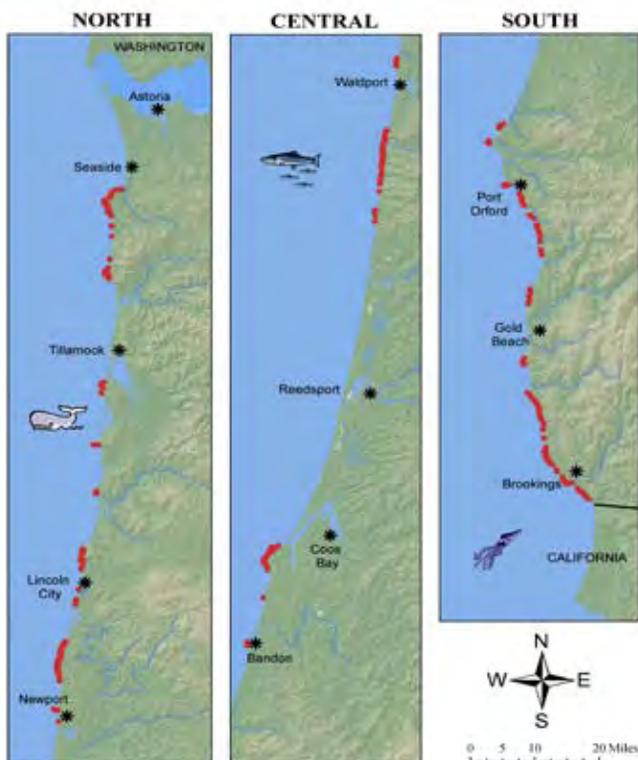


Figure 1. Rocky intertidal habitat along the Oregon Coast

Although sixty-one percent of the visitors to Oregon's beaches are Oregonians, a large number are from out of state, drawn for various reasons to Oregon's unique and beautiful coast (Shelby and Tokarczyk, 2002). Therefore, although Oregon's population increase is likely to be reflected in visitor use of coastal areas, out-of state visitors will also play a role. Tourist revenue in Oregon's coastal counties is increasing, which suggests that more out-of-state visitors are using Oregon's coast (Dean Runyan Associates, 2004). This increase in population and

tourism is also reflected in visits to Oregon's state parks next to rocky shores (fig. 2).

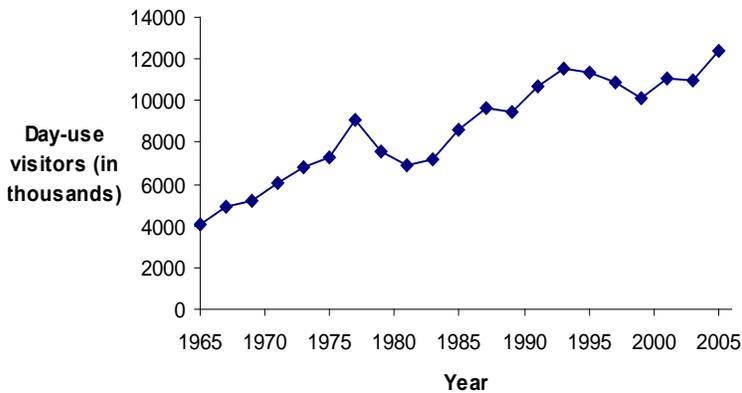


Figure 2. Human use trends for rocky shore adjacent Oregon State Parks from 1965-2005. Data comes from automated parking lots counters.

Two of Oregon's coastal resources that depend upon rocky shore areas (marine wildlife and tidepools) have been identified by coastal visitors as ones they are most interested in learning about (Shelby and Tokarczyk, 2002). Additionally, results from a study of recreation preferences of Oregon's aging population show that more than half (59%) of Oregonians aged 42-80 take part in ocean beach activities, and 37% spend time exploring tidepools (OPRD, 2007).

Oregonians age 42-80 rank ocean beach activities and exploring tidepools as their fifth and eight favorite forms of outdoor recreation (OPRD, 2007). Based on the survey, that use is evenly distributed among income brackets, likely because it is virtually cost-free, except for traveling to the sites. Oregonians in this age bracket make up 42% of Oregon's population (PRC, 2005), which indicates at least approximately 600,000 people explore Oregon's tidepools each year.

Impacts of human use on rocky shore areas range from the effects of trampling on sensitive intertidal habitat (Brosnan and Crumrine, 1994), to collection of intertidal resources (Castilla, 1999) and conflicts between humans and marine wildlife (Riemer and Brown, 1997). Comprehensive, interdisciplinary management of rocky shores that recognizes the need to balance visitor use and natural resource stewardship is crucial to successful coastal

management. In order to plan for the future of Oregon's rocky intertidal, managers need a better understanding of threats to intertidal habitats and ways to educate visitors that both improve their experiences but also help protect the resource.

One of the potential impacts on rocky intertidal areas is human recreation; therefore, to better manage the interface between human use and natural resources, information about visitor use numbers, recreation types and impact of human use is needed. This information is also helpful when looking at ways to improve recreational and interpretive opportunities at these locations.

PURPOSE

As a first step towards achieving this goal of improved management, visitor use and biological data was collected at two rocky intertidal areas along the central Oregon coast, Devil's Punchbowl State Natural Area and Seal Rock State Recreation Site between May and September of 2007. This information, in conjunction with input from management and steering committees is used to develop the following site management plans for those two sites. An overview diagram of the planning process is presented in figure 3.

The focus of these plans is on improving management based on existing authorities and responsibilities. Current information will be used, along with existing designations to work within OPRD jurisdiction, along with partner agencies to develop and implement site management plans. These plans will be used by OPRD staff to guide future natural resource management (with a focus on the rocky shore areas), as well as minor facility improvements (such as public access improvements) and interpretive opportunities in the future. Advisory committees provided OPRD with their view of the issues and concerns, ideas and proposals for improving site management.

Site management plan goals and objectives

The general goals presented in these site management plans are in keeping with OPRD's mission to "provide and protect outstanding natural, scenic, cultural, historic and recreational sites for the enjoyment and education of present and future generations." The following general goals and site planning objectives are fleshed out in more detail based on the specific sites and are intended to provide for an appropriate balance between resource protection and public recreational access and enjoyment.

The general goals addressed in the following site management plans are the following:

- Protect, manage and enhance as appropriate, outstanding natural, cultural and scenic resources in the parks.
- Provide recreation opportunities and experiences that are appropriate for the park resources and recreation settings
- Provide for adequate management, maintenance, rehabilitation, and park operations
- Provide for safe, efficient, identifiable and pleasant access and circulation
- Promote public awareness, understanding, appreciation, and enjoyment of the recreation settings through resource interpretation.
- Form partnership and agreements to aid in achieving goals

OPRD wants to take a closer look at how to best manage these sites, particularly the rocky shore resource and public use of it, as well as to learn how to best offer educational opportunities for visitors to understand the resource and its importance. In Oregon's Ocean Shore Management Plan, the need to do this type of site based management was recognized, and a recommendation was made to prepare such plans (OPRD, 2005). This effort is the first attempt to follow through with that recommendation. A review of Oregon's current management of rocky shore areas was also conducted, and completing site management plans was one of the primary recommendations (Hillmann,

2006).

The reasons for a site planning process for these locations include the following primary objectives:

- Plan for public enjoyment and protection of state park and ocean shore resources
- Provide a forum for stakeholder discussion and participation about each site
- Understand the current management designations and what they mean for use and access for each site
- Direct and educate visitors through on-site interpretation about the importance of the rocky shore resource and the particular site designation
- Address current recreational use levels, activities and patterns, and determine how best to provide for recreational use without harming the rocky shore and state park resources.

Site Planning Process

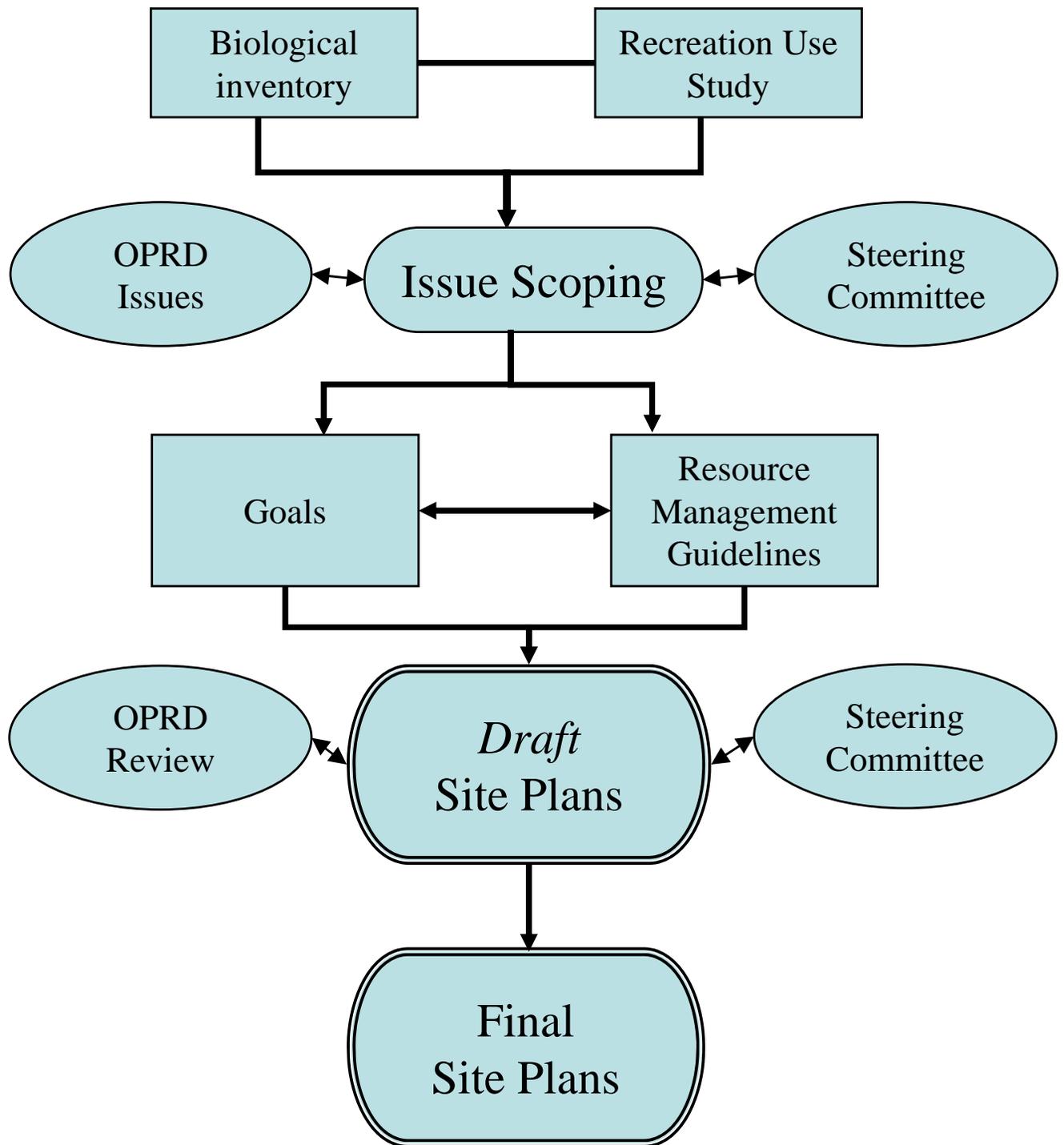


Figure 3. Flow chart showing the planning process for rocky shore site planning

SITE MANAGEMENT PLANS

Devil's Punchbowl

Existing Conditions

Location:

Devil's Punchbowl State Natural Area is located approximately eight miles north of Newport, and five miles south of Depoe Bay, in the unincorporated community of Otter Rock, Lincoln County, Oregon. The site is located approximately 100 miles southwest of Portland and 60 miles almost directly west of Corvallis (fig. 4).

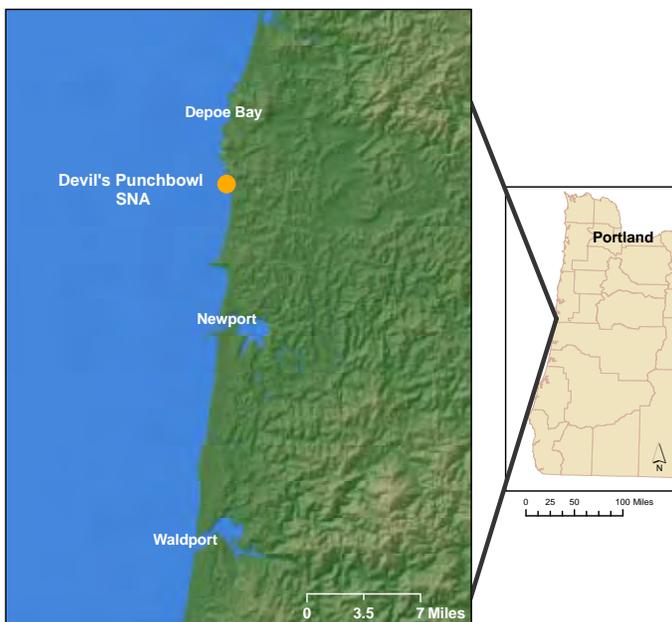


Figure 4. Location of Devil's Punchbowl on the central Oregon coast

Description:

This section of coastline is characterized by extensive rocky intertidal habitat made up of shallow pools and surge channels weathered into a large, flat surf-cut sandstone shelf (Fox et. al., 1994). Devil's Punchbowl, on the southern end of the site is a circular shaped hole created from the collapse of two sea caves (Lund, 1974). The 8.17-acre OPRD property known as Devil's Punchbowl State Natural Area (SNA) provides public access on both the northern and southern ends of the small headland

(fig. 5). The Inn at Otter Crest, a 130-guestroom hotel, on the upland side of the far northern end of the site provides private access.

The Otter Rock area has been a popular tourist destination since the early 20th century, particularly since the 1950's when a resort hotel (on land which now houses the Inn at Otter Crest but was originally a resort called West Shore Manor) was built. Named for the sea otters that once frolicked on the large rock approximately 1/2 mile offshore and slightly to the south, Otter Rock is still a popular destination for tourists today. Purportedly, the last sea otter in Oregon was shot on Otter Rock in 1906 by fur trappers. Today, recreational pursuits include beachcombing, tidepooling, surfing, fishing, kayaking and sightseeing.

Classification:

Devil's Punchbowl is classified by OPRD as a State Natural Area (SNA). The primary purpose of a SNA is to protect important ecosystem components and provide public interpretation and education. Natural resources are the predominant resource at the property. "Natural" resources are defined as components of the larger ecosystem. A component could be a smaller ecosystem or a portion of an ecosystem such as a plant or animal community, a wetland, or single plant species occurrence.



Devil's Punchbowl entry sign

Devil's Punchbowl SNA and Vicinity

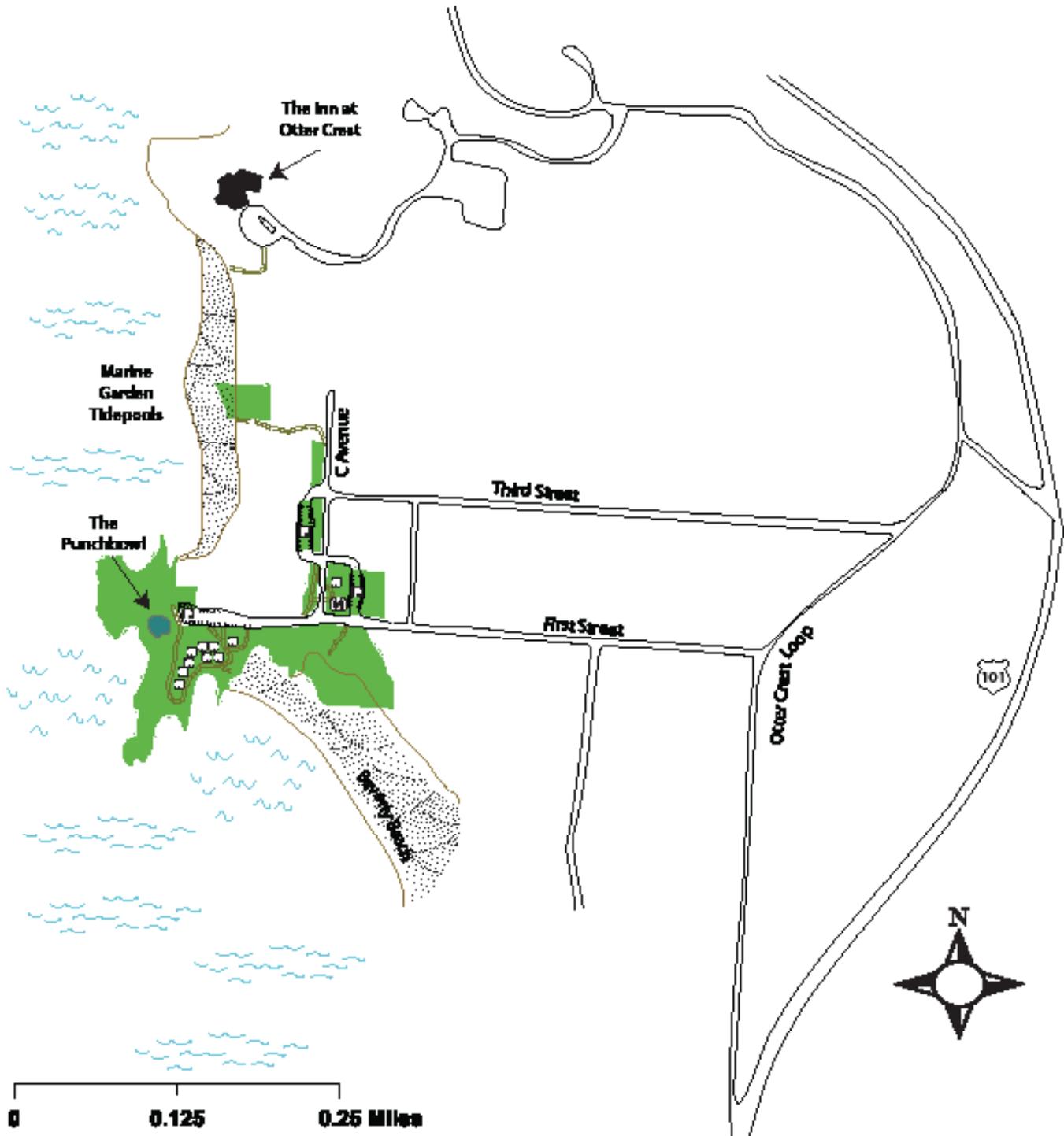


Figure 5. Diagram showing Devil's Punchbowl SNA and the immediate vicinity

Aerial View of Devil's Punchbowl SNA



Figure 6. View of Devil's Punchbowl State Natural Area showing approximate park boundary

Devil's Punchbowl SNA: Existing Conditions

Components could also be important geological features or formations (OPRD, 1995).

Generally, use levels are intended to be low to moderate. However, public enjoyment and education is to be accommodated as is appropriate based on site and resource constraints. Management priorities at SNAs are to maintain long term resource quality and provide interpretive devices and structures.

Other classifications include the status of the site as an Oregon Department of Fish and Wildlife (ODFW) marine garden. Collection of shellfish and marine invertebrates is prohibited in a certain portion of the site, except for single mussels for bait. The Otter Rock Marine Garden includes "all rocky areas, tide pools, and sand beaches situated between extreme high tide and extreme low tide lying between a line projected due west from the highest point of Cape Foulweather visible from the shore (Otter Crest State Wayside) on the north, to a line projected due west from the Devil's Punchbowl on the south (ODFW, 2008)."

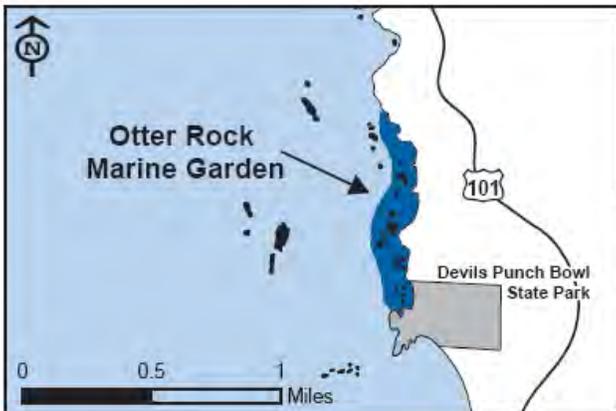


Figure 7. Marine garden boundaries (Source: 2008 ODFW Sport Fishing Regulations)

The site is also listed in the Oregon Territorial Sea Plan (TSP) as a marine garden (OPAC, 1994). This site is Oregon's first marine garden and was designated as such prior to the TSP being published.

There are a few management guidelines that go along with listing in the TSP. The management objective for the site is to "enhance enjoyment and appreciation of intertidal resources while protecting the intertidal area from effects of overuse (OPAC, 1994)." Prescriptions

include suggestions to implement rotational area closures as necessary to allow recovery of intertidal areas receiving greatest use, and to prohibit harvest of intertidal algae (OPAC, 1994). The Otter Crest area is also proposed for designation in the Oregon Natural Heritage Plan as a Natural Heritage Conservation Area (Oregon Natural Heritage Program, 2003).

Facilities:

OPRD facilities at the site are typical of a beach access and scenic overlook day-use area. However, since Devil's Punchbowl SNA is nestled in the small community of Otter Rock, with properties purchased and/or donated at various times, it is dispersed among three separate parking areas (fig. 5). The parking lot by the restroom (25), the punchbowl overlook parking (36) and the marine garden parking (36) lot together provide for a capacity of 97 cars. There are several benches, picnic tables (20), as well as a restroom facility, outdoor shower/footwash, drinking fountain, and trashcans. A wooden stairway provides beach access to the Beverly Beach (also known as South Beach) side of the headland and a 381' long asphalt and gravel/dirt trail winds down to the marine garden tidepools on the northern side (for which the state was granted a permanent easement in 1971 for pedestrian access).

Two viewing telescopes are located near the punchbowl along with several interpretive panels. The panels describe Oregon's rocky shores, the unique formation of the punchbowl, the richness of intertidal habitats, and a description of what a marine garden is.



One of the interpretive panels at the Devil's Punchbowl overlook

Neighborhood and Zoning:

The park is surrounded by developed residential areas of the unincorporated community of Otter Rock, in Lincoln County (fig 6.). The entrance road to the park winds through a residential neighborhood from US Highway 101 on first the Otter Crest Loop and then to 1st Street, which dead ends at the Punchbowl overlook. Otter Crest Loop used to be part of U.S. 101, but is now maintained as a scenic drive. Park traffic may conflict with the residential nature of this road. Local residents likely use the park extensively. The park is surrounded by residences and small commercial establishments. The park property is mostly zoned Public Facilities (PF), with a small portion in the southeast area zoned Residential (R-1).

The park is included in a master plan for the general area, the Beverly Beach District Parks South Master Plan (OPRD, 1988). Most of the park is in the “protection” category (70%), with 14% listed under management (the flat plateau near the picnic area), and 16% listed for development (the small parcels in the east part of the park). Those areas listed for development are noted to have “flat areas [with] suitable soils and conditions for development” (OPRD, 1988). The only development proposal that has not occurred is for a small picnic shelter near the Punchbowl.

Acquisition and Ownership:

The various properties that make up the current park area were acquired through donations from private citizens between 1929 and 1972, particularly



Black oystercatcher

the Leadbetter family who between 1929 and 1971 donated or sold the majority of the property to the State for park purposes.

Natural Resources:

Resources include high public-use intertidal habitat; small seabird colonies; and a harbor seal haulout. A 2007 Catalog of Oregon Seabird Colonies notes that surveys have, in the past, found a few nesting gulls, pigeon guillemots as well as black oystercatchers at Devil’s Punchbowl, although the most recent of these was done in the early 1990’s (Naughton et. al., 2007). USFWS volunteers have noted black oystercatchers in the vicinity since observations began in 2004, and although nesting was observed every year, with chicks seen a few times, no fledged birds have been documented (USFWS, 2007; Liz Kelly, pers comm, 9/23/2008). Slightly to the north, in the vicinity of the Inn at Otter Crest, more recent surveys (2003) found no breeding birds, where there used to be pelagic cormorants, gulls, and black oystercatchers in



Gull Rock from Devil's Punchbowl intertidal area

previous surveys from the 1980’s and 1990’s. Gull Rock, offshore, is an important site for several species of seabirds. The Territorial Sea Plan notes that “six species of seabirds breed here including approximately 23,000 common murrens and 550 Brandt’s cormorants” use the site as well as “bald eagles and [endangered, although proposed for de-listing] brown pelicans” are noted as being in the

Devil's Punchbowl SNA: Existing Conditions

vicinity (OPAC, 1994).

The 2007 Catalog of Oregon Seabird Colonies makes note of no nesting common murrelets in the most recent surveys (2001-2004) of Gull Rock, although a small number of birds (35 in 1999 and 15 in 2000) were seen a few years in the recent past (Naughton et. al, 2007). Approximately the same number of Brandt's cormorants (522 estimated breeding birds) were observed in a 2004 study of the site as were seen in the early study noted in the TSP as well as a few black oystercatchers. Otter Rock, slightly to the south is also home to some nesting seabirds, namely pelagic cormorants, whose numbers appear to be quite stable at this site (Naughton et. al., 2007).

A list of "at-risk" species that have been documented in the vicinity of the park (within three miles) is located in Table 1. For example, peregrine falcons, bald eagles and black oystercatchers are all known to nest in the vicinity and Stellar sea lions have been observed on rocks in the area. The list also includes several plants and terrestrial invertebrates. A survey for these species has not been conducted as part of this process, so this is based on existing data and it is possible that additional species are found in the park

and surrounding area that are not listed in the table. "At risk" species are species that meet one of the following criteria:

- 1.) Currently listed as "threatened" or "endangered" under state or federal Endangered Species Acts (ESA);
- 2.) Candidate for listing as "threatened" or "endangered" under state or federal ESA;
- 3.) Not "threatened" or "endangered", or candidate for such listing, but considered to be "at risk" as indicated by inclusion on a state or federal watch list.

"At risk" species documented within three miles of Devil's Punchbowl include: northern (Stellar) sea lion, peregrine falcon, black oystercatcher, coho and steelhead salmon (to the south in Beverly Beach State Park), brown pelican, Oregon plant bug and silverspot butterfly (Table 1).

Table 2 shows the species documented during the intertidal biodiversity study conducted by the

Table 1. Listing of "at risk species" that have been documented within three miles of Devil's Punchbowl (DPB). Details about ranking and status can be found in ONHIC, 2007. Detailed surveys for these species were not conducted at the sites for this project, therefore there may be other at risk species within the vicinity of the park that do not appear on this list.

	Scientific Name	Common Name	Heritage Global Rank	Heritage State Rank	Federal Status	State Status	ORNHIC List
Vertebrates							
	<i>Eumetopias jubatus</i>	Northern sea lion	G3S2	S2	LT	SV	2
	<i>Falco peregrinus anatum</i>	American peregrine falcon	G4T4	S2B		LE	2
	<i>Haematopus bachmani</i>	Black oystercatcher	G5	S3	SOC		4
	<i>Haliaeetus leucocephalus</i>	Bald eagle	G5S	S4B, S4N		LT	4
	<i>Oncorhynchus kisutch</i>	Coho salmon (Oregon Coast ESU)	C4T2Q	S2		SC	1
	<i>Oncorhynchus mykiss</i>	Steelhead (Oregon Coast ESU, winter run)	C5T2T3Q	S2S3	SOC	SV	1
	<i>Pelecanus occidentalis californicus</i>	California brown pelican	G4T3	S2N	LE	LE	2
Invertebrates							
	<i>Lygus oregonae</i>	Oregon plant bug	G2	S2			1
	<i>Speyeria zerene hippolyta</i>	Oregon silverspot (butterfly)	G5T1	S1	LT		1

Table 2. Listing of species documented at Devil's Punchbowl during the intertidal biodiversity survey conducted by PISCO in 2007. Details can be found in Appendix B. This table is on this page and the following 2 pages.

Species	Common Name	If common, where (high, mid, low-mid, low intertidal)
<i>Acrosiphonia sp.</i>	green rope algae	
<i>Ahnfeltia fastigiata</i>	busy Ahnfelt's seaweed (red)	
<i>Alaria marginata</i>	angel wing kelp (brown algae)	
Amphipods	amphipods	Mid, Low
<i>Analipus japonicus</i>	fir needle (brown algae)	
<i>Anthopleura elegantissima</i>	clonal anemone	Mid
<i>Anthopleura xanthogrammica</i>	giant green anemone	
<i>Balanus glandula</i>	acorn barnacle	Mid
<i>Balanus nubilus</i>	(barnacle)	
Bryozoans	bryozoan	
Calcareous tube worms	(tube worms)	
<i>Calliostoma sp.</i>	topsnail	Low
<i>Callithamnion sp.</i>	(red algae)	
<i>Cancer sp.</i>	(crab)	
<i>Chaetomorpha sp.</i>	(green algae)	
<i>Chthamalus sp.</i>	(barnacle)	High, Mid
<i>Cirolana harfordi</i>	(isopod)	
<i>Codium setchelli</i>	green spongy cushion algae	
Colonial tunicates	colonial tunicates	
<i>Constantinea simplex</i>	cup and saucer (red algae)	
Crustose coralline algae	crustose coralline algae	Mid, Low-mid, Low
<i>Cryptopleura spp.</i>	hidden rib (red algae)	Low-mid, low
<i>Cryptosiphonia woodii</i>	(red algae)	
Diatoms	diatoms	Low
<i>Dilsea spp.</i>	(red algae)	Mid
<i>Egregia menziesii</i>	feather boa (brown algae)	
<i>Endocladia spp.</i>	sea moss (red algae)	High, Mid
<i>Epiactis prolifera</i>	brooding anemone	
Erect coralline algae	erect coralline algae	Mid, Low-mid, Low
Fleshy crustal algae	fleshy crustal algae	
<i>Fucus sp.</i>	rockweed	
<i>Gunnel sp.</i>	gunnel (fish)	
Hairy chiton	(chiton)	
<i>Halosaccion glandiforme</i>	sea sack (red algae)	
<i>Hedophyllum sessile</i>	sea cabbage (brown algae)	Low-mid, low
<i>Hemigrapsus nudus</i>	purple shore crab	Mid
Hydroids	hydroid	

Devil's Punchbowl SNA: Existing Conditions

Table 2 cont. (listing of Devil's Punchbowl species)

Species	Common Name	If common, where (high, mid, low-mid, low intertidal)
<i>Idotea sp.</i>	(isopod)	Low-mid
<i>Katharina tunicata</i>	black leather chiton	Mid, Low-mid
<i>Laminaria sp.</i>	oarweed (brown algae)	Low
<i>Leathesia/Colpomenia</i>	(brown algae)	
<i>Lepidochiton spp.</i>	(chiton)	Low-mid, low
<i>Leptasterias hexactis</i>	(sea star)	Mid, Low
<i>Lessoniopsis littoralis</i>	strap kelp (brown algae)	
<i>Littorina spp.</i>	periwinkle	High, Mid, low-mid
<i>Lottia spp.</i>	(limpet)	High, Mid, low-mid
<i>Mastocarpus papillatus</i>	Turkish washcloth (red algae)	
<i>Mastocarpus spp.</i>	(red algae)	Low-mid, low
<i>Mazzaella flaccida</i>	rainbow leaf (red algae)	Low-mid
<i>Mazzaella splendens</i>	rainbow seaweed (red algae)	Low-mid, low
<i>Microcladia borealis</i>	sea lace (red algae)	
<i>Mopalia sp.</i>	(chiton)	
<i>Mytilus californianus</i>	California mussel	High, Mid
<i>Mytilus trossulus</i>	blue mussel	
Nemertean	ribbon worm	Low-mid
<i>Neorhodomela larix</i>	black larch (red algae)	
<i>Neorhodomela spp.</i>	(red algae)	Low-mid, low
<i>Nereid spp.</i>	(polychaete worm)	
<i>Nucella emarginata/ostrina</i>	dogwinkle	Mid, Low-mid
Nudibranchia	nudibranch	Low-mid
<i>Odonthalia spp.</i>	seabrush (red algae)	Mid, Low-mid, Low
<i>Osmundea spectabilis</i>	sea fern (red algae)	Low
<i>Pachygrapsus crassipes</i>	striped shore crab	Low-mid
<i>Pagurus hirsutiusculus</i>	hairy hermit crab	
Peanut worms	peanut worm	Low-mid
<i>Pelvetiopsis limitata</i>	little rockweed (brown algae)	
<i>Petrolisthes sp.</i>	crab	
<i>Phyllospadix sp.</i>	surfgrass	Mid
<i>Pisaster ochraceus</i>	ochre sea star	Mid, Low-mid, Low
<i>Plocamium sp.</i>	sea braid (red algae)	Low-mid
<i>Pollicipes polymerus</i>	goose neck barnacle	Mid
<i>Polysiphonia spp.</i>	poly (red algae)	Low-mid
<i>Porphyra sp.</i>	wild nori (red algae)	
<i>Prionitis spp.</i>	bleach weed (red algae)	

Table 2 cont. (listing of Devil's Punchbowl species)

Species	Common Name	If common, where (high, mid, low-mid, low intertidal)
<i>Ptilota sp.</i>	(red algae)	
<i>Pugettia spp.</i>	kelp crab	
<i>Schizymenia spp.</i>	slimy leaf (red algae)	
Sculpin	(sculpin/fish)	
<i>Semibalanus cariosus</i>	haystack barnacle	High, Mid
Shrimp	(shrimp)	
Smooth chiton	(chiton)	
Sponges	(sponge)	
<i>Strongylocentrotus purpuratus</i>	purple sea urchin	Mid, Low-mid, Low
<i>Tegula funebris</i>	black turban snail	
<i>Tonicella lineata</i>	lined chiton	Mid, Low-mid, Low
<i>Ulva spp.</i>	sea lettuce (green algae)	High
Unidentified crab		
Unidentified red blade	(red algae)	

Partnership for Interdisciplinary Studies (PISCO) (Table 2). A detailed explanation of the results of the study are found in Appendix B. The most common species based on percent cover are *Mytilus californianus*, *Mazzaella flaccida*, *Cryptopleura spp.* (northern site), *Chthamalus sp.*, *Mytilus californianus*, crustose coralline algae, and *Odonthalia spp.* (southern site). The most common based on number of individuals (count) are *Littorina spp.*, *Lottia spp.*, *Strongylocentrotus purpuratus* (northern site) and *Littorina spp.*, and *Lottia spp.* (southern site).

There is a high degree of variability between the different areas surveyed (north vs. south and the different tidal zones (e.g., high vs. low). Although for some areas, there is some indication that human visitation plays a role in the number and type of species present, no clear causation can be drawn from this initial, baseline data collection effort. Therefore, as funding is available more data will be collected and analyzed.

Mussel and barnacle recruitment data was also collected at the site (and many others along the coast). Patterns demonstrate “very high species-to-species, cape-to-cape, site-to-site and period-to-period variability in recruitment rates.” However, even

given this high level of variability, recruitment of all three species monitored at the site were relatively low, particularly for barnacles.

The beach on the south side of the headland (called Otter Rock State Park beach, actually the northern portion of Beverly Beach, also known as South Beach) is one of the state’s regular water quality monitoring sites. The marine garden beach used to be tested but no longer is part of the regular monitoring program. The Department of Human Services (DHS) tests the water against the headland as well as 0.2 km south of the state park access stairs. Up-to-date results of the testing can be found on the Oregon Coastal Atlas. For the marine garden beach, data collected in 2003 and 2004 shows only a few instances of detectable levels of contaminants (and none resulted in a water quality warning). For the south side of the headland, testing between 2002-2008 shows only one case where a warning was issued, but quite a few instances of detectable levels of contaminants being found.

Scenic Resources:

Particularly because the site is a day-use area, and is often used by visitors for enjoyment of the scenic

Devil's Punchbowl SNA: Existing Conditions

nature of Oregon's coast and ocean, the scenic qualities of the park are important to the recreational experience of visitors. The master plan notes that the park is designated an "Area of Exceptional Scenic and Aesthetic Resources" by Lincoln County (OPRD, 1988). The overlook area is frequently used by visitors to get a quick glimpse of the powerful ocean and the geologic features that make the site unique. The Punchbowl itself provides scenic enjoyment, as does the visual access to the ocean at this point. The natural features of the beach on the south end of the headland and the tidepool area of the marine garden on the north end allow visitors to visually observe the ecosystems that live in the interface between the land and sea and the geologic features created by the passage of time.

Cultural Resources:

Evidence of cultural resources has been found in the vicinity of the park and the area is considered a "high probability" zone by the State Historic Preservation Office (SHPO). Reports for known sites are filed with SHPO. Pursuant to state law, this information is not available for public review.

The park land is an important traditional-use area of the Confederated Tribes of the Siletz Indians and their cultural heritage within the area is of considerable antiquity. Much of the area now known as Otter Rock used to be owned by Siletz Indians around the turn of the century, namely the Dope Spencer family (de Sosa, 1981).

During World War One, the Spruce Division of the Army was stationed in the area. During that time, much work was done to bring the railroad to Otter Rock but after the war, it was never completed (de Sosa, 1981). In the early 1930's the Civilian Conservation Corps (CCC) built a cedar fence at the current overlook as well as stairs down to the Punchbowl and South (Beverly) Beach (de Sosa, 1981). Erosion has since destroyed these features.

Recreational activities:

Visitor use at Devil's Punchbowl SNA has increased significantly since counts began in 1965 (fig. 8).

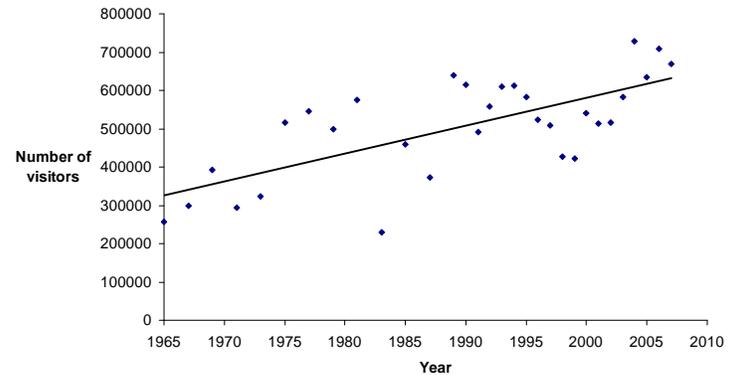


Figure 8. Visitor use based on day use parking lot data from Devil's Punchbowl SNA (1965-2007).

Although visitation fluctuates from year to year, there is an continuing upward trend evidenced by parking lot counts. Although it is not known what percentage of these visitors move beyond the parking lots, and the methodology assumes some things that may slightly overestimate or underestimate visitation (the counters count cars and a multiplier is used to determine the average number of passengers per car), it does give a general sense of increased site popularity. For example, the many school buses that are known to frequent this site are not fully accounted for in these numbers.



Visitors exploring the rocky shoreline at Devil's Punchbowl

To help answer this question in more detail, visitor use surveys were conducted in 2007 to measure actual visitation to the rocky shore (on the marine garden side of the headland) and characterize types of visitor use. A full report (along with a description of methodology) is located in the appendix and key findings are summarized here.

Visitation

The average number of visitors per day is 94 with a range between 4 visitors on a rainy June 1st and 177 on June 5th (Table 3). During the 9 days sampled (following the methods described in the appendix), the daily average hourly use ranged from 1 to 35 persons with an average hourly visitation of 19 visitors per hour. Daily totals are shown in Table 3.

On average, weekdays (104 visitors/day) got more use than weekends (82 visitors/day) and more visitors came during summer vacation (137 visitors/day) than when school is in session (59 visitors/day). Days that fall on weekends when school is in session (WeS appear to receive the lowest mean use (37 visitors/day) with weekdays during summer vacation (WdH) receive the most (148 visitors/day). Bad weather may have been a factor on at least one of the observation days (June 1st), where only 4 visitors were observed during the observation period. The other day with rain, also received about half as many visitors as the other day of the same type (May 20th had 29 visitors vs. June 2nd had 45).

Visitation at Devil's Punchbowl appears to be evenly spread out over the observation period. Visitation peaks the hour after low tide with 36% of visitors

Table 3. Visitor counts totals for each of the 9 survey dates at Devil's Punchbowl SNA. The two rainy days are indicated with a * next to the number of visitors.

Day Type	Dates	Number of visitors
WdS	May 16 th	42
	June 1 st	4*
	June 5 th	177
		$X' \approx 74$
WeS	May 20 th	29*
	June 2 nd	45
		$X' \approx 37$
WdH	July 3 rd	138
	July 4 th	158
		$X' \approx 148$
WeH	June 16 th	140
	June 17 th	113
		$X' \approx 127$
TOTAL		846
Average		$X' \approx 94$

choosing this time frame to visit the site. The most popular time to visit Devil's Punchbowl during this survey was between 9 and 10 in the morning, with 40% of visitation occurring during that period. No

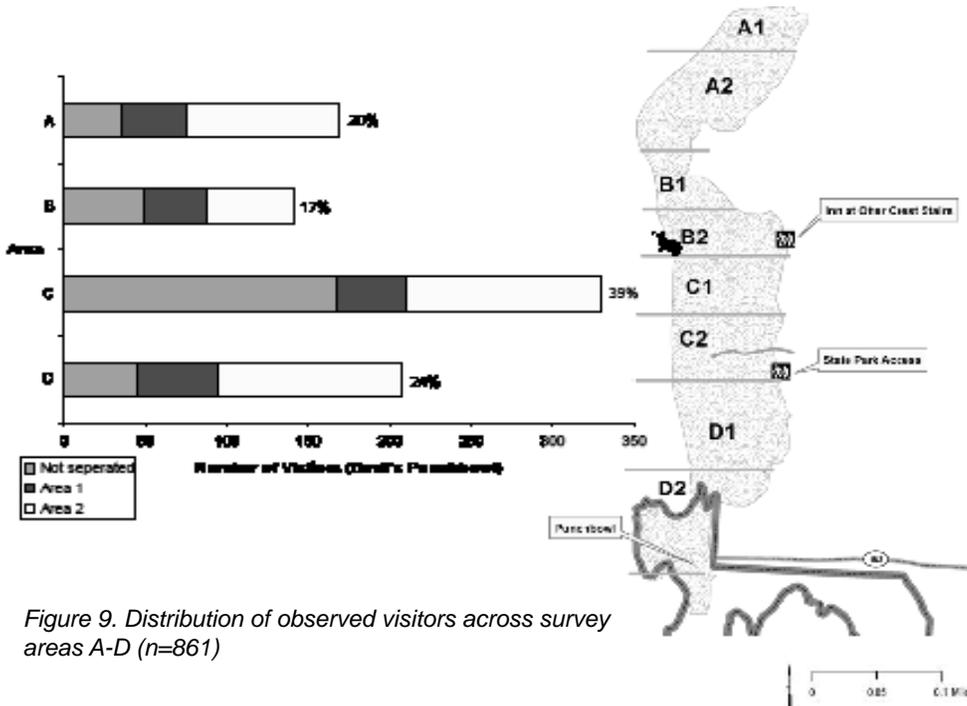


Figure 9. Distribution of observed visitors across survey areas A-D (n=861)



Aerial view of Devil's Punchbowl SNA

Devil's Punchbowl SNA: Existing Conditions

visitors were observed between 6 and 7 in the morning. In general, visitation appears to increase as the time of low tide moves later in the day with the busiest day falling on the latest low tide of 10:17 AM.

Distribution

The most frequented area is between the two access points: the Inn at Otter Crest stairwell and the state park access (fig. 9). This is area "C", as noted in figure 9 and is frequented by 39% of visitors to the site. Area "C" was subdivided into two sections (C1 and C2). C2 is the most popular, which is the area that runs just to the north of the state park access point (fig. 9).

The second most popular area is area "D", which runs from just south of the state park access into the punchbowl itself (24% of visitation), with the punchbowl area (D2) being the most frequented between the two sub-sections. The least visited section of shoreline was area "B". Area "B" runs to the north of the Inn at Otter Crest access point to just before the end of the small headland and receives 17% of visitation. This is where the harbor seal haulout is. However, all visitors to area "A" have to pass through area B, but because of limitations of the survey methodology, this information is a snapshot in time and does not necessarily capture this.

Types of recreation

Passive recreation (e.g., walking, observing, tidepooling (without handling organisms or rocks)) was the most common activity with 51% of visitors (fig. 10). Beach activities such as walking on the beach were the second most common activity (28%), however, many of these people were observed to simply be using the beach to access other sections of the rocky shore. Unlike some of Oregon's rocky shorelines, a sandy beach fronts the majority of the intertidal of the Devil's Punchbowl area. Therefore, it is quicker and easier to move from one area to another by way of the beach. For this reason, beach (non-rocky-shore) recreation was not omitted from the survey so as not to underestimate the potential (and likely) total pressure on the area.

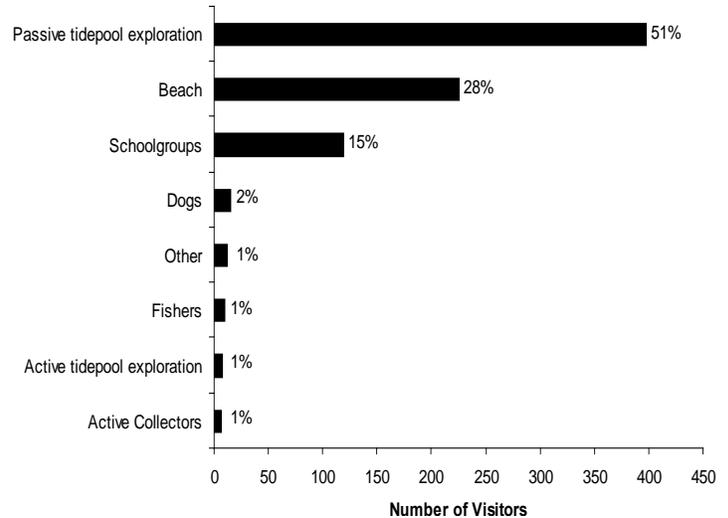


Figure 10. Recreational activities at Devil's Punchbowl (n=861)

Educational (schoolgroup) visits make up one of the primary activities at Devil's Punchbowl intertidal (15%), especially during the spring low tide series that coincide with end of year field trips (fig. 10). Groups visiting the site often come with pre-planned activities such as identification scavenger hunts. However, several groups were seen with apparently no pre-set educational plan, except for free roaming exploration by the children, moderated in part by parent volunteers. During peak low tides during the spring, especially those that occur later in the day (providing time for the school groups to travel to the site) as many as 14 school busses have been seen in the parking areas. With 14 school busses, there could potentially be over 800 people in the intertidal at one time during peak spring low tides. These numbers were not observed during the survey period.

Active rocky shore recreation (picking things up, handling organisms, touching organisms and/or turning over rocks) were far less common (1%), however, it is likely that this figure is underestimated. This study was only able to provide a snapshot of activity and cannot possibly catch all subtle (and sometimes quick) actions such as poking a sea star, especially from a distance. Although collecting was not common at this site, it does occur. While some limited amount of collection is of living organisms (which is illegal in the marine garden), in most cases

it is not possible to distinguish people collecting living vs. non-living organisms (such as urchin shells). Therefore, the figure of 1% for collecting may include some non-living items.

Demographics

The median group size for visitors is 3 people with a range between 1-100 people. Over half of the visitors (63%) were with families, with 14% traveling with friends and only seven percent visiting the intertidal area alone.

Three percent of the visitor groups were traveling with an educational (school) group with an average group size of 94. School groups came from schools including Canyon Creek in Billings Montana, Meadow View (Eugene) and Albany Central.

The majority (68%) of visitors interviewed were Oregonians, the second largest group coming from Washington State (10%) and 1% from Canada. The median one-way distance traveled was 110 miles with a range of less than one mile (Otter Rock, OR) to 3,076 miles (Great Barrington, MA). Forty eight percent of in-state visitors came from the Portland Metro area, 34% from the Willamette Valley, and 10% from the Oregon coast.

Over half of the visitors (59%) said they were repeat visitors to the Devil's Punchbowl intertidal area. The average visit time for return visitors is two hours with a range between one and six and a half hours. 60 percent of return visitors indicated visiting the Devil's Punchbowl intertidal area between one to three times per year with an average of ten visits per year and a range between one and 250 days. If the one 250 outlier is removed, the average number of visitors falls to an average of five visits per year.

Of those visitors that came to Devil's Punchbowl for the first time, 19% indicated it was also their first visit to the Oregon Coast. All first-time visitors interviewed indicated they would return to Devil's Punchbowl at some time in the future. The average visit to the intertidal is 1 hour 40 minutes for first time visitors with a range of one half hour to 6 hours. Sixty percent of first-time visitors indicated they spend between one

and two hours at the site.

Access

With two access points available to reach the marine garden tidepools, those interviewed either came down via the Inn at Otter Crest or the state park access. Of those people interviewed there was almost a 50-50 split between which access points they used (48% for the hotel vs. 52% for the park). However, the number of people in the groups coming down at the park was 20% higher than those arriving from the Inn at Otter Crest stairs, due in large part to school groups.



Public access point to marine gardens at Devil's Punchbowl

Although most school groups come down at the state park, some do access the beach from the hotel. As a result, the majority of the actual individual visitors (56%) accessed the beach from the state park (257 individuals, 47 groups) with the other 44% (205 individuals, 43 groups) coming down at the Inn at Otter Crest.

Beach access is also provided on the south side of the small headland, to Beverly Beach. There is a small section of accessible rocky shoreline, although most is only exposed (and accessible) at negative low tides. This section of rocky shoreline receives relatively low amounts of use. However, there is a small "cave" that attracts visitors at low tide to explore and visitors that come down to the beach for other reasons often drift over to explore the cliffs and accessible rocky areas.

Devil's Punchbowl SNA: Recreation Needs and Opportunities

This beach is more often used for non rocky-shore recreational pursuits such as surfing, water access for kayaking, pickinicking, beachcombing/walking and relaxing in a stationary position. This is a particularly popular surfing beach and large groups can often be seen here as part of surfing lesson groups.

Recreation Needs and Opportunities

An assessment of the recreation needs and opportunities is based on a review of the following information sources: 1) The 2003-07 and 2008-2012 Statewide Comprehensive Outdoor Recreation Plans (SCORP); 2.) The Oregon Ocean Shore Management

Plan (OSMP); 3.) The Rocky Shore Recreational Use Study conducted as part of this planning process and summarized in the visitation section. Additionally, information collected from the advisory committee and staff team in the issue scoping process is factored into the goals and strategies involving recreation needs and opportunities.

2003-2007 SCORP

The Statewide Comprehensive Outdoor Recreation Plan (SCORP) for 2003-2007 looks at outdoor recreational demand and participation trends for a wide range of activities, both regionally and statewide (OPRD, 2003). Devil's Punchbowl SNA is in SCORP Planning Region 1, which encompasses Clatsop,

Table 4. Recreation Demand and change over time in SCORP Region 1 (OPRD, 2003)

Recreation Activity	2002 User Occasions	% Change 1987-2002
Beach Activities, including swimming (fresh & salt)	6,041,082	82.7%
Ocean beach activities	4,693,793	NA
Sightseeing/Driving for Pleasure	2,410,370	-22.7%
Bird watching	1,943,404	NA
Nature/Wildlife Observation	1,797,447	26.8%
Day Hiking	993,897	80.6%
Fishing from a bank or shore	757,909	NA
Picnicking	637,321	-53.1%
Outdoor Photography	460,141	-64.5%
Walking for pleasure on trails (all surfaces)	313,710	NA
Clamming	312,421	NA
Camping on an ocean beach	264,668	NA
Running/walking for exercise on trails (all surfaces)	213,061	NA
Sea kayaking	77,532	NA
SCUBA diving or snorkeling	63,278	NA

Tillamook, Lincoln and coastal Lane Counties.

For each of the planning regions in the SCORP, estimates of recreational participation were measured (in “user occasions”) in 2002. In some cases, it was possible to compare these numbers with data from 1987 to look at change in recreational demand over time. Activities that are potentially associated with Devil’s Punchbowl are presented in the below table, showing 2002 user occasions as well as, as applicable, change since 1987 (Table 4).

The highest growth activity for Region 1 is use of beaches (87.7%), followed closely by day hiking (80.6%) (Table 4). Activities that appear to be decreasing in popularity regionally include outdoor photography (-64.5%) and picnicking (-53.1%). Most of the activities do not have specific data available that would make comparisons possible over time. Popular activities in the region include ocean beach recreation, sightseeing for pleasure, bird watching and general nature/wildlife observation.

2007-2012 SCORP: Unlike previous SCORP planning efforts which focused on regional planning, in this SCORP, OPRD addressed a limited number of important demographic and social changes facing Oregon’s outdoor recreation providers in the coming years including: a rapidly aging population, fewer youth learning outdoor skills, an increasingly diverse population, and the physical activity crisis (OPRD, 2007).

Important findings of relevance to this plan are summarized very briefly below and in tables 5 and 6, which show some results from these focused surveys (OPRD, 2007). Table 5 shows the top 10 recreation types that members of Oregon’s aging population indicate they participate in at least once per year, along with how many times they say they participate and an average number of hours per day spent doing that activity (OPRD, 2007).

Aging Oregonians

- The most popular outdoor recreation activities for

Table 5. Top 10 Outdoor Recreation Types (by percent participating) for Oregon’s aging population (OPRD, 2007).

Rank	Recreation Type	Percent participating	Mean days	Mean hours/day
1	Walking	80%	64.3	1.8
2	Picnicking	68%	5.2	3.2
3	Sightseeing	63%	9.9	4.1
4	Visiting historic sites	62%	3.6	3.1
5	Ocean beach activities	54%	4.1	3.9
6	Day hiking	52%	6.6	3
7	Children/grandchildren to playground	39%	5.7	2.1
8	Exploring tidepools	37%	1.5	2.5
9	Bicycling	33%	2.6	4.8
10	Other nature/wildlife observation	31%	5.4	2.8

Devil's Punchbowl SNA: Recreation Needs and Opportunities

Oregonians between the ages of 42-80 included walking, picnicking, sightseeing, visiting historic sites and ocean beach activities (Table 5). Not too far behind, in 8th place (based on percent participating at least once a year) is exploring tidepools with 37% participation (Table 5). Other nature/wildlife observation is in 10th.

- The average number of days spent exploring tidepools is 1.5 with approximately 2.5 hours spent exploring each day (Table 5).
- The top five activities in terms of future participation intensity 10 years from now included walking, bicycling, jogging, bird watching and day hiking.
- The most important current motivations or reasons for participating in outdoor activities were to have fun and be in the outdoors.
- Ensuring clean and well-maintained parks and facilities was the most important management action that will lead to a large increase in recreation, followed by developing walking/hiking trails closer to home and providing more free-of-charge recreation opportunities.
- Over a third of Oregon Boomers and Pre-Boomers indicate they volunteer in their community, with an average time commitment of 5.3 hours per week (with 43% expecting changes in their activities, with most of the changes involving greater volunteerism, more time, and looking for

new opportunities). Providing more information appeared to be the key to increase volunteerism.

- Oregon's recreation managers can expect substantial increases in the number of visitors with a physical or mental disability using their recreational facilities and services.
- Priority should be given to trails, picnic areas, sightseeing areas, and historic sites in terms of where resources should be directed for providing accessibility accommodations
- Coastal Oregon has been, and is likely to continue to be, one of the most popular destinations for people moving to Oregon from other states.
- On average across all activities, respondents expect to spend 28% more days recreation 10 years from now than they currently do (potentially breaking the trend of decreasing recreation with age).

Table 6 shows the top five outdoor recreation types, by numbers of people participating, for two other categories (minorities and youth) that were surveyed as part of the 2007-2012 SCORP (OPRD, 2007). For the minorities surveyed, an average figure is also presented.

A Growing Minority Population

- Walking for pleasure, fishing and hiking were the most commonly mentioned favorite activities.

Table 6. Top 5 Outdoor Recreation Types (by percent participating) for Oregon's minorities and parents/youth* (note: the children's favorite activities do not correspond exactly with the other groups (for example, bicycling is tied for first for their favorite but isn't listed in this table and viewing natural features is not in their top 5 because of the popularity of biking, outdoor sports/games and swimming).

Source: OPRD, 2007

Recreation Type	Hispanic	Asian	Average	Parents	Youth*
Walking for pleasure	77%	80%	78%	74%	80%
Picnicking and family gatherings	74%	63%	70%	69%	77%
Relaxing, hanging out, etc.	67%	53%	63%	56%	64%
Viewing natural features	62%	56%	60%	60%	58%
Ocean/freshwater beach	56%	52%	55%	67%	73%

- In terms of percent participating, walking, picnicking/family gatherings, and relaxing/hanging out were the top activities (Table 6).
- Over half of respondents indicated they participate in ocean/freshwater beach activities.
- The majority of respondents participated in their favorite activity with immediate family members
- The most common location to do their favorite activity was in a park or other area outside one's town or city.
- Ensuring clean and well-maintained parks and facilities were the most important management action followed by keeping parks safe from crime, providing more free-of-charge recreation opportunities and expanded facilities.
- The most commonly recommended facilities for development in parks were picnic tables, followed by trails and campgrounds.
- Overall, the internet was the most frequently noted as the desired information outlet.
- Lack of information and cost were reported as the main constraints to participation in children's outdoor programs.

Oregon Parents and Youth Study

- The most popular (highest average days in the past year) outdoor activities for parents was walking, viewing natural features, and relaxing/hanging out (Table 6). For children, the most popular were walking, followed by outdoor sports/games, relaxing/hanging out, and general play at neighborhood parks/playgrounds.
- 67% of parents and 73% of children indicated they participate in ocean or freshwater beach activities.
- The more a parent engages in an outdoor recreation activity, the more their child does.
- Almost all parents felt that it was a priority for their child to spend more time in outdoor activities.
- Youth preferred to do their favorite program activity with friends and in groups of 3-5 or 6-10 people.
- Recreation resource managers should attempt to understand if their existing and proposed facilities are appropriate for Oregon's youth
- Recreation resource managers should strive to develop partnerships with appropriate recreation entities.

Ocean Shore Management Plan

For the Ocean Shore Recreational Use Study conducted as a part of the Ocean Shore Management Plan, Devil's Punchbowl is in recreation segment 3 and the Beverly littoral cell. The Devil's Punchbowl/Otter Rock marine garden beach was not included in the study, while Beverly Beach to the south was, running from the headland south to Schooner Point.

Activities noted during this study include primarily relaxing/swimming (53%) along with walking/running (29%) along with some surf sports (4.4%) (OPRD, 2005). Other activities noted include surf fishing, equestrian use, beach camping and dog walking. Respondents did not feel crowded within this segment of beach and distribution of people was given a "local" rating. The level of peak use (average number of people observed on a weekend day) noted during this survey was 187.

Devil's Punchbowl SNA: Issues

Issues

A number of issues have been brought up through the public interview process, as well as staff and stakeholder meetings regarding Devil's Punchbowl SNA. Issues that can be addressed in this planning process are reflected in the goals and/or resource management guidelines. Not every issue identified as part of this process is appropriate to address in this plan. For example, this is not a Master Plan, so no development proposals are being made. Therefore, those issues that cannot be reasonably addressed are mentioned for potential future consideration by OPRD in other appropriate programs. Some issues are addressed through related follow-up work, including suggested future studies and work with agency partners.

In this section, a list of issues is presented by general category and a matrix outlines potential solutions and barriers, and potential partners (Table 7). Then, as appropriate, issues are addressed in the goals and/or resource management guideline sections.

Facilities:

- The restroom wall will need to be fixed in the near future
- The parking lot is often over-capacity, especially with school busses in the spring and early summer
- The site was not built to accommodate RV's, although they continue to use the site, especially during the summer
- There are no trash receptacles down at the beach and some visitors complain about litter on the beach
- The restroom is not in close proximity to the beach and some visitors complain about distance to reach the restroom facilities
- Beach access on the marine garden side is in poor condition and continues to degrade near the bottom of the trail. It is not possible to use the seasonal stairs anymore. The general area (near the bottom of the trail) is eroding and presents a hazard.
- ADA access to the beach is not possible
- Adjacent landowner wants to install private drive

on the current trail (county road) to provide access to their property for home development

- Highway access approaches are not very good, particularly the southbound approach. Therefore, any increase in capacity or attendance (more than 250 trips per day) would be problematic

Recreation:

- Issues can be substantially different on the north (marine garden) and south (Beverly Beach) portions of the ocean shore accessed by Devil's Punchbowl SNA and may need to be addressed separately
- Some visitors experience crowding on the ocean shore
- Recreation safety of visitors climbing over the barriers near the punchbowl and other cliff areas, especially since there is ongoing erosion in the area

Natural Resource/Environmental:

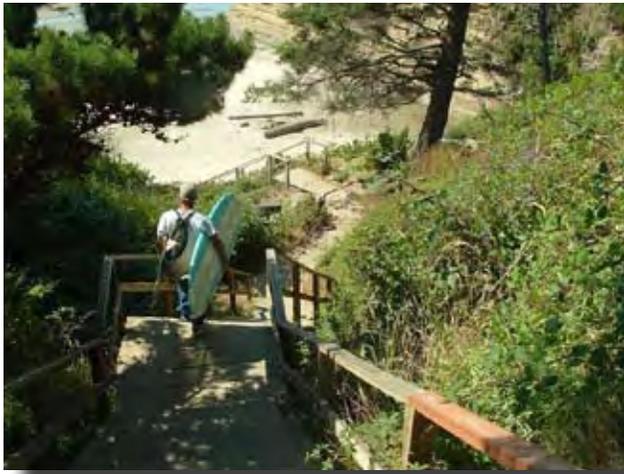
Rocky Shore

- Level of direct human impact from trampling/ collection to the rocky shore (intertidal) is not currently known
- Few visitors are aware of rules and guidelines for protecting marine mammals and regular disturbance of the animals hauled out on the rocks has been observed, including disturbance by dogs off-leash
- Some small level of illegal collection occurs at the marine garden
- Potential disturbance of resident and migratory



Young seal resting on the rocks

- shorebirds by visitors on the beach and rocky shore
- Black oystercatchers nest in the area and could potentially be disturbed by visitors, particularly if kite flying (or some other type of airborne device) becomes popular near the punchbowl, particularly on the Beverly Beach side of the headland
- Pigeon guillemots nest in the area and could be disturbed by visitors if they climb over the fence near the punchbowl
- Some visitors use the stairwell on the Beverly Beach side to access the beach for surfing and kayaking. There is the potential for disturbance to seabirds depending on where they go from there and how they behave.



Access via the park stairwells on the south side of the headland

- Offshore seabird colonies (particularly common murres) appear to have dramatically decreased in the past 20 years. Although there are likely many factors at play, the key culprits may be bald eagles, whose populations are making a resurgence (USFWS, pers. comm., 2008).

Pollution

- Residential effluent may be polluting surface water outfalls onto the beach
- Septic material is coming out of seeps in the ocean bluffs
- Sewage treatment plant releases treated effluent into the intertidal (the use is permitted but needs repair)
- Approximately 50% of the drain fields in the area have failed (very permeable)

- Potential future increases in development could lead to increased runoff (e.g., proposed Otter Woods Development could add an additional 150-200 homes)
- Residents, the county, and other landowners use pesticides on their properties which may end up in surface runoff and eventually reach the marine garden tidepools.

Interpretation:

- The site needs additional interpretive/enforcement and generally staff oversight presence. It would be helpful to have an interpretive strategy.
- There is no on-site interpreter like at some other rocky shore sites
- No visitors interviewed mentioned knowledge of the site being a protected marine garden, although a small percentage did indicate they believed the site had special protections (beyond general, non-site specific, fish and wildlife regulations)
- None of the existing signage at the access points talks about offshore rocks and shorebird/seabirds. Signage should be consistent along the coast and if in close proximity to the birds themselves, try not to attract additional visitors.
- It is difficult for the public to understand ocean shore vs. state park rules
- School groups do not often coordinate with the park prior to their visits
- Resources are not readily available for teachers to facilitate intertidal visits
- Existing interpretive panels (at the punchbowl) are starting to fade and one has been removed completely (vandalized)

Cultural:

- The area is within a “high probability” and “known site” zone for cultural resources

Miscellaneous:

- The GIS layer for the park boundary is not exact



Table 7. Issues matrix for Devil's Punchbowl SNA. The table should be read across the two page spread and is continued on the next 5 pages.

Issue	Issue Type
Restroom wall needs to be fixed	Facilities
Parking lot is often over-capacity (particularly a problem with busses and RVs)	Facilities
No trash receptacles close to beach	Facilities
Restroom is far from the beach	Facilities
Marine Garden trail access is in poor condition near the bottom, not able to use stairs any more. ADA access is not possible.	Facilities
Adjacent landowner wants to install private drive	Facilities
Issues are different on the north (marine garden) and south (Beverly Beach) portions of the beach and may need to be addressed separately	Recreation
Some visitors experience crowding on the ocean shore	Recreation
Safety of visitors climbing over barriers near punchbowl and other cliff areas, especially with ongoing erosion	Recreation
Impact of visitors to rocky shore	Environmental
Human disturbance of marine mammals that are hauled out on accessible rocks, including disturbance by dogs off leash	Environmental
Some illegal collection occurs	Environmental/Interpretation

Devil's Punchbowl SNA: Issues

Potential Solution(s)	Potential Barrier(s)	Potential Partners
Replace restroom, routine repairs	Funding	OPRD Operations
New striping for busses, look at pull through options, regular striping, encourage to use other sites with higher capacity, coordinate with schools	Funding, no room for expansion, staff time	OPRD Operations, OPRD RPP, Schools (Oregon and out-of-state)
Install a bag dispenser for visitors to pick up beach trash to deposit at the trash cans by the restroom	Funding, space to put the dispenser	OPRD Operations, SOLV (?)
No viable solution	No viable location to place restroom	
Routine maintenance (continue to grade routinely, as appropriate), relocate trail, permanent wooden stair like at Yaquina Head, examine geological situation more thoroughly, close when deemed unsafe	Fortified in the past and continues to fail-had to stop using the seasonal stairs, funding, location to relocation, instability of terrain/ongoing erosion, no affordable engineering solution (?), public ignores safety closures, geologists say not any real solutions, sandstone too unstable for stairs	OPRD Operations, Private Landowner, Lincoln County, Adjacent landowners, DOGAMI
Work with landowner and neighbors to develop a solution for public and private access	Potential conflicts between driveway and public access	OPRD Operations, Private Landowner, Lincoln County, Adjacent landowners
		OPRD Operations, OPRD RPP
Do not increase parking capacity		OPRD Operations, OPRD RPP
Interpretive/warning signage, on-site presence	Funding, staff time	OPRD Operations, OPRD RPP
Use baseline inventories/visitor surveys to develop more focused & long-term impact studies.	Funding, staff time	OPRD RPP, OPRD Operations, Oregon University System
Add marine mammal related interpretive signage, on-site interpretive services (roving ranger)	Staff time, funding	OPRD Operations, OPRD RPP, NOAA/USFWS
Interpretive signage explaining appropriate harvest methods, interpretive brochures, roving ranger can explain to visitors	Lack of compliance, lack of knowledge, staff time (enforcement and education), funding for new signage	OPRD Operations, OPRD RPP, ODFW, DSL

Table 7. Issues matrix cont.

Issue	Issue Type
Potential disturbance of resident and migratory shorebirds by visitors on the rocky shore and beach	Environmental
Potential future disturbance of nesting black oystercatchers if kite flying (or other airborne devices) become popular, particularly on the south side of the headland	Environmental
Beach access used for kayaking, potential for disturbance to seabirds on offshore rocks	Environmental
Offshore seabird colonies (common murre) appear to have declined	Environmental
Residential effluent and runoff may be polluting surface water outfalls onto the beach	Environmental/Safety
Septic material coming out of seeps in ocean bluffs	Environmental/Safety
Sewage treatment plant effluent releases into intertidal	Environmental/Safety
Drain field failure	Environmental/Safety
Visitors unaware of protected status (marine garden)	Interpretation
Hard for public to understand ocean shore vs. state park rules	Interpretation

Devil's Punchbowl SNA: Issues

Potential Solution(s)	Potential Barrier(s)	Potential Partners
Coordinate with USFWS on development of interpretive strategy (signage, on-site message etc.)	Lack of compliance, lack of knowledge, staff time (enforcement and education), funding for new signage	OPRD Operations, OPRD RPP, USFWS
Encourage these types of activities at sites without nesting seabirds so close by; see above (interpretive strategy). Interpretive signage.	Lack of compliance, lack of knowledge, staff time (enforcement and education), funding for new signage	OPRD Operations, OPRD RPP, USFWS
Interpretive signage	Lack of compliance, funding for new signage	OPRD Operations, OPRD RPP, USFWS
Consult with USFWS as appropriate		OPRD Operations, OPRD RPP, USFWS
Coordinate with DEQ to determine if water quality testing is occurring, extent of problem and potential next steps such as education about pesticides.		OPRD Operations, OPRD Safety Program, DEQ, Surfrider, ODA, Private Landowners, Lincoln County Sanitarian
Coordinate with DEQ to determine if testing is occurring and extent of problem		OPRD Operations, OPRD Safety Program, DEQ, Surfrider, Private Landowners, Lincoln County
Coordinate with DEQ to determine if testing is occurring and extent of problem		OPRD Operations, OPRD Safety Program, DEQ, Private Sewage treatment Operator, Lincoln County Sanitarian
Coordinate with DEQ to determine if testing is occurring		OPRD Operations, DEQ, Private Landowners, Lincoln County
Improve marine garden signage-making it clear that no collecting is allowed because this is a protected area, on-site interpretive services (roving ranger)	Staff time, funding	OPRD Operations, OPRD RPP, ODFW
Revise rules to make enforcement uniform along the shore	Staff time	OPRD RPP, OPRD Operations, OPRD Ocean Shores Program
Install signage to explain the regulatory differences	Funding, hard to explain, need too many signs, hard to place signs on/near beach	OPRD Operations, OPRD RPP, OPRD Ocean Shores Program

Table 7. Issues matrix cont.

Issue	Issue Type
None of existing interpretive signs discuss offshore rocks and shore/seabirds	Interpretation
Resources not readily available for teachers to facilitate intertidal visits	Interpretation
School groups do not often coordinate with the park prior to their visits	Interpretation
Need additional enforcement/oversight/education	Interpretation
High probability and “known site” cultural resource site	Cultural
GIS park (ownership) boundary layer not exact	Miscellaneous

Devil's Punchbowl SNA: Issues

Potential Solution(s)	Potential Barrier(s)	Potential Partners
Coordinate with USFWS on development of interpretive strategy	Lack of compliance, lack of knowledge, staff time (enforcement and education), funding for new signage	OPRD Operations, OPRD RPP, USFWS
Provide lesson plans to teachers	Staff time, voluntary participation	OPRD RPP, OPRD Operations, Schools (Oregon and out-of-state)
Have a teacher resource section on the OPRD website	Staff time, voluntary participation	OPRD RPP, OPRD Operations, Schools (Oregon and out-of-state)
Discourage unmanaged visits	Staff time, volunteer compliance of request	OPRD RPP, OPRD Operations, Schools (Oregon and out-of-state)
Facilitate scheduling with schools to improve experience, avoid crowding by reaching out to the education community	Support infrastructure, staff time, funding	OPRD RPP, OPRD Operations, Schools (Oregon and out-of-state)
Provide oversight guidelines	Staff time	OPRD RPP, OPRD Operations
Encourage educational focus for visits	Staff time, volunteer compliance, resources to support teachers, teacher time, participation of parent supervisors	OPRD RPP, OPRD Operations, Schools (Oregon and out-of-state)
New rocky Shore Interpreter, share with other sites (e.g., Seal Rock)	Funding, staff time for coordination	OPRD RPP, OPRD Operations,
Interns	Housing, Funding	OPRD Operations, OPRD RPP, Oregon Coast Comm. College, OUS
Volunteer docents	Staff time to coordinate, need dedicated volunteers, training	OPRD RPP, OPRD Operations, Coastwatch, Oregon Coast Aquarium, HMSC
Partner with aquarium volunteer program	Staff time to coordinate, training	OPRD RPP, OPRD Operations, Oregon Coast Aquarium
Partner with the new OSU master naturalist program	Staff time, training	OPRD RPP, OPRD Operations, OSU Extension,
Temporary signs with docents like at YHONA	Funding, staff time	OPRD Operations, OPRD RPP, YHONA
Rocky shore "hosts"	Campsite, staff support (e.g., oversight, training), safety issues	OPRD Operations, OPRD RPP
Maintain current practices (e.g., require clearance forms, continue consultation for activities that could disturb resources)		OPRD Heritage Programs, OPRD Operations, Tribes
Verify boundary and 16' contour elevation with a survey	Staff time, funding	OPRD Operations, Lincoln County



Natural, Cultural and Scenic Resource Management

This section outlines general guidelines for management of natural, cultural and scenic resources in the park based on OPRD policies and statewide guidelines.

Statewide Natural Resource Policy:

It is the policy of the Oregon Parks and Recreation Department to plan, design and implement resource management practices consistent with the principles of conservation, energy efficiency, and sustainability.

The following policy guidelines have been established:

- Manage OPRD properties to preserve and protect Oregon's natural landscape; manage park properties to enhance the natural ecological processes that sustain natural resources in balance with current and future outdoor recreation interests.
- Manage natural resources in a manner emphasizing ecosystem-based approaches that protect the integrity of the natural environment and promote ecosystems that favor biodiversity, reduce ecological fragmentation, and promote native species.
- Comply with all applicable federal, state, and local rules and regulations, and seek ways to avoid or minimize ecological impacts that may occur as part of the implementation of operations and business systems. Where such impacts are unavoidable, OPRD will mitigate for such impacts.
- Develop and maintain an Environmental Management System (EMS) to conserve resources, reduce impacts to the environment, and implement sustainable operational policies and procedures.
- Implement energy conservation and efficiency measures in all aspects of agency operations including; facility design and maintenance, fleet

and transportation systems, and department administration.

- Incorporate sustainable practices into all facets of the department's mission, particularly: facility and site planning, design, construction, operation and maintenance; grant programs; contracting and procurement, and visitor programs and services.
- Reduce, and where possible eliminate, hazardous chemicals and toxic materials in construction, operations and maintenance activities.
- Reduce the department's contribution to atmospheric carbon dioxide and other pollutants.
- Create systems to eliminate waste in department operations.
- Train staff and volunteers to reinforce the agency's commitment to resource stewardship and conservation and to gain compliance with adopted practices.
- Conduct educational and interpretive activities to inform and inspire visitors and local communities to reduce their impact on the environment for the benefit of present and future generations.
- Support sustainable practices that strengthen local economies.
- Promote these guidelines to others for their adoption and use and, when working with others as partners in joint activities.

Statewide Cultural Resource Policy:

OPRD's policy relating to its cultural resources, which include, but are not limited to, tangible resources and cultural practices is to:

- Foster an understanding and appreciation of the cultural resources entrusted to OPRD's management, both within and outside the agency, through appropriate programs of training, research, identification, treatment, and interpretation.

- Conduct sufficient research to locate and evaluate OPRD's cultural resources, prior to making decisions on their treatment. Treat the agency's property as significant until a final determination has been made.
- Evaluate all cultural resources that appear to meet the criteria for inclusion in the National Register of Historic Places. All those determined to be eligible will be nominated for listing.
- Employ The Secretary of the Interior's Standards for the Treatment of Historic Properties with Guidelines for Preserving, Rehabilitating, Restoring, and Reconstructing Historic Buildings for any work that will be conducted on OPRD historic properties.
- Engage in active stewardship that ensures the agency's historic properties are preserved, protected and made available, when appropriate, for public understanding and appreciation.
- Consider cultural resource preservation intrinsically as a form of sustainable conservation.
- Encourage appropriate uses of historic properties that will allow for and ensure their long-term protection while minimizing harm to character-defining features. Discourage inappropriate uses or changes to historic properties that adversely affect an historic property's character-defining features.
- Preserve and protect the cultural heritage of this state embodied in objects and sites that are of archaeological significance.
- Seek the acquisition or lease of sites of historic significance for state use, in accordance with Oregon Revised Statute 358.653. Conversely, should OPRD surplus property of historic significance, attach all appropriate preservation covenants to ensure the property's long-term protection.
- Adhere to all other applicable OPRD Commission

policies and OPRD Operations policies while implementing this policy, including, but not limited to, consultation with Oregon tribes regarding cultural resources and tribal traditions of interest to the tribes.

- Recognize agreements between the Heritage Conservation Division and Operations as the basis for defining how the two divisions work together in achieving the policies listed above.

Scenic Resource Standards:

Scenic resources are very important to OPRD and are one of the primary factors considered by the ocean shore program when evaluating ocean shore permits. The following standards are part of state rule that applies to modifications to the ocean shore:

Projects on the ocean shore shall be designed to minimize damage to the scenic attraction of the ocean shore area. The following scenic standards shall be applied, where applicable:

- Natural Features -- Retain the scenic attraction of key natural features, for example, beaches, headlands, cliffs, sea stacks, streams, tide pools, bedrock formations, fossil beds and ancient forest.
- Shoreline Vegetation -- Retain or restore existing vegetation on the ocean shore when vital to scenic values.
- View Obstruction -- Avoid or minimize obstruction of existing views of the ocean and beaches from adjacent properties.
- Compatibility with Surroundings -- Blend new additions to the landscape with the existing shoreline scenery (type of construction, color, etc.).

Oregon statewide planning goal 5 also discusses conservation of scenic resources. Local governments and state agencies are encouraged to maintain inventories of scenic views and sites.

Goals and Strategies

This section establishes OPRD's goals and strategies for management of the park and adjacent ocean shore. The goals and strategies are based on consideration of the recreation needs assessment, and evaluation of the issues identified in the planning process and summarized in this plan as well as statewide agency policies. Below is a summary of the major goals and strategies (note: these are not prioritized):

Goal 1: Provide recreation opportunities and experiences that are appropriate for the park resources and recreation settings.

Every effort will be made to provide visitors with an assortment of recreational experiences that continue to meet and exceed their expectations.

- Development or rehabilitation of recreational facilities will be guided by indicators of need, the recreation settings, resource suitability, and the capacities of the park to accommodate use without overcrowding, degradation of recreation experience, or conflicts with other uses
- Recreational activities that threaten to harm the natural, cultural or scenic resources and/or the safety of the visitors will be discouraged and/or re-routed to alternate locations that are less sensitive.

The need for maintaining the current day-use experiences for park visitors is recognized, but potential future activities need to be anticipated. This is based on the anticipated increase in demand for recreation and recognizing parks needs to meet future visitor expectations.

- The current capacity for day-use in the park is at the right level given space and natural resource restrictions. There is no viable opportunity to increase parking capacity.
- Given that parking capacity will not increase, the potential for future additional crowding is minimized. However, there is the potential for the park to be "at-capacity" more often than it is currently. Therefore, those that experience crowding may increase.
- As appropriate, provide information to visitors

about other nearby parks and accesses that offer similar or complementary experiences.

- As possible, efforts will be made to coordinate with schoolgroups to help minimize crowding and improve their educational experience at the site.
 - Determine the appropriate maximum number of busses and look at providing designated parking. As feasible, work with the county for any on-street parking opportunities and necessary signage for non-bus parking area.
 - Explore opportunities to work with the school districts to coordinate scheduling of school visits.
- Explore options for improving services to visitors with disabilities.
- Explore ways to improve facilities and services to accommodate Oregon's youth. Work to develop partnerships with recreation providers that encourage youth outdoor exploration and interpretation.

The anticipated increase in future demand for recreational activities includes activities such as walking, hiking, tidepooling and generally ocean beach activities.

- Continue to provide and maintain opportunities for these key recreational activities. As new trends emerge, consider the feasibility of providing for those at the site.
- Maintain facilities such as picnic tables and telescopes (for sightseeing) to accommodate the interest of aging Oregonians and minority populations in these activities.

Goal 2: Protect, manage and enhance as appropriate, outstanding natural, cultural and scenic resources.

Enjoyment and appreciation of resources will be enhanced while protecting those resources from effects of overuse.

Scenic resources:

One important aspect of visiting the park is the views of some of the major features at Devil's Punchbowl. These views focus on the ocean and more specifically, at the overlook, of the geologic features of

the Punchbowl itself.

- Retain the scenic attraction of key natural features. Unforeseen future actions may impair views and efforts will be made to minimize the possibility for negative impacts on key viewsheds and features within the park and adjacent ocean shore.
- As possible, retain or restore existing vegetation when vital to scenic values.
- Avoid or minimize obstruction of existing views of the ocean and beaches.
- Blend new additions to the landscape with the existing shoreline scenery (type of construction, color, etc.).

Cultural resources:

The park land is an important traditional-use area of the Confederated Tribes of the Siletz Indians and their cultural heritage within the area is of considerable antiquity.

- Preserve and protect the cultural heritage of the site in consultation with the Tribes.
- Consult, as appropriate, with the Confederated Tribes of the Siletz Indians to identify potential interpretive themes/stories to highlight at the site.

Natural resources:

As resources become available, additional inventories of high quality ecosystems will be completed and evaluated for the presence of threats to desired ecosystem types or conditions. Determine whether there are changes desired in ecosystem types or conditions based on consultation with appropriate resource agencies and stakeholders over time and as new information becomes available.

- As possible, develop long-term monitoring of the high use intertidal areas (and complementary control areas) to track potential impacts of visitor use (this may be part of a coast-wide strategy).
- As recommended in the Territorial Sea Plan, consider prohibiting the harvest of intertidal algae (seaweeds) within the boundaries of the existing marine garden to make restrictions for plants consistent with those for animals.
- To the extent practicable, on-site staff and/or volunteers will discourage illegal collection and efforts will be made to improve signage and increase voluntary compliance.

The resources will be managed to minimize any

unacceptable threats or to attain desired ecosystem conditions and types.

- Use scientific information to adaptively manage as new information becomes available.
 - As deemed appropriate based on monitoring and scientific research, and in coordination with appropriate agencies and stakeholders, implement temporary rotational area closures as necessary to allow recovery of intertidal areas receiving greatest use
 - As possible, potential habitats for at-risk species found within the park boundary and adjacent ocean shore will be identified. The list of at-risk species may need to be updated and a plan for monitoring these species developed, as appropriate.
 - Work with interested agencies to protect at-risk species, their habitats, and identify opportunities to improve key habitats and minimize negative interactions with visitors to assist with species survival and recovery.
 - Where appropriate, restore or enhance existing low quality resource areas to a higher quality or desired ecosystem types or conditions based on consultation with natural resource agencies as to what a desired ecosystem should be for the planning area and for the region.
 - Work with partners agencies who are attempting to resolve environmental and safety risks associated with septic material, residential effluent and sewage effluent that have the potential to effect park or ocean shore resources and/or present safety risks to park/ocean shore visitors.
- Sustainable practices will be incorporated, to the extent practicable, in all aspects of OPRD's mission, particularly: facility and site planning, design, construction, operation and maintenance, contracting and procurement, and visitor programs and services.
- If plantings are necessary, efforts will be made to use plants native to the Oregon coast.
 - Minimize use of hazardous chemicals and toxic materials used in operation and maintenance activities.

Goal 3: Provide for adequate management, maintenance, rehabilitation, and park operations

Devil's Punchbowl SNA: Goals and Strategies

To the extent that resources are available, recreational activities and facilities will be managed, maintained, rehabilitated and operated as needed for the safety, satisfaction and enjoyment of the visitors and local citizens. In allocating state park operational and facility investment funds, strive to provide adequate support for the maintenance and rehabilitation of existing facilities, and an adequate level of oversight and enforcement in the park and adjacent ocean shore.

- Continue routine maintenance of the marine garden access trail and stairwell to the beach
- Routine maintenance of the parking lot (including striping) will help with appropriate parking of larger vehicles.

Goal 4: Provide for safe, efficient, identifiable and pleasant access and circulation

- Long-term solutions will be considered as the marine garden trail, which is located in a geologically unstable and erosive area, continues to degrade. Additionally, potential changes in adjacent land ownership and needs of the neighbors will be considered.
- The trail may need to be temporarily closed when access is deemed hazardous for visitors and solutions (temporary and long-term) are being sought. Signage will indicate to visitors the reason and expected length of the closure, along with contact information.
- Maintain, and install (as necessary) directional signage to direct vehicular traffic to recreational use areas and facilities within the park.
- Look at long-term solutions such as modifying pull-through options and signage. As mentioned in goal 1, this may include designating bus specific parking in coordination with the county (for any changes to on-street parking).
- Explore ways to enhance the visual appearance and identity at the entrance using signage and vegetation.
- Plant, remove and prune designed landscape areas where needed to beautify roads and parking areas, retain scenic views, and provide visual buffers within the park.

Goal 5: Promote public awareness, understanding, appreciation, and enjoyment of the recreation settings through resource interpretation.

Strive to share and interpret park and local history along with geologic and natural resources with a wider audience. The interesting local history, unique geology and ocean shore and marine resources make Devil's Punchbowl a great location for interpretation.

- As feasible, develop an interpretive plan (likely as part of a plan for the area) that includes themes, recommended programs and materials.
- Work to improve on site interpretive services including roving rangers, signage etc. Work with partners to help accomplish this.
- Improve visitor awareness and understanding of the special protected status of the marine garden
- Improve, as feasible, public understanding of the difference between ocean shore rules and those that apply to areas adjacent to state parks. This will likely need to be part of a larger coastwide effort.
- As possible, efforts will be made to provide interpretive services to schoolgroups to improve their educational experience at the site.
- Coordinate with the Confederated Tribes of the Siletz Indian on any interpretive stories that relate to cultural resources.
- Provide information to harness the increasing availability and interest of aging Oregonians in volunteering in their communities.
- Communicate information about park resources and services on the OPRD website.

Goal 6: Form partnership and agreements to aid in achieving goals

Many of the issues identified in the scoping for this site identified partners as part of the solution.

- Identify and follow-through with viable potential partnerships, as practicable, to work through the above listed activities, and new ones that emerge in the future.
- Promote the use of the above goals and strategies when working with others as partners in joint activities at the site.

Seal Rock

Existing Conditions

Location:

Seal Rock State Recreation Site is located approximately 10 miles south of Newport in the unincorporated community of Seal Rock, Lincoln County, Oregon. The site is located approximately 150 miles southwest of Portland and about 60 miles west of Corvallis on US Highway 101 (fig. 11).

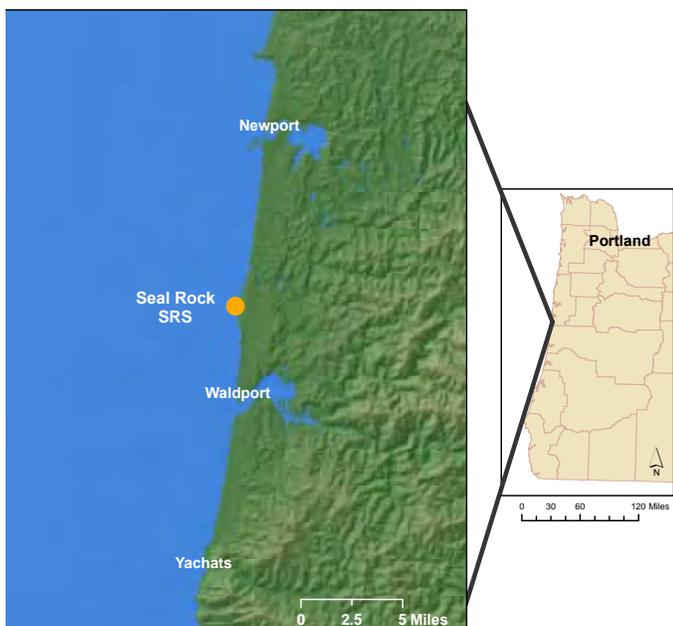


Figure 11. Location of Seal Rock SRS on the central Oregon coast

Description:

This section of coastline is characterized by a combination of basalt and sandstone cliffs, sandy beaches interspersed with rocky intertidal areas and a string of offshore rocks that provide a portion of the area with shelter (Fox et. al., 1994). The 7.80 acre OPRD property known as Seal Rock State Recreation Site (SRS) provides public beach access and several highway pullouts provide additional access to the north and south. A viewing deck and observation platform provide opportunities to enjoy the scenic nature of the site without walking down the somewhat steep trail to the beach (fig. 12).



Seal Rock intertidal area

The Seal Rock area has been a tourist destination for a long time, with Seal Rock being near the culmination of the old Corvallis and Yaquina Bay Military Wagon Road which was completed in 1866 (City of Corvallis, 2003). The Seal Rock community was platted in the late 1800's when a hotel was also built in the "Seal Rock Resort" area. The area is named for the large rocks on which many seals used to reside.

Classification:

Seal Rock is classified by OPRD as a State Recreation Site (SRS). The primary purpose of a SRS or State Recreation Area (SRA) is to provide access to resource-dependent, recreational activities, without OPRD ownership of extensive scenic settings. A recreational resource is defined as "certain resources and related access opportunities needed for active and passive recreational activities." These resources, generally cannot be or are very difficult to create (OPRD, 1995). Sites are generally smaller, isolated parcels, with low to moderate use intensity. Management priorities at State Recreation Sites are to continue safe, clean and convenient recreational access while stabilizing impacted resources.

The site is also listed in the Oregon Territorial Sea Plan (TSP), although it is listed as "not yet designated." The plan notes that this is "because the

Seal Rock SRS and Vicinity

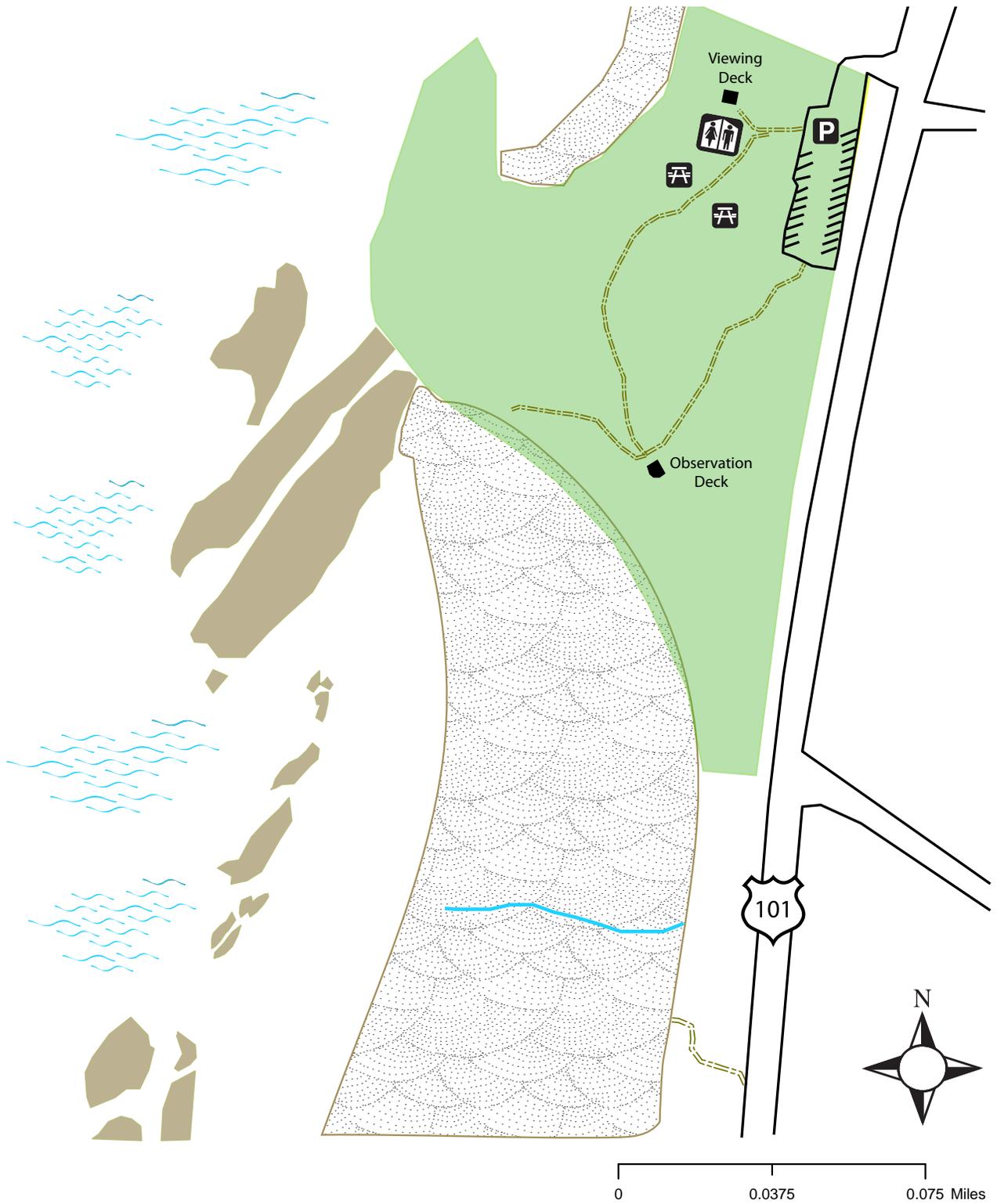


Figure 12. Diagram showing Seal Rock SRS boundary and facilities and the immediate vicinity.

Aerial View of Seal Rock SRS



Figure 13. Aerial view of Seal Rock State Recreation Site showing approximate park boundary

Seal Rock SRS: Existing Conditions

site is relatively small but contains a complex mixture of resources and high usage”, therefore, “this entire area needs more detailed study and assessment before designation into one or more rocky shores management categories (OPAC, 1994)”. The TSP notes that the objective for the site is to “protect [a] variety of habitat values of the site while accommodating public access and use (OPAC, 1994).”

Facilities:

OPRD facilities at the site are typical of a beach access day-use area. Located immediately off of US Highway 101, Seal Rock is composed of one day-use parking area that provides room for 28 cars with two of those being ADA designated. There is limited room for RVs and no turn-around width (HUB, 2006). The one restroom facility is noted to be inadequate for the volume of visitors to the site (HUB, 2006).



Seal Rock day-use area, restroom and wooden overlook deck

The asphalt trail system is rather extensive and well used for the size of the site, totaling 2,254 feet with a width that varies from 3' to 7' (HUB, 2006). The southern trail provides steep access to the beach with the upper parallel trail also providing access following along the eroded bluff adjacent to “Tourist” rock (HUB, 2006). Scattered between the parking area and the various trails are nine permanent picnic tables. There is one wooden viewing deck near the restrooms and another larger observation deck on the trail system. The observation deck is highly used and also hit by

chronic vandalism (HUB, 2006).

The deck rails have been repaired numerous times and the interpretive panels and frames that used to be on the deck were removed due to vandalism. The hope is to replace them in the future.

Neighborhood and Zoning:

The park is surrounded by US Highway 101 on one side and the Pacific Ocean on the other. It is part of a small residential and commercial unincorporated community of Seal Rock, in Lincoln County. The park property is zoned Public Facilities (PF).

Acquisition and Ownership:

The state acquired this property between 1929 and 1942 through a combination of land sales from private citizens and one transfer from Lincoln County. The majority of the property was sold to the state by the Geiser family in 1936. Ownership also includes Castle, Tourist and Elephant Rocks, which were given to the state for “park purposes” by Congress in 1928. Conditions of this grant are that the state maintains the property in the present condition as natural monuments and objects of scenic interest.

Natural Resources:

Resources include diverse intertidal communities, limited seabird nesting and use of the offshore rocks by marine mammals (OPAC, 1994). Brown pelicans



A variety of birds using the offshore rocks near Seal Rock SRS

(endangered, although proposed for de-listing) sometimes use the offshore rocks for roosting and both Steller sea lions and harbor seals use rocks in the area for haulouts (ODFW, 2001).

A 2007 Catalog of Oregon Seabird Colonies notes that surveys of the area (including the various offshore rocks) have found pigeon guillemots, black oystercatchers, gulls, as well as double-crested and pelagic cormorants in the past (Naughton et. al., 2007). The most recent surveys have

documented double-crested cormorants in 2000 but not in the following surveys conducted in 2001 and 2003 (Naughton et. al., 2007). In 2003, surveys also documented pelagic cormorants in the area. USFWS monitoring documented nesting of black oystercatchers every year between 2005 and 2007 and in 2008 at least 4 nests failed, with no successes noted (USFWS, 2007; Liz Kelly, pers comm, 9/23/2008).

Table 8 shows the species documented during

Table 8. Listing of species documented at Seal Rock during the intertidal biodiversity survey conducted by PISCO in 2007. Details can be found in Appendix B. This table is on this page and the following page.

Species	Common Name	If common, where (in high, mid, low-mid, low intertidal)
<i>Ahnfeltia fastigiata</i>	busy Ahnfelt's seaweed (red algae)	low
<i>Alaria marginata</i>	angel wing kelp (brown algae)	
Amphipods	amphipods	low-mid, low
<i>Analipus japonicus</i>	fir needle (brown algae)	
<i>Anthopleura elegantissima</i>	clonal anemone	mid, low-mid, low
<i>Anthopleura xanthogrammica</i>	giant green anemone	
<i>Balanus glandula</i>	acorn barnacle	mid
<i>Balanus nubilus</i>	(barnacle)	
Bryozoans	bryozoan	
Calcareous tube worms	(tube worms)	
<i>Callithamnion sp.</i>	(red algae)	
<i>Chthamalus sp.</i>	(barnacle)	mid, low-mid
<i>Cirolana harfordi</i>	(isopod)	
<i>Codium fragile</i>	sea staghorn (green algae)	
<i>Codium setchelli</i>	green spongy cushion (green algae)	
Colonial tunicates	colonial tunicates	
<i>Costaria costata</i>	seersucker kelp (brown algae)	
Crustose coralline algae	crustose coralline algae	low-mid, low
<i>Cryptopleura spp.</i>	hidden rib (red algae)	low-mid
Diatoms	diatoms	
<i>Dilsea spp.</i>	(red algae)	
<i>Egregia menziesii</i>	feather boa (brown algae)	low-mid
<i>Endocladia spp.</i>	sea moss (red algae)	
Erect coralline algae	erect coralline algae	low-mid, low
Fleshy crustal algae	fleshy crustal algae	low-mid, low
<i>Flustrellidra corniculata</i>	(bryozoan)	
<i>Hedophyllum sessile</i>	sea cabbage (brown algae)	low-mid

Seal Rock SRS: Existing Conditions

Hydrozoans		
<i>Idotea sp.</i>	(isopod)	low-mid, low
<i>Katharina tunicata</i>	black leather chiton	
<i>Laminaria sp.</i>	oarweed (brown algae)	low
<i>Leathesia/Colpomenia</i>	(brown algae)	
<i>Lepidochiton spp.</i>	(chiton)	low-mid, low
<i>Leptasterias hexactis</i>	(sea star)	
<i>Littorina spp.</i>	periwinkle	mid, low-mid
<i>Lottia spp.</i>	(limpet)	mid, low-mid, low
<i>Mastocarpus spp.</i>	Turkish washcloth (red algae)	low
<i>Mazzaella flaccida</i>	rainbow leaf (red algae)	
<i>Mazzaella splendens</i>	rainbow seaweed (red algae)	low-mid, low
<i>Mopalia sp.</i>	(chiton)	low-mid, low
<i>Mytilus californianus</i>	California mussel	mid
<i>Mytilus trossulus</i>	blue mussel	
Nemertean	ribbon worm	
<i>Neorhodomela spp.</i>	black larch (red algae)	low-mid, low
Nereid	(polychaete worm)	low-mid
<i>Nucella canaliculata</i>	channeled dogwinkle	mid, low
<i>Nucella emarginata/ostrina</i>	dogwinkle	mid, low-mid, low
<i>Odonthalia spp.</i>	seabrush (red algae)	low-mid, low
<i>Osmundea spectabilis</i>	sea fern (red algae)	
<i>Pagurus hirsutiusculus</i>	hairy hermit crab	mid, low-mid, low
<i>Phyllospadix sp.</i>	surfgrass	
<i>Pisaster ochraceus</i>	ochre sea star	low
<i>Plocamium sp.</i>	sea braid (red algae)	
<i>Pollicipes polymerus</i>	goose neck barnacle	
Polychaete	worm	
<i>Prionitis spp.</i>	bleach weed (red algae)	
<i>Ptilota sp.</i>	(red algae)	low
<i>Pugettia spp.</i>	kelp crab	low-mid
Sandy Tube Complex		
<i>Semibalanus cariosus</i>	haystack barnacle	mid
Sponges	sponge	
<i>Strongylocentraus purpuratus</i>	purple sea urchin	
<i>Tegula funebris</i>	black turban snail	mid
<i>Tonicella lineata</i>	lined chiton	low
<i>Ulva spp.</i>	sea lettuce (green algae)	low
Unidentified crab		mid

the intertidal biodiversity study conducted by the Partnership for Interdisciplinary Studies (PISCO) at OSU (Table 8). A detailed explanation of the results of the study are found in Appendix B. The most common species based on percent cover are *Mytilus californianus*, *Neorhodomela spp.*, *Laminaria spp.* (northern site), *Mytilus californianus*, crustose coralline algae, *Laminaria sp.* (southern site). The most common based on number of individuals (count) are *Littorina spp.*, *Lottia spp.*, and amphipods (northern site) and *Littorina spp.* and *Lottia spp.* (southern site).

There is a high degree of variability between the

different areas surveyed (north vs. south and the different tidal zones (e.g., high vs. low). Although for some areas, there is some indication that human visitation plays a role in the number and type of species present, no clear causation can be drawn from this initial, baseline data collection effort. Therefore, as funding is available more data will be collected.

A list of “at-risk” species that have been documented in the vicinity of the park (within three miles) is located in Table 9. The list also includes several plant and terrestrial invertebrates. A survey for these species has not been conducted as part of this effort, so

Table 9. Listing of “at risk species” that have been documented within three miles of Seal Rock. Details about ranking and status can be found in ONHIC, 2007. Detailed surveys for these species were not conducted at these sites for this project, therefore there may be other at risk species within the vicinity of the parks that do not appear on this list.

	Scientific Name	Common Name	Heritage Global Rank	Heritage State Rank	Federal Status	State Status	ORNHIC List
Vertebrates							
	<i>Eumetopias jubatus</i>	Northern sea lion	G3S2	S2	LT	SV	2
	<i>Falco peregrinus anatum</i>	American peregrine falcon	G4T4	S2B		LE	2
	<i>Haematopus bachmani</i>	Black oystercatcher	G5	S3	SOC		4
	<i>Haliaeetus leucocephalus</i>	Bald eagle	G5S	S4B, S4N		LT	4
	<i>Oncorhynchus kisutch</i>	Coho salmon (Oregon Coast ESU)	C4T2Q	S2		SC	1
	<i>Oncorhynchus mykiss</i>	Steelhead (Oregon Coast ESU, winter run)	C5T2T3Q	S2S3	SOC	SV	1
	<i>Pelecanus occidentalis californicus</i>	California brown pelican	G4T3	S2N	LE	LE	2
Invertebrates							
	<i>Lygus oregonae</i>	Oregon plant bug	G2	S2			1
Plants							
	<i>Abronia umbellata ssp. breviflora</i>	Pink sandverbena	G4G5T2	S1	SOC	LE	1
	<i>Calypogeia sphagnicola</i>	Liverwort	G4	S2			2
	<i>Cladidium bolanderi</i>	Lichen	G3	S1			2
	<i>Eriophorum chamissonis</i>	Russet cotton-grass	G5	S1			2
	<i>Gilia millefoliata</i>	Seaside gilia	G2	S1	SOC		1
	<i>Lycopodiella inundata</i>	Northern bog clubmoss	G5	S2			2

Seal Rock SRS: Existing Conditions

this is based on existing data and it is possible that additional species are found in the park and surrounding area that are not listed in the table. “At risk” species are species that meet one of the following criteria:

- 1.) Currently listed as “threatened” or “endangered” under state or federal Endangered Species Acts (ESA);
- 2.) Candidate for listing as “threatened” or “endangered” under state or federal ESA;
- 3.) Not “threatened” or “endangered”, or candidate for such listed, but considered to be “at risk” as indicated by inclusion on a state or federal watch list.

At risk species documented within three miles of Seal Rock SRS include: northern (Steller) sea lion, peregrine falcon, black oystercatcher, bald eagle, coho and steelhead salmon (to the north in Beaver Creek), brown pelican, Oregon plant bug, along with several plants: pink sandverbena, a liverwort and lichen, russet cottongrass, seaside gilia and northern bog clubmoss.

Scenic Resources:

Particularly because the site is a day-use area, and is often used by visitors for enjoyment of the scenic nature of Oregon’s coast and ocean, the scenic qualities of the park are important to the recreational experience of visitors. The overlook area is frequently used by visitors to get a quick glimpse of the powerful ocean and the geologic features that make the site unique. The natural features of the beach, offshore rocks and tidepool areas allow visitors to visually observe the ecosystems that live in the interface between the land and sea and the geologic features created by the passage of time.

Cultural Resources:

Evidence of cultural resources has been found in the vicinity of the park and the area is considered a “high probability” zone by the State Historic Preservation Office (SHPO). Pursuant to state law, details about this information is not available for public review.

The park land is an important traditional-use area of the Confederated Tribes of the Siletz Indians and their cultural heritage within the area is of considerable antiquity. The Seal Rock area is part of the historic lands of the Confederated Tribes of Siletz Indians and also falls within the boundaries of the original reservation.

Recreational activities:

Visitor use at Seal Rock SRS has decreased slightly since counts began in 1965 (fig. 14). Although visitation fluctuates from year to year, there is an continuing downward trend evidenced by parking lot counts. Although it is not known what percentage of these visitors move beyond the parking lots, and the methodology assumes some things that may slightly overestimate or underestimate visitation (the counters count cars and a multiplier is used to determine the average number of passengers per car), it does give a general sense of decreased site popularity. For example, the many school buses that are known to frequent this site are not accurately accounted for in these numbers.

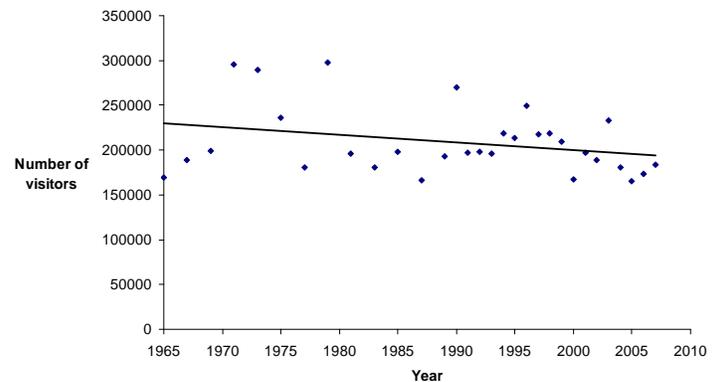


Figure 14. Visitor use based on day use parking lot data from Seal Rock SRS (1965-2007).

To help answer this question in more detail, visitor use surveys were conducted in 2007 to measure actual visitation to the rocky shore and characterize types of visitor use. A full report is located in the appendix and only key findings are summarized here.

Visitation

The average number of visitors per day at the Seal Rock SRS intertidal area is 97 with a range between 9 visitors on May 2nd and 146 on July 17th (Table 10). During the 9 days sampled, the daily average hourly use ranged from 2 to 29 persons with an average hourly visitation of 19 visitors per hour.

Table 10. Visitor counts totals for each of the 9 survey dates at Seal Rock SRS. The two rainy days are indicated with a * next to the number of visitors.

Day Type	Dates	Number of visitors
WdS	May 2 nd	9
	May 7 th	58
	June 15 th	125*
		$\bar{X} \approx 64$
WeS	May 6 th	92
	June 3 rd	67
		$\bar{X} \approx 78$
WdH	June 19 th	122
	July 17 th	146*
		$\bar{X} \approx 134$
WeH	July 1 st	127
	July 14 th	123
		$\bar{X} \approx 125$
Total		869
Average		$\bar{X} \approx 97$

During a similar survey, a much higher number was observed, with 49 visitors on average observed per hour (Rawichutiwan, 2006). This survey was conducted later in the summer (7 days between June 14th and August 11th). It is possible, therefore, that visitation peaks later in the summer. However, in both surveys, large numbers of schoolgroups were not observed. This is likely due to chance because anecdotally, the OPRD beach ranger stationed at the site on most low-tide days (and park management who has been observing the site for many years) noted that there are many schoolgroups that visit the site.

On average, weekend days (102 visitors/day)

received almost the same amount of use as weekdays (92 visitors/day). More visitors come during summer vacation (130 visitors/day) than when school is in session (70 visitors/day). Days that fall on weekdays during summer holiday (WdH) appear to receive the highest mean use (134 visitors/day) with weekdays when school is in session (WdS) receiving the least (64 visitors/day) amount of visitation pressure (Table 10). Rain did not appear to deter visitors, as the 2 days it did rain received some of the highest amount of visitor use.

It appears that at Seal Rock, visitors do base the time of their visits on the time of low tide, with 63% of visitors visiting during the peak time of one hour before to one hour after. Visitation at the Seal Rock intertidal area peaks the hour after low tide with 53% of visitors choosing this time frame to visit the site. These results are slightly different from those found previously at Devil's Punchbowl, where the highest counts were found between one and two hours after low tide (Fox, 1994; Hillmann, 2005).

As with Devil's Punchbowl, the most popular time of day to visit Seal Rock during this survey was between 9 and 10 in the morning, with 24% of visitation occurring during that time. However, visitation was more evenly spread out than for Devil's Punchbowl.

Distribution

The most popular section of the intertidal at Seal Rock is the area between the stream and the rocky outcropping just to the south of it (fig. 15). This is area "B" as noted in figure 15 and receives approximately 63% of visitation. Area B was subdivided into two sections for the latter half of the study and between the two (B1 and B2), B2 receives the most visitors.

All visitors that access the beach from the park must pass through area "A", however, limitations of the survey methodology (information is a snapshot in time) mean not all visitation is captured. However, this likely indicates simply that the majority of visitors pass quickly through area A to get to the preferred location of area B and the numbers presented here demonstrate visitor use pressure.

Seal Rock SRS: Existing Conditions



Aerial view of Seal Rock SRS

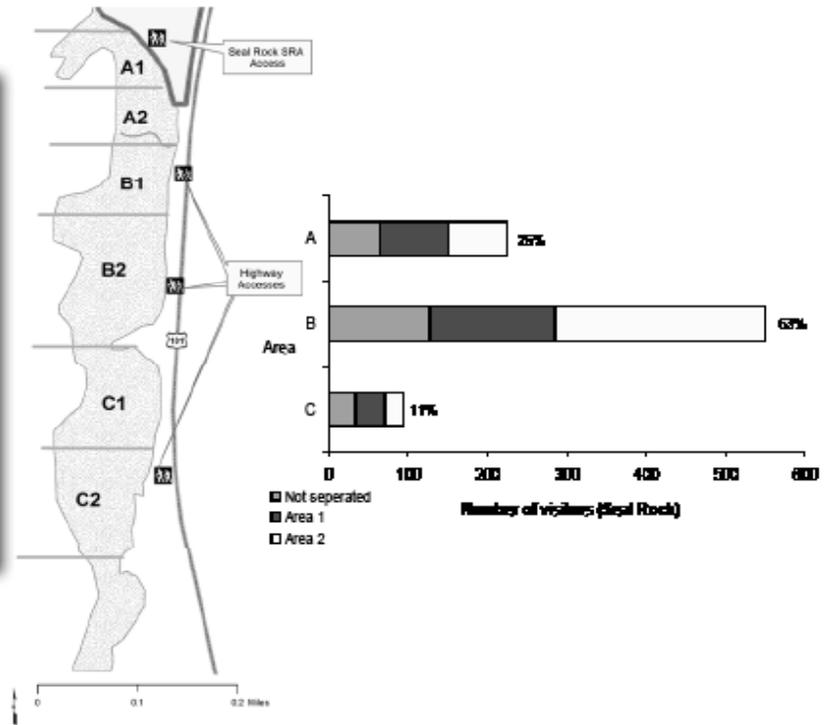


Figure 15. Visitor count levels in survey areas A-D at Seal Rock (n=869)

The area that receives the lowest visitation is area “C”, to which approximately 11% of visitors venture. Area C is south of the rocky outcropping and requires either access from a highway access point, or climbing over rocks to reach it.

Types of recreation

Beach recreation was the most common activity with 41% of visitors. Like Devil’s Punchbowl, a sandy beach fronts the majority of the intertidal of the Seal Rock intertidal area and for some people the beach is a way to access other sections of the rocky shore. Passive tidepool exploration (35%) was the second most common activity. Educational (schoolgroup) visits make up approximately 10% of visitation at Seal Rock.

Although collecting was not common at this site during the survey period, it does occur. Collecting within legal limits is allowed at this site. Four percent of visitors were observed collecting. As with all observations, it is likely that this number is under-estimated since snap-shots are unlikely to capture quick activities such as picking an item up. However, they are more likely to capture activities

of people who are out there with collecting as their main purpose since that takes more time and is more obvious (people tend to have equipment such as buckets for mussels, seaweed, shellfishing etc.). In a separate survey in which the observer spent more time actually observing individual visitors, 13% of the 1770 visitors observed over 7 days were seen



Mussel collecting at Seal Rock

to be collecting something (Rawichutiwan, 2006). Collecting is also noted to be quite common by the beach ranger that spends most summer low tides at the site providing interpretive services. Anecdotal information indicates that seaweed collection is also relatively popular at this site as is agate collecting, particularly in the winter months.

Demographics

The median group size for visitors to the Seal Rock intertidal area is two people with a range between 1-30 people. More than a third of visitors (44%) came in groups of two, with only eight percent traveling alone and six percent traveling in groups of 11 or more.

Approximately two thirds of visitors (66%) were with families, with 16% traveling with friends. School groups interviewed came from the University of Nevada at Reno and a Hatfield Marine Science Center Day-Camp.

Just over 50% of visitors interviewed were Oregonians with ten percent from Washington and two percent from out of the country. The median one-way distance traveled to reach Seal Rock was 158 miles with a range of one mile (Seal Rock, OR) to 3,330 miles (Fort Meyers, FL). Forty nine percent of in-state visitors came from the Willamette Valley, 29% from the coast and 15% from the Portland Metro area. Five percent came from Central Oregon and two percent each from Eastern and Southern Oregon.

Over half of the visitors (56%) said they were repeat visitors to Seal Rock intertidal area. The average visit time for return visitors is one hour 48 minutes with a range between 15 minutes and 5.5 hours. Sixty one percent of return visitors indicated visiting the Seal Rock intertidal area between one to three times per year with an average of 13 visits per year and a range between one and 200 days.

Of those visitors that came to Seal Rock for the first time, 29% indicated it was also their first visit to the Oregon Coast. An overwhelming majority (91%) of first-time visitors indicated they would return to

Seal Rock intertidal at some time in the future. The average visit to the intertidal is one hour 50 minutes with a range of one half hour to 6 hours. 46% of visitors spend one to two hours at the site.

Access

With several access points available, those interviewed either came down from one of a few highway access points or the state park access trail. Of those people interviewed the majority (71%) accessed the shoreline from the state park. Additionally, the number of people in the groups coming down at the park was higher than those arriving from the highway, again, like Devil's Punchbowl, due in large part to schoolgroups. All schoolgroups appear to have come down at the state park based on the interviewes of members of those groups.



End of access trail at Seal Rock

Seal Rock SRS: Recreation Needs and Opportunities

Recreation Needs and Opportunities

An assessment of the recreation needs and opportunities is based on a review of the following information sources: 1) The 2003-07 and 2008-2012 Statewide Comprehensive Outdoor Recreation Plans (SCORP); 2.) The Oregon Ocean Shore Management Plan (OSMP); 3.) The Rocky Shore Recreational Use Study conducted as part of this planning process and summarized in the visitation section. Additionally, information collected from the advisory committee and staff team in the issue scoping process is factored into the goals and strategies involving recreation needs

and opportunities.

2003-2007 SCORP

The Statewide Comprehensive Outdoor Recreation Plan (SCORP) for 2003-2007 looks at outdoor recreational demand and participation trends for a wide range of activities, both regionally and statewide (OPRD, 2007). Seal Rock is in SCORP Planning Region 1, which encompasses Clatsop, Tillamook, Lincoln and coastal Lane Counties.

For each of the planning regions in the SCORP, estimates of recreational participation were measured (in "user occasions") in 2002. In some cases, it was

Table 11. Recreation Demand and change over time in SCORP Region 1

Recreation Activity	2002 User Occasions	% Change 1987-2002
Beach Activities, including swimming (fresh & salt)	6,041,082	82.7%
Ocean beach activities	4,693,793	NA
Sightseeing/Driving for Pleasure	2,410,370	-22.7%
Bird watching	1,943,404	NA
Nature/Wildlife Observation	1,797,447	26.8%
Day Hiking	993,897	80.6%
Fishing from a bank or shore	757,909	NA
Picnicking	637,321	-53.1%
Outdoor Photography	460,141	-64.5%
Walking for pleasure on trails (all surfaces)	313,710	NA
Clamming	312,421	NA
Camping on an ocean beach	264,668	NA
Running/walking for exercise on trails (all surfaces)	213,061	NA
Sea kayaking	77,532	NA
SCUBA diving or snorkeling	63,278	NA

possible to compare these numbers with data from 1987 to look at change in recreational demand over time. Activities that are potentially associated with Seal Rock are presented in the above table, showing 2002 user occasions as well as, as applicable, change since 1987 (Table 11).

The highest growth activity for Region 1 is use of beaches (87.7%), followed closely by day hiking (80.6%) (Table 11). Activities that appear to be decreasing in popularity regionally include outdoor photography (-64.5%) and picnicking (-53.1%). Most of the activities do not have specific data available that would make comparisons possible over time. Popular activities in the region include ocean beach recreation, sightseeing for pleasure, bird watching and general nature/wildlife observation.

2007-2012 SCORP

Unlike previous SCORP planning efforts which focused on regional planning, in this SCORP, OPRD addressed a limited number of important demographic

and social changes facing Oregon's outdoor recreation providers in the coming years including: a rapidly aging population, fewer youth learning outdoor skills, an increasingly diverse population, and the physical activity crisis.

Important findings of relevance to this plan are summarized very briefly below.

Aging Oregonians

- On average across all activities, respondents expect to spend 28% more days recreation 10 years from now than they currently do (potentially breaking the trend of decreasing recreation with age).
- The most popular outdoor recreation activities for Oregonians between the ages of 42-80 included walking, picnicking, sightseeing, visiting historic sites and ocean beach activities. Not too far behind, in 8th place (based on percent participating at least once a year) is exploring tidepools with 37% participation (Table 12). Other

Table 12. Top 10 Outdoor Recreation Types (by percent participating) for Oregon's aging population.

Rank	Recreation Type	Percent participating	Mean days	Mean hours/day
1	Walking	80%	64.3	1.8
2	Picnicking	68%	5.2	3.2
3	Sightseeing	63%	9.9	4.1
4	Visiting historic sites	62%	3.6	3.1
5	Ocean beach activities	54%	4.1	3.9
6	Day hiking	52%	6.6	3
7	Children/grandchildren to playground	39%	5.7	2.1
8	Exploring tidepools	37%	1.5	2.5
9	Bicycling	33%	2.6	4.8
10	Other nature/wildlife observation	31%	5.4	2.8

Seal Rock SRS: Recreation Needs and Opportunities

- nature/wildlife observation is in 10th.
- The average number of days spent exploring tidepools is 1.5 with approximately 2.5 hours spent exploring each day.
- The top five activities in terms of future participation intensity 10 years from now included walking, bicycling, jogging, bird watching and day hiking.
- The most important current motivations or reasons for participating in outdoor activities were to have fun and be in the outdoors.
- Ensuring clean and well-maintained parks and facilities was the most important management action that will lead to a large increase in recreation, followed by developing walking/hiking trails closer to home and providing more free-of-charge recreation opportunities.
- Over a third of Oregon Boomers and Pre-Boomers volunteered in their community, with an average time commitment of 5.3 hours per week (with 43% expecting changes in their activities, with most of the changes involving greater volunteerism, more time, and looking for new opportunities). Providing more information appeared to be the key to increase volunteerism.
- Oregon's recreation managers can expect substantial increases in the number of visitors with a physical or mental disability using their recreational facilities and services.
- Priority should be given to trails, picnic areas, sightseeing areas, and historic sites in terms of where resources should be directed for providing accessibility accommodations
- Coastal Oregon has been, and is likely to continue to be, one of the most popular destinations for people reallocating to Oregon from other states.

Oregon Parents and Youth Study

- The most popular (highest average days in the past year) outdoor activities for parents was walking, viewing natural features, and relaxing/hanging out. For children, the most popular were walking, followed by outdoor sports/games, relaxing/hanging out, and general play at neighborhood parks/playgrounds.
- 67% of parents and 73% of children indicated they participate in ocean or freshwater beach activities (Table 13).
- The more a parent engages in an outdoor recreation activity, the more their child does.
- Almost all parents felt that it was a priority for their child to spend more time in outdoor activities.
- Youth preferred to do their favorite program activity with friends and in groups of 3-5 or 6-10 people.
- Recreation resource managers should attempt to

Table 13. Top 5 Outdoor Recreation Types (by percent participating) for Oregon's minorities and parents/youth* (note: the children's favorite activities do not correspond exactly with the other groups (for example, bicycling is tied for first for their favorite but isn't listed in this table and viewing natural features is not in their top 5 because of the popularity of biking, outdoor sports/games and swimming).

Recreation Type	Hispanic	Asian	Average	Parents	Youth*
Walking for pleasure	77%	80%	78%	74%	80%
Picnicking and family gatherings	74%	63%	70%	69%	77%
Relaxing, hanging out, etc.	67%	53%	63%	56%	64%
Viewing natural features	62%	56%	60%	60%	58%
Ocean/freshwater beach	56%	52%	55%	67%	73%

understand if their existing and proposed facilities are appropriate for Oregon's youth

- Recreation resource managers should strive to develop partnerships with appropriate recreation entities.

A Growing Minority Population

- Walking for pleasure, fishing and hiking were the most commonly mentioned favorite activities.
- In terms of percent participating, walking, picnicking/family gatherings, and relaxing/hanging out were the top activities (Table 13).
- Over half of respondents indicated they participate in ocean/freshwater beach activities.
- The majority of respondents participated in their favorite activity with immediate family members
- The most common location to do their favorite activity was in a park or other area outside one's town or city.
- Ensuring clean and well-maintained parks and facilities were the most important management action followed by keeping parks safe from crime, providing more free-of-charge recreation opportunities and expanded facilities.
- The most commonly recommended facilities for development in parks were picnic tables, followed by trails and campgrounds.
- Overall, the internet was the most frequently noted as the desired information outlet.
- Lack of information and cost were reported as the main constraints to participation in children's outdoor programs.

number of people observed on a weekend day) noted during this survey was 60 people.

Ocean Shore Management Plan

For the Ocean Shore Recreational Use Study conducted as a part of the Ocean Shore Management Plan, Seal Rock is in recreation segment 4 and the Newport littoral cell. However, the actual Seal Rock beach was not included in the study, while the beach to the south was running from Collins Creek to the Alsea River. Activities noted during this study include primarily walking/running (40%) along with relaxing/swimming (38%) with some surf sports (1.2%) (OPRD, 2005). Other activities noted include equestrian use, beach camping and dog walking. Respondents did not feel crowded within this segment of beach and distribution of people was given a "moderate" rating. The level of peak use (average

Issues

A number of issues have been brought up through the public interview process, as well as staff and stakeholder meetings regarding Seal Rock SRS. Issues that can be addressed in this planning process are reflected in the goals and/or resource management guidelines. Not every issue identified as part of this process is appropriate to address in this plan. For example, this is not a Master Plan, therefore, no development proposals are being made. Therefore, those issues that cannot be reasonably addressed are mentioned for potential future consideration by OPRD in other appropriate programs. Some issues are addressed through related follow-up work including suggested future studies and work with agency partners.

In this section, a list of issues is presented by general category and a matrix outlines potential solutions and barriers, and potential partners (Table 14). Then, as appropriate, issues are addressed in the goals and/or resource management guideline sections.

Facilities:

- The public restroom is outdated, blocks ocean views, is often over-capacity and ADA access could use improvement
- The parking lot is often over-capacity, especially with school busses in the spring and early summer
- The site was not built to accommodate RV's, although they continue to use the site, especially during the summer (there is no turn-around)
- There are no trash receptacles down at the beach and some visitors complain about litter on the beach
- The restroom is not in close proximity to the beach and some visitors complain about distance to reach the restroom facilities
- Beach access is in poor condition and continues to degrade
- ADA access to the beach is not possible

Recreation:

- Some visitors experience crowding on the ocean shore

- There are safety issues involving pedestrians crossing the highway to access the beach at the southern access points
- It is difficult to reach visitors (with interpretive messages, especially via signs) that access the site via the highway access points instead of the state park access

Environmental:

Rocky Shore

- Level of direct human impact from trampling/ collection to the rocky shore (intertidal) is not currently known
- Few visitors are aware of rules and guidelines for protecting marine mammals
- Visitors enter bird nesting area near Elephant Rock
- Visitors (illegally) access offshore rocks at low tides
- Potential disturbance of resident and migratory shorebirds by visitors on the beach and rocky shore.
- There are bird predation issues (potentially racoons) at the site.
- Black oystercatchers nest in the area and disturbance events have been observed. There have been nesting pairs that have had reoccurring nest failures at this site, although direct causation with disturbance is difficult to determine. The birds could be disturbed by visitors more in the future, particularly if kite flying (or some other type of airborne device) becomes popular.
- Dogs off leash can be a problem for seabirds and shorebirds if they chase the birds.
- Some level of seaweed harvest occurs at the site. Regular anecdotal (staff and visitor-observed) cases of more than "small amounts" for personal use.
- Individuals have been observed collecting plants from the area near the bottom of the trail at the bottom of the RV cove trail.
- Quantity of harvest of edible plants, both on the ocean shore and on the terrestrial side is undocumented.

Pollution

- There was an EPA Superfund removal project at the site in 1992. The EPA and USCG led the



Bag of seaweed left at bottom of RV Cove trail

clean-up, which did not require a site assessment, only removal of a drum. It was classified as a waterways/creeks/rivers type of incident by the EPA.

- Upstream septic systems are potentially polluting the stream that feeds into the beach
- There is the potential that there is left-over mercury from gold-mining activities in the stream. There was an effort where beads of mercury were removed in the cobble and creek bed near the vegetation line, but it is possible not all of it was discovered.

Interpretation:

- Less than 1/3 of visitors are aware of any restrictions on marine plant collection, none interviewed indicated knowledge of the OPRD guideline for “small amounts” of 10 lbs wet weight.
- Very few visitors are aware of restrictions protecting seabirds at the site
- None of the existing signage at the access points talks about offshore rocks and shorebird/seabirds. Signage should be consistent along the coast and if in close proximity to the birds themselves, try not attract additional visitors.
- It is difficult for the public to understand ocean shore vs. state park rules
- School groups do not often coordinate with the park prior to their visits
- Resources are not readily available for teachers to facilitate intertidal visits

- The site needs additional interpretive/enforcement and generally staff oversight presence
- Interpretive signs were recently vandalized and need to be replaced, along with the development of a integrated sign plan for sign placement

Cultural:

- One of the beach access points goes through a midden site, which is being damaged by foot traffic
- The park is within a “high probability” zone for cultural resources

Miscellaneous:

- The GIS layer for the park boundary is not exact and needs to be verified with the deeds



Visitors on offshore rock and rocky shoreline

Table 14. Issues matrix for Seal Rock SRS. The table should be read across the two page spread and is continued on the next 6 pages.

Issue	Issue Type
Restroom is outdated, blocks ocean view and is often over capacity	Facilities
Restroom ADA access	Facilities
Parking lot is often over-capacity (particularly a problem with busses and RVs)	Facilities
No trash receptacles close to beach, litter on beach	Facilities
Restroom is far from the beach	Facilities
OPRD trail access is in poor condition, poor ADA access	Facilities/Safety
Safety issues with pedestrians crossing highway at southern access	Recreation
Some visitors experience crowding on the ocean shore	Recreation
Difficult to reach visitors that access the beach via the highway pullouts	Recreation
Impact of visitors to rocky shore	Environmental
Few visitors are aware of rules and guidelines for protecting marine mammals	Environmental/Interpretation
Visitors enter bird nesting area near Elephant Rock, access offshore rocks at low tide and are generally unaware of protections in place for seabirds	Environmental/Interpretation

Seal Rock SRS: Issues

Potential Solution(s)	Potential Barrier(s)	Potential Partners
Replace restroom and relocate	Funding, temporary displacement	OPRD Operations, OPRD RPP
Relocate restroom and improve ADA access	Funding, temporary displacement	OPRD Operations, OPRD RPP
New striping for busses, regular striping, encourage to use other sites with higher capacity, coordinate with schools	Funding, no room for expansion, staff time	OPRD Operations, OPRD RPP, Schools (Oregon and out-of-state)
Partnerships to increase frequency of beach cleanup events	Staff time	OPRD Operations, SOLV
No viable solution	No viable location to place restroom	
Routine maintenance	Fortified in the past and continues to fail, funding	OPRD Operations
Wooden stair like at Yaquina Head	Funding, geologic stability in question	OPRD Operations
Improve access to the viewing platform	Funding	OPRD Operations
Indirect methods to improve experience (like touch tanks)	Staff time, funding	OPRD Operations, OPRD RPP
Provide contact information for appropriate staff	Staff time, funding	OPRD Operations
Offer alternative access to ODOT through our property & place signage to indicate new route	Not on OPRD property, shortest route to the beach from RV Cove, unlikely that guardrail would stop crossing, funding for signage, cooperation of partners and the public	ODOT, OPRD Operations, RV Cove Management
Do not increase parking capacity		OPRD Operations, OPRD RPP
Coordinate with partners to improve signage (as practical) at highway pulloffs	Funding, staff time, logistics	OPRD Operations, OPRD RPP, ODOT, non-state landowners
Use baseline inventories/visitor surveys to develop more focused & long-term impact studies.	Funding, staff time	OPRD RPP, OPRD Operations, Oregon University System
Add marine mammal related interpretive signage, on-site interpretive services (roving ranger)	Staff time, funding	OPRD Operations, OPRD RPP, NOAA/USFWS
Interpretive signage explaining why the area is closed to public access (not just do not enter), move current sign to block current volunteer trail, explain federal crime for larger effect, new interpretive signs, roving ranger	Lack of compliance, lack of knowledge, staff time (enforcement and education), funding for new signage	USFWS, OPRD Operations, OPRD RPP, ODFW

Table 14. Issues matrix cont.

Issue	Issue Type
Potential and observed seabird and shorebird (resident and migratory) disturbance events. This includes off-leash dogs and recreational activities that simulate predators (i.e., kite-flying)	Environmental/Interpretation/Recreation
Black oystercatchers have experienced reoccurring nest failures in the area	Environmental
Bird predation issues (possibly raccoons)	Environmental
Upstream septic potentially polluting the stream	Environmental/Safety
Potential left-over mercury from gold mining in stream	Environmental/Safety
Few visitors are aware of restrictions on marine plants, particularly the OPRD guideline of “small amounts” or 10 lbs wet weight. There is an unknown level of harvest.	Environmental/Interpretation/Recreation
Quantity of harvest of edible plants, both marine and terrestrial is unknown	Environmental/Recreation
Sign placement not effective	Interpretation
Hard for public to understand ocean shore vs. state park rules	Interpretation
School groups do not often coordinate with the park prior to their visits	Interpretation

Seal Rock SRS: Issues

Potential Solution(s)	Potential Barrier(s)	Potential Partners
In addition to above suggestions, focus interpretive efforts on asking visitors to keep dogs on leash as a courtesy to other visitors and natural resources.	Voluntary compliance, staff time, funding	USFWS, OPRD Operations, OPRD RPP, ODFW
Encourage visitors to use other sites with less potential for bird disturbance for recreational activities such as kite-flying	Voluntary compliance, staff time, funding	USFWS, OPRD Operations, OPRD RPP, ODFW
Coordinate with USFWS to determine extent of the problem and whether follow up efforts are warranted		OPRD Operations, USFWS
Coordinate with USFWS to determine extent of the problem and whether follow up efforts are warranted		OPRD Operations, USFWS
Coordinate with DEQ to determine if water quality testing is occurring and extent of problem		OPRD Operations, OPRD Safety Program, DEQ, Surfrider, ODA, Private Landowners
Coordinate with DEQ to determine if testing has occurred		OPRD Operations, OPRD Safety Program, DEQ, Surfrider
Interpretive signage explaining appropriate harvest methods and limits, interpretive brochures, roving ranger	Lack of compliance, lack of knowledge, staff time (enforcement and education), funding for new interpretive services	OPRD Operations, OPRD RPP, ODFW, DSL
On-site presence to document level of harvest	Staff time, funding, logistics	OPRD Operations, DSL, ODFW
Develop a comprehensive, integrated sign plan with interpretive intent	Staff time, funding for new signs	OPRD RPP, OPRD Operations
Revise rules to make enforcement uniform along the shore		OPRD RPP, OPRD Operations, OPRD Ocean Shores Program
Install signage to explain the regulatory differences	Funding, hard to explain, need too many signs, hard to place signs on/near beach	OPRD RPP, OPRD Operations, OPRD Ocean Shores Program
Interpretive services (e.g., brochures)	Hard to explain without signage	
Discourage unmanaged visits	Staff time, volunteer compliance of request,	OPRD RPP, OPRD Operations, Schools (Oregon and out-of-state)
Facilitate scheduling with schools to improve experience, avoid crowding by reaching out to the education community (possibly via the web).	Support infrastructure, staff time, funding	OPRD RPP, OPRD Operations, Schools (Oregon and out-of-state)
Provide oversight guidelines	Staff time	OPRD RPP, OPRD Operations
Encourage educational focus for visits	Staff time, volunteer compliance, resources to support teachers, teacher time, participation of parent supervisors	OPRD RPP, OPRD Operations, Schools (Oregon and out-of-state)

Table 14. Issues matrix cont.

Issue	Issue Type
Resources not readily available for teachers to facilitate intertidal visits	Interpretation
Need additional enforcement/oversight/education	Interpretation
High probability cultural resource site. One of the beach access points disturbs cultural resources	Cultural
GIS boundary layer not exact	Miscellaneous

Seal Rock SRS: Issues

Potential Solution(s)	Potential Barrier(s)	Potential Partners
Provide lesson plans to teachers	Staff time, voluntary participation	OPRD RPP, OPRD Operations, Schools (Oregon and out-of-state)
Have a teacher resource section on the OPRD website	Staff time, voluntary participation	OPRD RPP, OPRD Operations, Schools (Oregon and out-of-state)
Extend dates of seasonal rocky shore interpreter. Focus on roving ranger duties per suggestions from visitor interviews	Funding	OPRD RPP, OPRD Operations,
Interns	Housing, Funding	OPRD Operations, OPRD RPP, Oregon Coast Community College, Oregon University System
Volunteer docents/hosts	Staff time to coordinate, need dedicated volunteers, training, campsite, safety issues	OPRD RPP, OPRD Operations, Coastwatch, Oregon Coast Aquarium, HMSC, Coastwatch
Partner with aquarium volunteer program	Staff time to coordinate, training	OPRD RPP, OPRD Operations, Oregon Coast Aquarium
Partner with the new OSU master naturalist program	Staff time, training	OPRD RPP, OPRD Operations, OSU Extension,
Temporary signs with docents like at Yaquina Head	Funding, staff time	OPRD RPP, OPRD Operations, Yaquina Head ONA
Model program based on the Beach Watchers program in WA state	Funding, staff time	OPRD RPP, OPRD Operations, WA Beach Watchers Program, Sea Grant Extension
Maintain current practices that require clearance forms and continue regular consultation with SHPO for any activities that could disturb resources		SHPO, OPRD Operations, ODOT, Tribes
Offer alternative access to ODOT through our property & signage to indicate appropriate route	Not on our property, shortest route to the beach from RV Cove, unlikely that guardrail would stop crossing, funding for signage, cooperation of partners	SHPO, OPRD Operations, Tribes
Verify ownership boundary and 16' contour elevation with a survey	Staff time, funding	OPRD Info Services, OPRD Operations, ODOT, Private Landowners

Natural, Cultural and Scenic Resource Management

This section outlines general guidelines for management of natural, cultural and scenic resources in the park based on OPRD policies and statewide guidelines.

Statewide Natural Resource Policy:

It is the policy of the Oregon Parks and Recreation Department to plan, design and implement resource management practices consistent with the principles of conservation, energy efficiency, and sustainability.

The following policy guidelines have been established:

- Manage OPRD properties to preserve and protect Oregon's natural landscape; manage park properties to enhance the natural ecological processes that sustain natural resources in balance with current and future outdoor recreation interests.
- Manage natural resources in a manner emphasizing ecosystem-based approaches that protect the integrity of the natural environment and promote ecosystems that favor biodiversity, reduce ecological fragmentation, and promote native species.
- Comply with all applicable federal, state, and local rules and regulations, and seek ways to avoid or minimize ecological impacts that may occur as part of the implementation of operations and business systems. Where such impacts are unavoidable, OPRD will mitigate for such impacts.
- Develop and maintain an Environmental Management System (EMS) to conserve resources, reduce impacts to the environment, and implement sustainable operational policies and procedures.
- Implement energy conservation and efficiency measures in all aspects of agency operations

including; facility design and maintenance, fleet and transportation systems, and department administration.

- Incorporate sustainable practices into all facets of the department's mission, particularly: facility and site planning, design, construction, operation and maintenance; grant programs; contracting and procurement, and visitor programs and services.
- Reduce, and where possible eliminate, hazardous chemicals and toxic materials in construction, operations and maintenance activities.
- Reduce the department's contribution to atmospheric carbon dioxide and other pollutants.
- Create systems to eliminate waste in department operations.
- Train staff and volunteers to reinforce the agency's commitment to resource stewardship and conservation and to gain compliance with adopted practices.
- Conduct educational and interpretive activities to inform and inspire visitors and local communities to reduce their impact on the environment for the benefit of present and future generations.
- Support sustainable practices that strengthen local economies.
- Promote these guidelines to others for their adoption and use and, when working with others as partners in joint activities.

Statewide Cultural Resource Policy: OPRD's policy relating to its cultural resources, which include, but are not limited to, tangible resources and cultural practices is to:

- Foster an understanding and appreciation of the cultural resources entrusted to OPRD's management, both within and outside the agency, through appropriate programs of training, research, identification, treatment, and

interpretation.

- Conduct sufficient research to locate and evaluate OPRD's cultural resources, prior to making decisions on their treatment. Treat the agency's property as significant until a final determination has been made.
- Evaluate all cultural resources that appear to meet the criteria for inclusion in the National Register of Historic Places. All those determined to be eligible will be nominated for listing.
- Employ The Secretary of the Interior's Standards for the Treatment of Historic Properties with Guidelines for Preserving, Rehabilitating, Restoring, and Reconstructing Historic Buildings for any work that will be conducted on OPRD historic properties.
- Engage in active stewardship that ensures the agency's historic properties are preserved, protected and made available, when appropriate, for public understanding and appreciation.
- Consider cultural resource preservation intrinsically as a form of sustainable conservation.
- Encourage appropriate uses of historic properties that will allow for and ensure their long-term protection while minimizing harm to character-defining features. Discourage inappropriate uses or changes to historic properties that adversely affect an historic property's character-defining features.
- Preserve and protect the cultural heritage of this state embodied in objects and sites that are of archaeological significance.
- Seek the acquisition or lease of sites of historic significance for state use, in accordance with Oregon Revised Statute 358.653. Conversely, should OPRD surplus property of historic significance, attach all appropriate preservation covenants to ensure the property's long-term

protection.

- Adhere to all other applicable OPRD Commission policies and OPRD Operations policies while implementing this policy, including, but not limited to, consultation with Oregon tribes regarding cultural resources and tribal traditions of interest to the tribes.
- Recognize agreements between the Heritage Conservation Division and Operations as the basis for defining how the two divisions work together in achieving the policies listed above.

Scenic Resource Standards:

Scenic resources are very important to OPRD and are one of the primary factors considered by the ocean shore program when evaluating ocean shore permits. The following standards are part of state rule that applies to modifications to the ocean shore:

Projects on the ocean shore shall be designed to minimize damage to the scenic attraction of the ocean shore area. The following scenic standards shall be applied, where applicable:

- Natural Features -- Retain the scenic attraction of key natural features, for example, beaches, headlands, cliffs, sea stacks, streams, tide pools, bedrock formations, fossil beds and ancient forest.
- Shoreline Vegetation -- Retain or restore existing vegetation on the ocean shore when vital to scenic values.
- View Obstruction -- Avoid or minimize obstruction of existing views of the ocean and beaches from adjacent properties.
- Compatibility with Surroundings -- Blend new additions to the landscape with the existing shoreline scenery (type of construction, color, etc.).

Oregon Statewide Planning Goal 5 also discusses conservation of scenic resources. Local governments and state agencies are encouraged to maintain

inventories of scenic views and sites.

Goals and Strategies

This section establishes OPRD's goals and strategies for management of the park and adjacent ocean shore. The goals and strategies are based on consideration of the recreation needs assessment, and evaluation of the issues identified in the planning process and summarized in this plan as well as statewide agency policies. Below is a summary of the major goals and strategies (note: these are not prioritized):

Goal 1: Provide recreation opportunities and experiences that are appropriate for the park resources and recreation settings.

Every effort will be made to provide visitors with an assortment of recreational experiences that continue to meet and exceed their expectations.

- Development or rehabilitation of recreational facilities will be guided by indicators of need, the recreation settings, resource suitability, and the capacities of the park to accommodate use without overcrowding, degradation of recreation experience, or conflicts with other uses
- Recreational activities that threaten to harm the natural, cultural or scenic resources and/or the safety of the visitors will be discouraged and/or re-routed to alternate, less sensitive locations

The need for maintaining the current day-use experiences for park visitors is recognized, but potential future activities need to be anticipated. This is based on the anticipated increase in demand for recreation and recognizing parks needs to meet future visitor expectations.

- The current capacity for day-use in the park is at the right level given space and natural resource restrictions. There is no viable opportunity to increase parking capacity.
- Given that parking capacity will not increase, the potential for future additional crowding is minimized. However, there is the potential for the park to be "at-capacity" more often than it

is currently. Therefore, those that experience crowding may increase.

- As appropriate, provide information to visitors about other nearby parks or accesses that offer similar or complementary experiences.
- As possible, efforts will be made to coordinate with schoolgroups to help minimize crowding and improve their educational experience at the site.
 - Work with those that visit the site and encourage use of smaller busses since safe turn-around is not feasible for larger vehicles.
 - Explore opportunities to work with the school districts to coordinate scheduling of school visits.
- Explore options for improving services to visitors with disabilities.
- Explore ways to improve facilities and services to accommodate Oregon's youth. Work to develop partnerships with recreation providers that encourage youth outdoor exploration and interpretation.

The anticipated increase in future demand for recreational activities includes activities such as walking, hiking, tidepooling and generally ocean beach activities.

- Continue to provide and maintain opportunities for these key recreational activities. As new trends emerge, consider the feasibility of providing for those at the site.
- Maintain facilities such as picnic tables and telescopes (for sightseeing) to accommodate the interest of aging Oregonians and minority populations in these activities.

Goal 2: Protect, manage and enhance as appropriate, outstanding natural, cultural and scenic resources.

Enjoyment and appreciation of resources will be enhanced while protecting those resources from effects of overuse.

Scenic resources:

One important aspect of visiting the park is the

Seal Rock SRS: Goals and Strategies

views. These views focus on the ocean and more specifically, at the overlooks, of the geologic and scenic characteristics of the offshore rocks.

- Retain the scenic attraction of key natural features. Unforeseen future actions may impair views and efforts will be made to minimize the possibility for negative impacts on key viewsheds and features within the park and adjacent ocean shore.
- As possible, retain or restore existing vegetation when vital to scenic values.
- Avoid or minimize obstruction of existing views of the ocean and beaches.
- Blend new additions to the landscape with the existing shoreline scenery (type of construction, color, etc.).

Cultural resources:

The park land is an important traditional-use area of the Confederated Tribes of the Siletz Indians and their cultural heritage within the area is of considerable antiquity.

- Preserve and protect the cultural heritage of the site in consultation with the Tribes.
- Consult, as appropriate, with the Confederated Tribes of the Siletz Indians to identify potential interpretive themes/stories to highlight at the site.

Natural resources:

As resources become available, additional inventories of high quality ecosystems will be completed and evaluated for the presence of threats to desired ecosystem types or conditions. Determine whether there are changes desired in ecosystem types or conditions based on consultation with appropriate resource agencies and stakeholders over time and as new information becomes available.

- As possible, develop long-term monitoring of the high use intertidal areas (and complementary control areas) to track potential impacts of visitor use (this may be part of a larger, coast-wide strategy).
- To the extent practicable, on-site staff and/or volunteers will discourage illegal collection and efforts will be made to improve signage and increase voluntary compliance.

The resources will be managed to minimize any unacceptable threats or to attain desired ecosystem conditions and types.

- Use scientific information to adaptively manage as new information becomes available.
- As possible, potential habitats for at-risk species found within the park boundary and adjacent ocean shore will be identified. The list of at-risk species may need to be updated and a plan for monitoring these species developed, as appropriate.
- Work with interested agencies to protect at-risk species, their habitats, and identify opportunities to improve key habitats and minimize negative interactions with visitors to assist with species survival and recovery.
- Where appropriate, restore or enhance existing low quality resource areas to a higher quality or desired ecosystem types or conditions based on consultation with natural resource agencies as to what a desired ecosystem should be for the planning area and for the region.
- Work with partner agencies who are attempting to resolve environmental and safety risks that have the potential to effect park or ocean shore resources and/or present safety risks to park/ocean shore visitors.

Sustainable practices will be incorporated, to the extent practicable, in all aspects of OPRD's mission, particularly: facility and site planning, design, construction, operation and maintenance, contracting and procurement, and visitor programs and services.

- If plantings are necessary, efforts will be made to use plants native to the Oregon coast.
- Minimize use of hazardous chemicals and toxic materials used in operation and maintenance activities.

Goal 3: Provide for adequate management, maintenance, rehabilitation, and park operations

To the extent that resources are available, recreational activities and facilities will be managed, maintained, rehabilitated and operated as needed for the safety, satisfaction and enjoyment of the visitors and local citizens. In allocating state park

operational and facility investment funds, strive to provide adequate support for the maintenance and rehabilitation of existing facilities, and an adequate level of oversight and enforcement in the park and adjacent ocean shore.

- Alternatives to routine maintenance of the access trail to the beach will be discussed since it does not seem to be working
- Routine maintenance of the parking lot (including striping) will help with appropriate parking of larger vehicles.

Goal 4: Provide for safe, efficient, identifiable and pleasant access and circulation

- Long-term solutions will be considered as the beach access trail, located in an geologically unstable and erosive area, continues to degrade.
- Efforts will be made to look at long-term solutions for the parking situation for large vehicles (see goal 1).
- Explore ways to enhance the visual appearance and identity at the entrance using signage and vegetation.
- Plant, remove and prune designed landscape areas where needed to beautify roads and parking areas, retain scenic views, and provide visual buffers within the park.

Goal 5: Promote public awareness, understanding, appreciation, and enjoyment of the recreation settings through resource interpretation.

OPRD will strive to share and interpret park and local history along with geologic and natural resources with a wider audience. The interesting local history, unique geology and ocean shore and marine resources make Seal Rock a great location for interpretation.

- As feasible, develop an interpretive plan (likely as part of a plan for the larger management unit). The plan may include interpretive themes and recommended interpretive programs and materials.
- Work to improve on site interpretive services including roving rangers, signage etc. Work with partners to help accomplish this.

- Improve visitor awareness and understanding of the ODFW fishing regulations that apply at the site
- Improve as feasible public understanding of the difference between ocean shore rules and those that apply to areas adjacent to state parks. This will likely need to be part of a larger coastwide effort.
- As possible, efforts will be made to provide interpretive services to schoolgroups to improve their educational experience at the site.
- Coordinate with the Confederated Tribes of the Siletz Indian on any interpretive stories that relate to cultural resources.
- Provide information to harness the increasing availability and interest of aging Oregonians in volunteering in their communities.
- Communicate information about park resources and services on the OPRD website.

Goal 6: Form partnership and agreements to aid in achieving goals

Many of the issues identified in the scoping for this site identified partners as part of the solution.

- Identify and follow-through with viable potential partnerships as practicable to work through the above listed activities, and new ones that emerge in the future.
- Promote the use of the above goals and strategies when working with others as partners in joint activities at the site.

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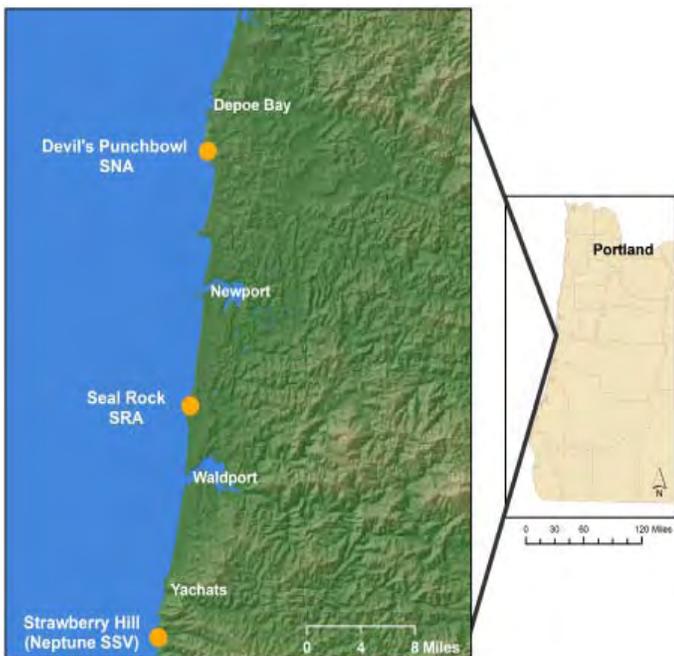
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I. EXECUTIVE SUMMARY

Introduction

This report describes the results of a visitor recreation use project conducted at three rocky intertidal sites on Oregon's central coast: Seal Rock State Recreation Site (SRS), Devil's Punchbowl State Natural Area, and Strawberry Hill wayside (part of Neptune State Scenic Viewpoint), all Oregon Parks and Recreation Department (OPRD) properties (see map).



Map of the 3 sites along the central Oregon coast

The results are based on both observational data and on-site interviews of visitors to the intertidal areas adjacent to these three parks. The objective of the project was to assist Oregon Parks and Recreation Department improve management of Oregon's Ocean Shore Recreation Area by obtaining information about visitor use numbers, recreation types, and public awareness levels in intertidal areas adjacent to and near coastal state parks. The results of this study are intended to complement biological inventories conducted at the same sites as well as future planning efforts to develop site management plans for the sites.

Summary of Key Results

Visitation Rates

Devil's Punchbowl

The average number of visitors per day at the Devil's Punchbowl SNA intertidal area is 94 with a range between 4 visitors on a rainy June 1st and 177 on June 5th. During the 9 days sampled, the average number of visitors per hour ranged from 1 to 35 persons with an average hourly visitation of 19 visitors per hour.

Seal Rock

The average number of visitors per day at the Seal Rock SRS intertidal area is 97 with a range between 9 visitors on May 2nd and 146 on July 17th. During the 9 days sampled, the daily average hourly use ranged from 2 to 29 persons with an average hourly visitation of 19 visitors per hour.

Strawberry Hill

The average number of visitors per day is 51 with a range between 10 visitors on June 30th and 118 on May 21st. During the 9 days sampled, the daily average hourly use ranged from 2 to 38 persons with an average hourly visitation of 12 visitors per hour.

**Average visitation
is 17 visitors
per hour**

Timing of Visits

Most visitors schedule their visit to correspond to the time of low tide with 63% of visitors observed during this time period. Regardless of the time of low tide, the most popular time to visit is between 9-10 AM. Visitation is extremely low in the early morning with only 5 percent of visitors observed prior to 7 AM.

Devil's Punchbowl

Visitation at Devil's Punchbowl appears to be more

evenly spread out over the observation period, but still peaks the hour after low tide with 36% of visitors choosing this time frame to visit the site. 60% of visitors visit during the peak time of one hour before to one hour after. Unlike Seal Rock where there doesn't appear to be a correlation, in general, later low tides attract more visitors to the Devil's Punchbowl intertidal area.

Seal Rock

Visitation at the Seal Rock intertidal area peaks the hour after low tide with 53% of visitors choosing this time frame to visit the site. Visitors appear to base the time of their visits on the time of low tide, with 63% of visitors visiting during the peak time of one hour before to one hour after. The actual time of low tide does not appear to affect visitation, with no apparent correlation with time of day.

Strawberry Hill

Visitation peaks the hour after low tide with 47% of visitors choosing this time frame to visit the site. Visitors to Strawberry Hill also appear to visit based on the time of low tide, with 67% of visitors counted during the peak time of one hour before to one hour after. Like Devil's Punchbowl, later low tides appear to draw in more intertidal visitors.

The most popular time to visit is one hour before to one hour after low tide, especially between 9-10 AM

Spatial Distribution

Distribution across the intertidal areas at the three parks is not even. In general, visitors do not move very far away from access points.

Devil's Punchbowl

At the Devil's Punchbowl intertidal area, the most frequented area is between the two access points (the Inn at Otter Crest stairwell and the state park access).



Interpretation at Strawberry Hill

Seal Rock

The most popular section of the intertidal at Seal Rock is the area between the stream and the rocky outcropping just to the south of it.

Strawberry Hill

The most popular section of rocky shoreline at Strawberry Hill is an approximately 1/4 mile section just south of the park access point.

Activity Types

Devil's Punchbowl

Passive recreation (e.g., walking, observing, tidepooling without handling organisms or rocks) the most common activity with 51% of visitors observed doing these types of activities. In second place with 28% of visitors is

Appendix A: Rocky Shore Recreation Use Study

with approximately 15% of the observed visitors appearing to be part of a school affiliated group.

Seal Rock

The characteristics of visitors observed at Seal Rock are quite similar to those at Devil's Punchbowl, however, there were slightly higher number of visitors observed on the beach than undertaking passive tidepool exploration (41% vs. 35%). This is followed by 10% of visitors in a schoolgroup.

Strawberry Hill

Visitors to the Strawberry Hill portion of Neptune SSV are largely made up of school affiliated groups, at least during the portion of time visitors were observed for this study. 41% of visitors appeared to be with a schoolgroup, followed by 37% engaging in passive tidepool exploration and 10% conducting beach activities.

Top Recreation Types

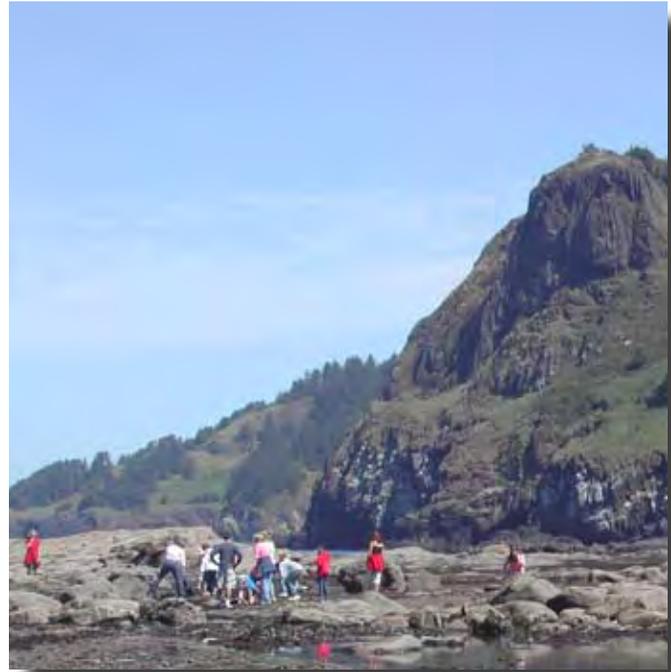
- 1. Passive tidepool exploration**
- 2. Beach recreation**
- 3. Schoolgroups**

Visitor Characteristics

The typical visitor to the rocky intertidal at these sites

- Travels in a family group of two to three people
- Visits two times per year;
- Spends one to two hours at the site;
- Is an Oregonian from either the Willamette Valley, the Portland metro area or the Coast;
- Travels 120 miles to reach the site;
- Accesses the site via the park access;
- Comes to the site to explore the tidepools;
- Visits other rocky shore sites along the central coast;
- Has an interest in learning more about tidepools, preferably via roving rangers ; and
- Believes there are special protections afforded to intertidal areas, which they strongly support. Recommendations will be develop using this information, biological surveys of the site,

stakeholder input and other knowledge as part of developing site management plans for the sites.



Visitors exploring the tidepools at Devil's Punchbowl rocky intertidal area

III. METHODS

The three study sites are sections of rocky shoreline on Oregon’s central coast between just north of Newport to slightly south of Yachats. Each section is approximately 1/2 mile in length and lie adjacent to three different state parks from Devil’s Punchbowl State Natural Area (approximately eight miles north of Newport), to Seal Rock State Recreation Site (approximately 10 miles south of Newport), and Strawberry Hill (approximately 5 miles south of Yachats) Oregon (fig. 3).

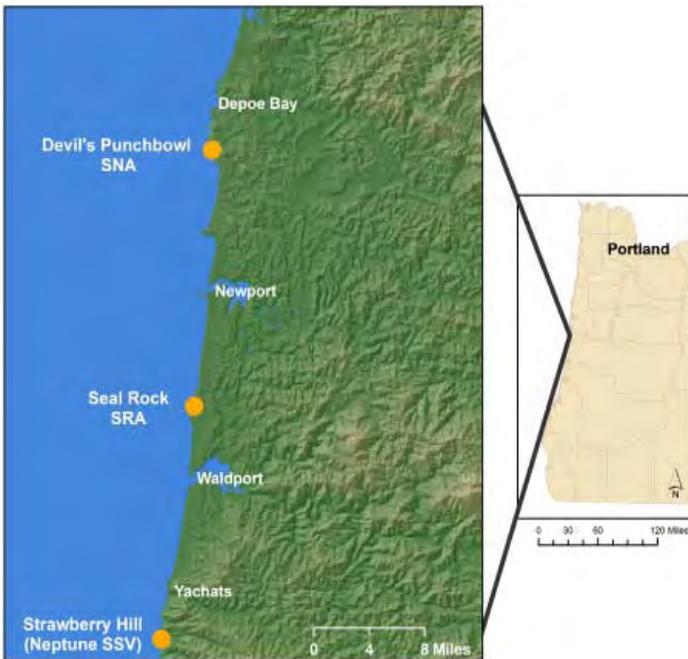


Figure 3. Map of the 3 sites along the central Oregon coast

Devil’s Punchbowl

This section of coastline is characterized by extensive rocky intertidal habitat made up of shallow pools and surge channels weathered into a large, flat surf-cut sandstone shelf (Fox et.al., 1994). Devil’s Punchbowl, on the southern end of the site is a circular shaped hole created from the collapse of two sea caves (Lund, 1974). The 8.17-acre OPRD property known as Devil’s Punchbowl State Natural Area (SNA) provides public access on both the northern and southern ends of the headland (fig. 4). The Inn at Otter Crest, a 130-guestroom hotel, on the

upland side of the far northern end of the site provides private access. The 1/2 mile long study region is subdivided into four main study areas (A-D) each of which is separated in two to distinguish where visitor activity is concentrated.



Figure 4. Map of Devil’s Punchbowl study site showing the seven sampling locations (A1-D2). Access points are depicted by black hiker icons. The harbor seal haulout is shown as a black seal icon. Approximate park boundary is shown in green.

Seal Rock

This section of coastline is characterized by a combination of basalt and sandstone cliffs, sandy beaches interspersed with rocky intertidal areas and a string of offshore rocks that provide a portion of the area with shelter (Fox et. al., 1994). The X acre OPRD property known as Seal Rock State Recreation Site (SRS) provides public access on the northern section of the study area and several highway

Appendix A: Rocky Shore Recreation Use Study

pullouts provide additional access points (fig. 5). The .56 mile long study region is subdivided into three main study areas (A-C) which are further subdivided in two to show where visitor activity is concentrated.



Figure 5. Map of Seal Rock study site showing the six sampling locations (A1-C2). Access points are depicted by black hiker icons. Approximate park boundary is shown in green.

Strawberry Hill

This section of shoreline is characterized by a series of rocky intertidal areas interspersed with sandy beaches along a basaltic bench that reaches from Cape Perpetua to the north all the way to Bob Creek to the south (Fox et. al., 1994). The X acre OPRD property known as Neptune State Scenic Viewpoint is actually made of several sections, one of which is the Strawberry Hill wayside area. The wayside provides public access near the middle of the study area (fig. 6).

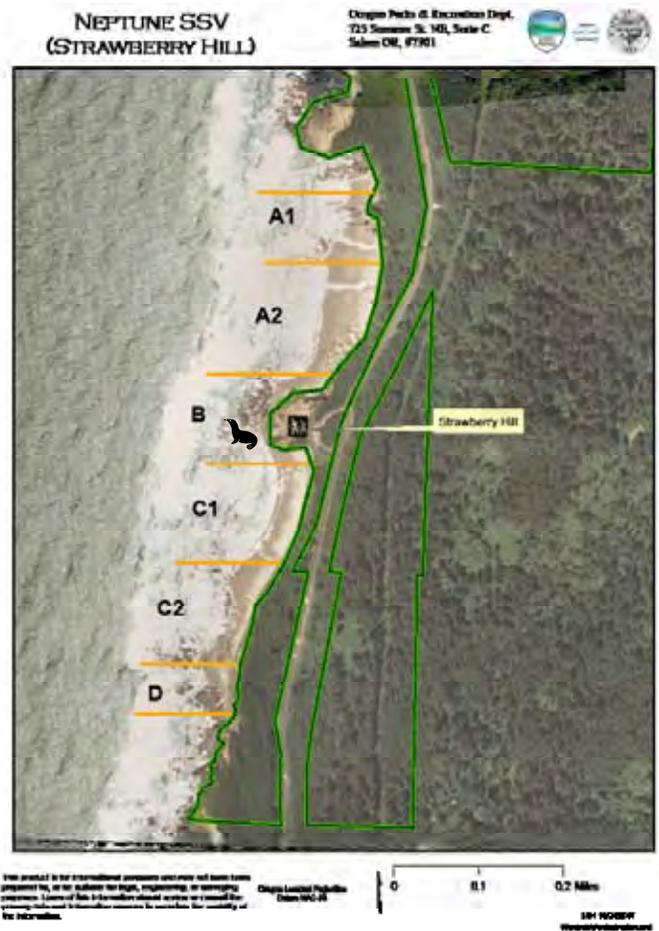


Figure 6. Map of Strawberry Hill study site showing the six sampling locations (A1-D). The access point is depicted by a black hiker icon. The harbor seal haulout is shown as a black seal icon. Approximate park boundary is shown in green.

Two methods of on-site data collection are employed, observational data of visitor recreational activities and a short interview. Information recorded includes location, time, number of users, and activity in the intertidal areas. The on-site interview collects information about recreation activities, knowledge of protections and restrictions, and access.

To gain an understanding about peak use periods, all on-site data is collected between May 2nd and July 17th, 2007. In Oregon, late spring and summer low tides are generally accepted to be the best time to gain access to the rocky intertidal. Not only are the tides the lowest during this time period, but weather conditions

tend to favor coastal recreation as does the timing of spring-time school field trips and summer school vacation.

Sample Selection

Days and Times

To achieve the objective of quantifying human activity in the rocky intertidal, potential sampling periods were chosen to coincide with a relatively low predicted tide (below -.05 MLLW) and daylight hours (between sunrise and sunset). To standardize time relative to predicted low tide and obtain counts over the entire span of low tide use, the survey period starts the hour before and ends four hours after the predicted low tide (Addessi, 1994; Fox, 1994).

Since visitor numbers and types of activity may be expected to vary between weekdays and weekends and also depending on whether schools are in session or not, it is necessary to stratify sampling over time (Underwood and Kennelly, 1990). Observations are divided into school weekdays (WdS), school weekends (WeS), summer holiday weekdays (WdH), and summer holiday weekends (WeH) to allow orthogonal comparisons (Underwood and Kennelly, 1990).

Potential days meeting the above mentioned criteria (low tides coinciding with daylight hours) were identified and separated out to allow for at least two replicates of each type of day (WdS, WeS, WdH, WeH) information is desired for. Ultimately, final sampling days should be randomly chosen, however, for the weekend category, there were not enough days available that met the criteria to randomly sample. The dates for school weekdays (WdS) and school holiday weekdays (WdH) were randomly selected. A full list of all potential (*) and chosen (27) survey dates is in Appendix *.

Area

Sampling is initiated from two different starting locations (on the north and south ends of each of the site) and begins in either a northward or southward

direction, chosen randomly on each day. From the starting location, sampling follows a set route through the rocky intertidal at each of the study sites. Visitor use observation and visitor interview periods alternate throughout the 5-hour sampling period as indicated in figure 7. Whether or not the starting period is visitor counting or visitor interview is chosen randomly each day. There are three, 40-minute visitor counting periods, which alternate with three, hour-long visitor interview periods (fig. 7).

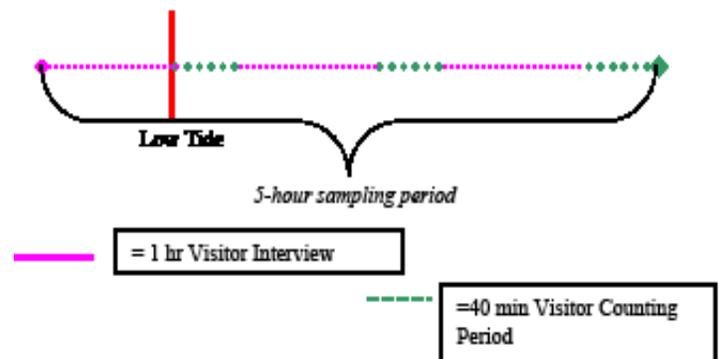


Figure 7. Schedule of Visitor Use Observation and Visitor Use Survey Periods during the sampling period. This figure depicts a day that starts with an interview period, for illustrative purposes only.

Visitor Observation and Counting Period

The first method of on-site data collection used is observational, whereby the surveyor observes visitor recreational activities and counts visitor numbers. The observations are brief “snap-shots” of the activities present at the site since the observer only notes activities as visitors pass through the rocky shore.

Observations are broken down into each of the observation sections and by activity. To monitor different types of use, activities are broken down into eight categories. These categories are as follows:

1. *Active, non-collectors* are people that are seen to be handling organisms (i.e. picking up a sea star, poking an anemone) and/or turning over rocks but it is not apparent that they are collecting organisms.

2. *Active, collectors* are people that are obviously collecting organisms. These people may have buckets or plastic bags and/or collecting tools such as knives. Any person seen putting something in their pocket or utilizing any sort of collecting device (e.g., prying tools) is considered an active collector. At any given distance it is unlikely that the specific organism(s) is identifiable, but if it is, it is noted on the data sheet.

3. *Passive visitors* are those that are moving about in the intertidal (e.g., standing, kneeling, walking) but are not collecting or turning rocks. These types of visitors may be tidepooling, birding, taking photos etc.

4. *Fishers* are people observed to be rock fishing from shore. Offshore fishing (from boats) is not included in this category.

5. The *Other* category is used for all activities that do not fit within the other groups. They are described in as much detail as possible.

6. *Dogs* present at the site are noted, as are whether or not they are on or off-leash.

7. *Schoolgroups* present at the site are noted and the approximate size is included if possible.

8. *Beach* or non-rocky shore activities are noted if they are in the areas adjacent to the rocky shore observation areas.

Visitor Interview Period

The second method of data collection used was a short on-site interview, whereby the surveyor interviews visitors about recreational rocky shore activities and general knowledge of protections (see Appendix X for survey instrument). Since it is not practical to interview all visitors to the site as use levels vary and visitor movements are not under the control of the interviewer, visitors are contacted at random (Shelby and Tokarczyk, 2002).

A standard script was utilized to contact visitors. The script informed potential respondents of the purpose of the study as a recreation use project being conducted by OPRD. The project was described as a way to gather information to help OPRD better manage Oregon's rocky shores for both recreation and natural resource preservation. Respondents were informed that participation in the interview was completely voluntary and confidential. Except for home zip codes, no personal information was collected about the participants. At the end of the interview, participants were provided with a copy of OPRD's "Oregon's Rocky Intertidal Area" brochure if they wanted one. The on-site script is located in the Appendix.

III. RESULTS

Observation Period

During the 27-day visitor observation period from May 2nd-July 17th, 2007, a total of 2,170 visitors were observed recreating in the three separate intertidal areas. Counts include the entire span of low tide use as they occurred one hour before the predicted morning low tide to four hours after the low (Fox, 1994).

The average number of visitors per day is 80 with a range between 4 visitors on June 1st at Devil's Punchbowl and 177 on June 5th at Devil's Punchbowl. During the 28 days sampled, the daily average hourly use at all three sites ranged from 1 to 38 persons with an average hourly visitation of 17 visitors per hour. Results for visitor use counts, distribution (temporally and spatially) and recreation types are summarized below for each site.

Devil's Punchbowl

The average number of visitors per day is 94 with a range between 4 visitors on a rainy June 1st and 177 on June 5th. During the 9 days sampled, the daily average hourly use ranged from 1 to 35 persons with an average hourly visitation of 19 visitors per hour. Based on automated car-counts in the adjacent state park parking lots, the seven-year average (2000-

2006) for May-July is approximately 69,760. Daily totals are shown in Table 1.

On average, weekdays (104 visitors/day) got more use than weekends (82 visitors/day) and more visitors came during summer vacation (137 visitors/day) than

Table 1. Visitor counts totals for each of the 9 survey dates at Devil's Punchbowl SNA. The two rainy days are indicated with a * next to the number of visitors.

Day Type	Dates	Number of visitors
WdS	May 16 th	42
	June 1 st	4*
	June 5 th	177
		$X' \approx 74$
WeS	May 20 th	29*
	June 2 nd	45
		$X' \approx 37$
WdH	July 3 rd	138
	July 4 th	158
		$X' \approx 148$
WeH	June 16 th	140
	June 17 th	113
		$X' \approx 127$
TOTAL		846
Average		$X' \approx 94$

when school is in session (59 visitors/day). Days that fall on weekends when school is in session (WeS) appear to receive the lowest mean use (37 visitors/day) with weekdays during summer vacation (WdH) receive the most (148 visitors/day). Bad weather may have been a factor on at least one of the observation days (June 1st), where only 4 visitors were observed during the observation period. The other day with rain, also received about half as many visitors as the other day of the same type (May 20th had 29 visitors vs. June 2nd had 45).

Seal Rock

The average number of visitors per day is 97 with a range between 9 visitors on May 2nd and 146 on July 17th. During the 9 days sampled, the daily average hourly use ranged from 2 to 29 persons with an

average hourly visitation of 19 per hour (Table X). Based on automated car-counts in the adjacent parking lots, for which the seven-year average (2000-2006) for May-July is approximately 23,688 visitors per month. Daily totals are shown in Table 2.

On average, weekend days (102 visitors/day) received almost the same amount of use as weekdays (92 visitors/day). More visitors come during summer vacation (130 visitors/day) than when school is in session (70 visitors/day). Days that fall on weekdays during summer holiday (WdH) appear to receive the highest mean use (134 visitors/day)

Table 2. Visitor counts totals for each of the 9 survey dates at Seal Rock SRS. The two rainy days are indicated with a * next to the number of visitors.

Day Type	Dates	Number of visitors
WdS	May 2 nd	9
	May 7 th	58
	June 15 th	125*
		$X' \approx 64$
WeS	May 6 th	92
	June 3 rd	67
		$X' \approx 78$
WdH	June 19 th	122
	July 17 th	146*
		$X' \approx 134$
WeH	July 1 st	127
	July 14 th	123
		$X' \approx 125$
Total		869
Average		$X' \approx 97$

with weekdays during when school is in session (WdS) receiving the least (64 visitors/day) amount of visitation pressure (Table 2). Rain did not appear to deter visitors, as the 2 days it did rain received some of the highest amount of visitor use.

Strawberry Hill

The average number of visitors per day is 51 with a range between 10 visitors on June 30th and 118 on May 21st. During the 9 days sampled, the daily

Appendix A: Rocky Shore Recreation Use Study

average hourly use ranged from 2 to 38 persons with an average hourly visitation of 12 visitors per hour.

Based on automated car-counts in the adjacent parking lots, the seven-year average for May-July (2000-2006) is approximately 12,613 visitors. Daily totals are shown in Table 3.

On average, weekend days (41 visitors/day) get less use than weekdays (73 visitors/day) and more visitors come when school is in session (81 visitors/day) than during summer vacation (31 visitors/day). Days that fall on weekdays when school is in session (WdS) appear to receive the highest mean use (94 visitors/day) with weekends during summer vacation (WdH) receive the least (20 visitors/day) amount of visitation pressure (table 3).

Low Tide

The “best time” to visit tidepools is generally thought to be one hour before to one hour after low tide. To determine if visitation corresponds to this belief, visitor counts are plotted against hours before or after low tide. The time of low tides varied between survey dates between 6:43 AM and 10:45 AM (table 4).

Table 3. Visitor counts totals for each of the 9 survey dates Strawberry Hill. The one rainy day is indicated with a * next to the number of visitors.

Day Type	Dates	Number of visitors
WdS	May 17 th	17
	May 18 th	76
	May 21 st	118
	$X' \approx 94$	
WeS	May 5 th	30
	May 19 th	92
	$X' \approx 61$	
WdH	June 18 th	48
	July 16 th	34
	$X' \approx 41$	
WeH	June 30 th	10
	July 15 th	30*
	$X' \approx 20$	
TOTAL		455
Average		$X' \approx 51$

Devil's Punchbowl

Visitation at Devil's Punchbowl appears to be evenly spread out over the observation period. Visitation peaks the hour after low tide with 36% of visitors choosing this time frame to visit the site (figure 8). The least popular time to visit the site was one to two hours after the time of low tide (thought to be the most likely time of visitation) with only 15% of visitors visiting then (figure 8). The reason for this is most

Table 4. Time and height of predicted low tides for survey dates.

Date	Time	Height	Site
5/2/2007	7:19 AM	-0.5	Seal Rock
5/5/2007	9:08 AM	-0.8	Strawberry Hill
5/6/2007	9:43 AM	-0.6	Seal Rock
5/7/2007	10:30 AM	-0.5	Seal Rock
5/16/2007	6:43 AM	-2.2	Devil's Punchbowl
5/17/2007	7:22 AM	-2.5	Strawberry Hill
5/18/2007	8:11 AM	-2.5	Strawberry Hill
5/19/2007	9:01 AM	-2.2	Strawberry Hill
5/20/2007	9:53 AM	-1.7	Devil's Punchbowl
5/21/2007	10:45 AM	-1.1	Strawberry Hill
6/1/2007	7:36 AM	-1.1	Devil's Punchbowl
6/2/2007	8:05 AM	-1.2	Devil's Punchbowl
6/3/2007	8:44 AM	-1.3	Seal Rock
6/5/2007	10:17 AM	-1.0	Devil's Punchbowl
6/15/2007	7:21 AM	-2.4	Seal Rock
6/16/2007	8:08 AM	-2.3	Devil's Punchbowl
6/17/2007	8:45 AM	-2.0	Devil's Punchbowl
6/18/2007	9:30 AM	-1.5	Strawberry Hill
6/19/2007	10:14 AM	-0.8	Seal Rock
6/30/2007	7:19 AM	-1.2	Strawberry Hill
7/1/2007	7:48 AM	-1.4	Seal Rock
7/3/2007	9:12 AM	-1.3	Devil's Punchbowl
7/4/2007	9:50 AM	-0.9	Devil's Punchbowl
7/14/2007	7:00 AM	-1.8	Seal Rock
7/15/2007	7:43 AM	-1.6	Strawberry Hill
7/16/2007	8:23 AM	-1.3	Strawberry Hill
7/17/2007	9:00 AM	-0.8	Seal Rock

likely because very few of the observations periods happened to fall within this time period, not that visitation was extremely low. It appears that at Devil's Punchbowl, visitors do base the time of their visits on the time of low tide, with 60% of visitors visiting during the peak time of one hour before to one hour after.

Seal Rock

Visitation at the Seal Rock intertidal area peaks the hour after low tide with 53% of visitors choosing this time frame to visit the site (figure 9). These results are

visitors choosing this time frame to visit the site (figure 10). The dramatic drop-off in visitation the hour after low tide is due to a methodological error, and not likely because this time period is extremely unpopular

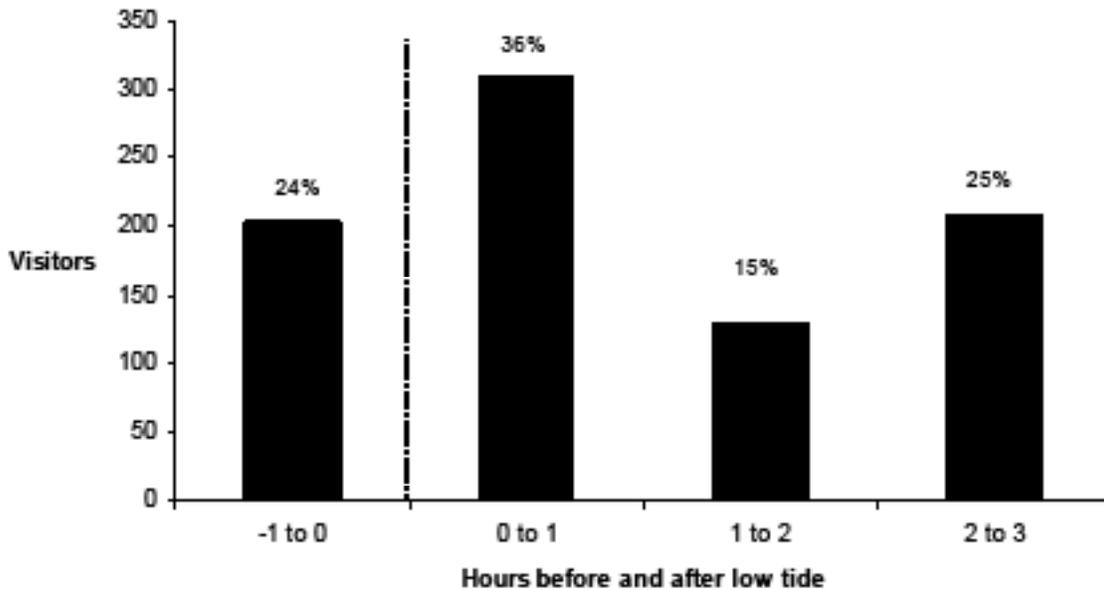


Figure 8. Visitor count levels before and after low tide at Devil's Punchbowl (May-July 2007).
N=846

slightly different from those found similar to previously at Devil's Punchbowl, where the highest counts were found between one and two hours after low tide (Fox, 1994; Hillmann, 2005).

The least popular time to visit the site was one to two hours after the time of low tide (thought to be the most likely time of visitation, but only 1% of observed visitors were counted during this time period) with only 10% of visitors visiting the hour before low tide (fig. 9). The reason for this is most likely because very few of the observations periods happened to fall within this time period, not that visitation was extremely low (due to methodological error). It appears that at Seal Rock, visitors do base the time of their visits on the time of low tide, with 63% of visitors visiting during the peak time of one hour before to one hour after.

Strawberry Hill

Visitation peaks the hour after low tide with 47% of

at Strawberry Hill. Only 1% of observed visitors were counted during this time period, however, the more likely "true" least popular time period is the hour before low tide, with 20% of visitors during that period (figure 10). It appears that at Strawberry Hill, visitors do base the time of their visits on the time of low tide, with 67% of visitors counted during the peak time of one hour before to one hour after.

Time of Day

If visitation is not entirely dependent on the time of low tide, time of day may be the factor that primarily determines visitation rates at intertidal areas. Visitor counts are plotted against time of day between 6 AM and 2 PM in figures 11-15. Regardless of the time of low tide, at all three sites, there appears to be a general trend of increased visitation in mid-morning, especially between 9-10 AM.

Appendix A: Rocky Shore Recreation Use Study

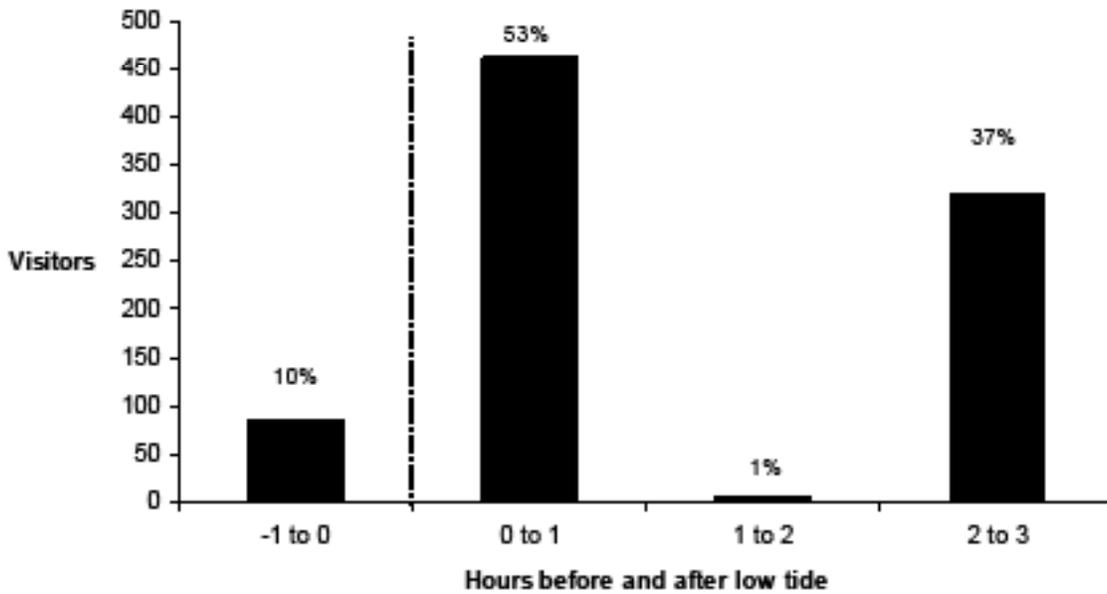


Figure 9. Visitor count levels before and after low tide at Seal Rock State Recreation Site (May-July 2007). N=869

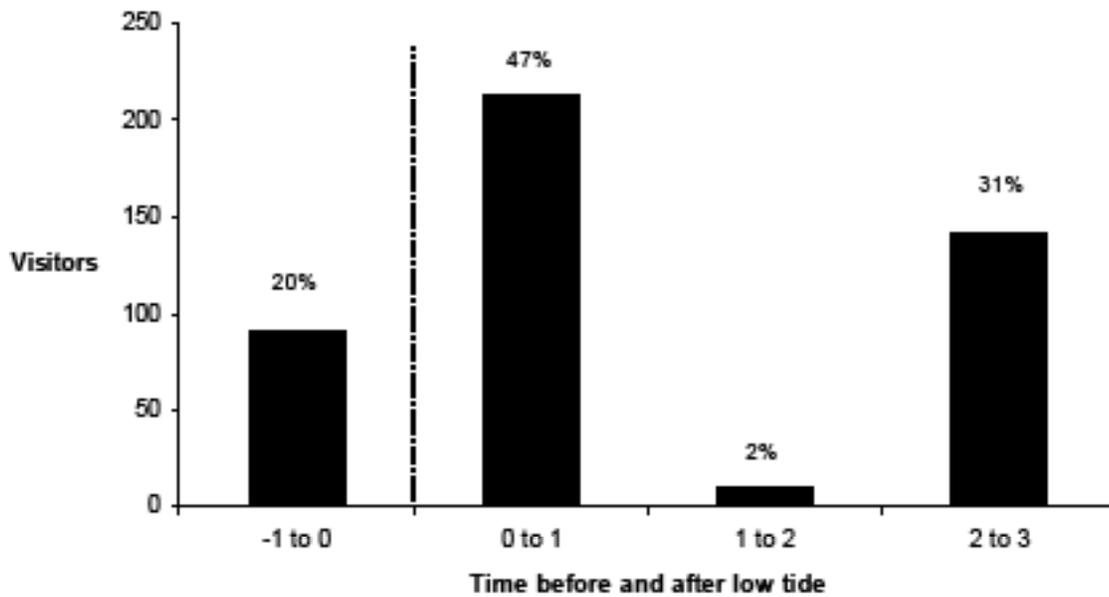


Figure 10. Visitor count levels before and after low tide at Strawberry Hill (May-July 2007). N=455

Devil's Punchbowl

The most popular time to visit Devil's Punchbowl during this survey was between 9 and 10 in the morning, with 40% of visitation occurring during that period (fig. 11). No visitors were observed between 6 and 7 in the morning.

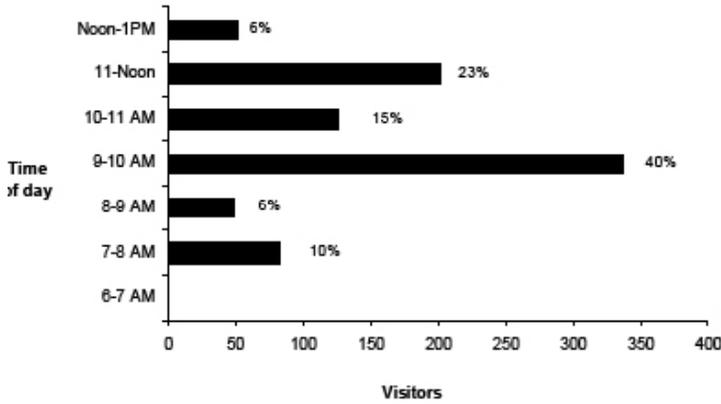


Figure 11. Number of visitors at different times of day at Devil's Punchbowl. N=846

In general, visitation appears to increase as the time of low tide moves later in the day with the busiest day falling on the latest low tide of 10:17 AM (fig. 12).

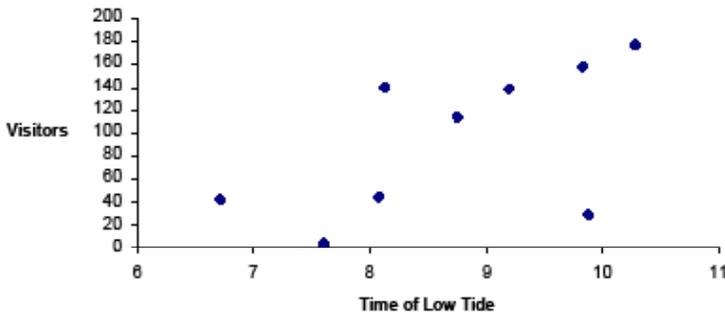


Figure 12. Number of visitors at Devil's Punchbowl for each day plotted against the time of peak low tide for that day. N=846

Seal Rock

As with Devil's Punchbowl, the most popular time of day to visit Seal Rock during this survey was between 9 and 10 in the morning, with 24% of visitation occurring during that time (fig. 13.). However, visitation was more evenly spread out than for Devil's Punchbowl.

This is also evident when looking at a graph showing visitation by hour of low tide (fig. 14.), where there does not appear to be an obvious pattern correlating

a later low tide with more visitors as there was at Devil's Punchbowl. The busiest day was one at which the low tide fell at 9 AM, which is a popular time to visit regardless of the hour of low tide.

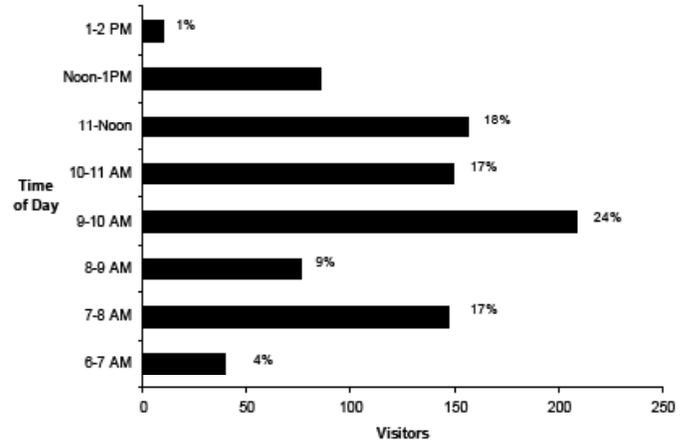


Figure 13. Number of visitors at different times of day at Seal Rock. N=869

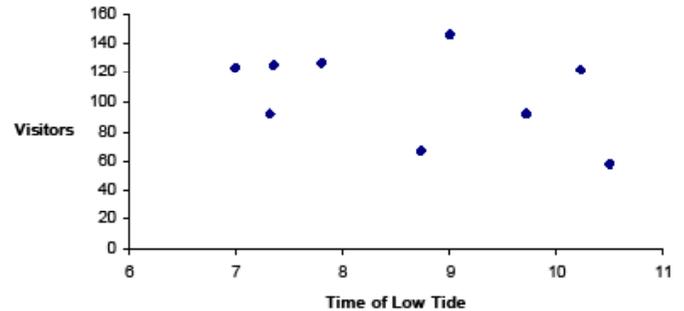


Figure 14. Number of visitors at Seal Rock for each day plotted against the time of peak low tide for that day. N=869

Strawberry Hill

At Strawberry Hill, the most popular time to visit, was again, between 9 and 10 in the morning (28%), however, a close second popular time was between 11 AM and noon (fig. 15). Very few visitors were observed before 7 AM.

Like Devil's Punchbowl, there appears to be a trend of higher visitation with later low tides (fig. 16). The busiest day was also the day during which the latest low tide fell (10:45 AM). This pattern was also evident at Devil's Punchbowl but not at Seal Rock.

Spatial Distribution of Visitors

In addition to the patterns evident in the temporal

Appendix A: Rocky Shore Recreation Use Study

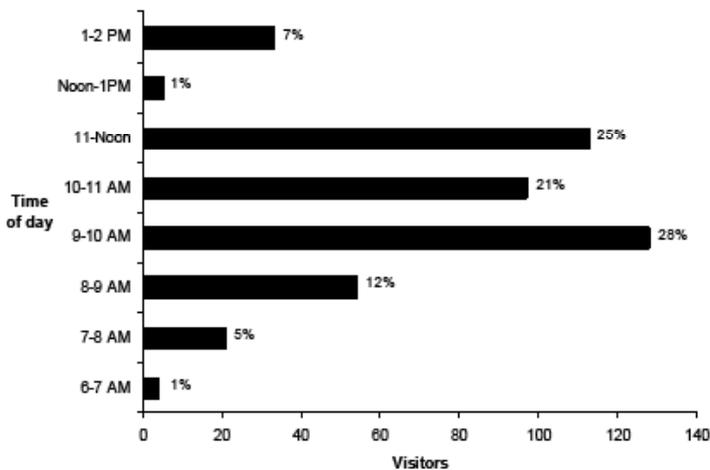


Figure 15. Number of visitors at different times of day at Strawberry Hill. N=455

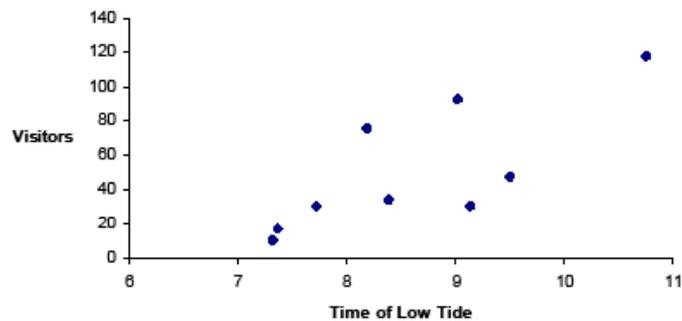


Figure 16. Number of visitors at Strawberry Hill for each day plotted against the time of peak low tide for that day. N=455

distribution of visitors, how they distribute themselves spatially is important as well. Do certain areas get heavier use? How far do visitors travel from the access points? These are questions that can only be answered by looking at how visitors are distributed across the intertidal areas. Distribution across the intertidal areas at the three parks is not even. In general, visitors do not move very far away from access points.

Devil's Punchbowl

At the Devil's Punchbowl intertidal area, the most frequented area is between the two access points: the Inn at Otter Crest stairwell and the state park access. This is area "C", as noted in figure 16 and is frequented by 39% of visitors to the site. Although not done for the entire length of the study, area "C" was subdivided into two sections (C1 and C2). C2 is the

most popular, which is the area that runs just to the north of the state park access point (fig. 16).

The second most popular area is area "D", which runs from just south of the state park access into the punchbowl itself (24% of visitation), with the punchbowl area (D2) being the most frequented between the two sub-sections. The least visited section of shoreline was area "B". This area runs to the north of the Inn at Otter Crest access point to just before the end of the small headland and receives 17% of visitation. This is where the harbor seal haulout is.

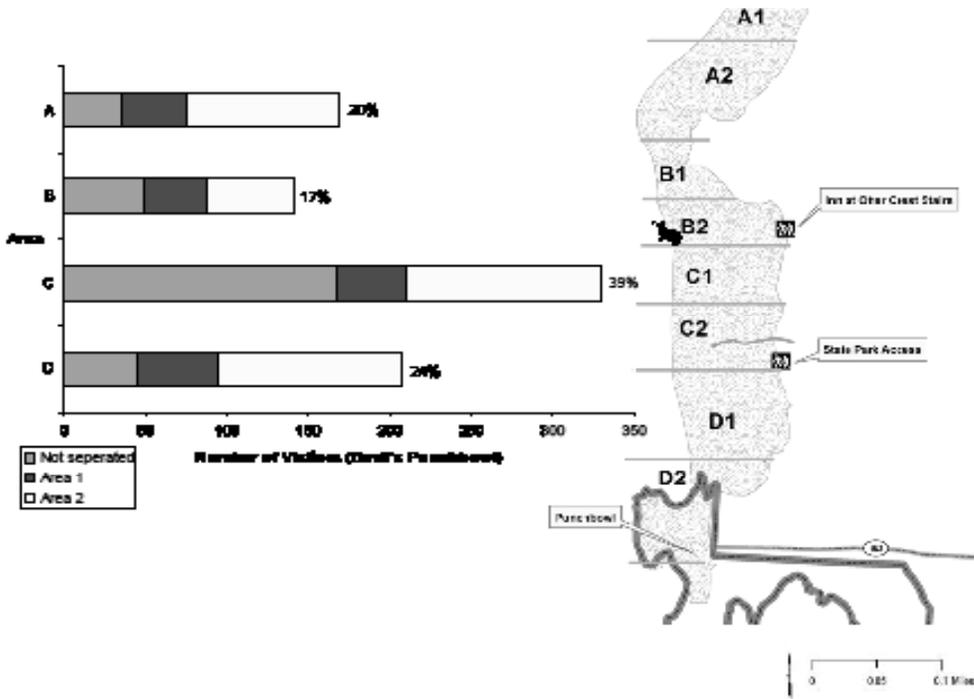
Seal Rock

The most popular section of the intertidal at Seal Rock is the area between the stream and the rocky outcropping just to the south of it (fig. 17). This is area "B" and receives approximately 63% of visitation. Area B was subdivided into two sections for the latter half of the study and between the two (B1 and B2), B2 receives the most visitors (fig. 17). The area that receives the lowest visitation is area "C", to which approximately 11% of visitors venture. Area C is south of the rocky outcropping and requires either access from a highway access point, or climbing over rocks to reach it.

Strawberry Hill

The most popular section of rocky shoreline at Strawberry Hill is an approximately 1/4 mile section just south of the park access point (fig. 18). This is area "C" and receives approximately 44% of visitation (fig. 18). The second most popular area is area "B" with 34% of visitation. This is the area in which the majority of the seals rest (haulout).

The least popular area is area "D", which receives on 3% of visitors, likely due to the distance from the access point. Strawberry Hill is the only of the three sites that has only one access point. This may explain the focus of visitation around areas B and C, which are most easily accessed from the park pathways from the parking area.



Aerial view of Devil's Punchbowl SNA



Aerial view of Seal Rock SRS

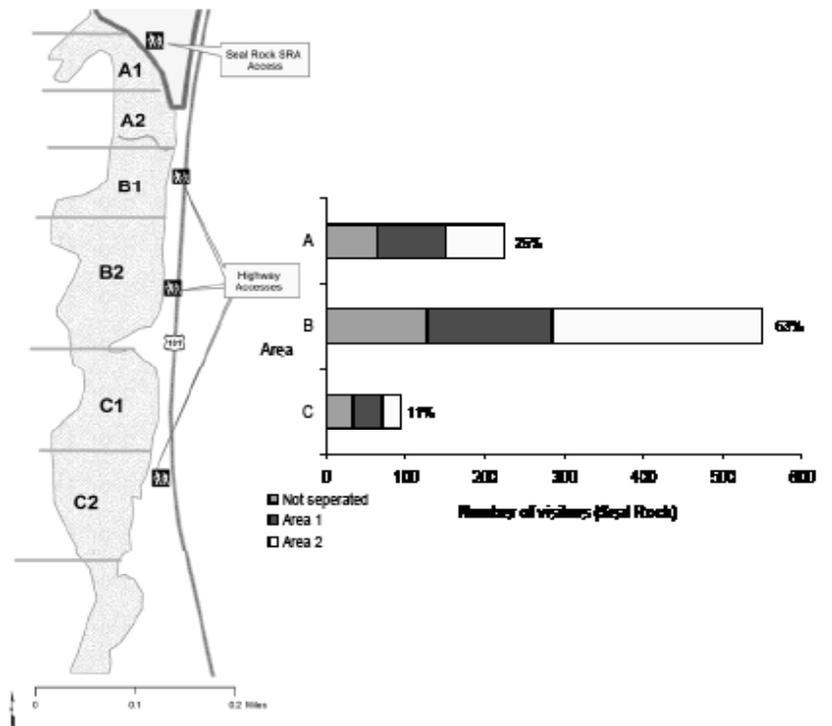


Figure 17. Visitor count levels in survey areas A-D at Seal Rock (n=869)

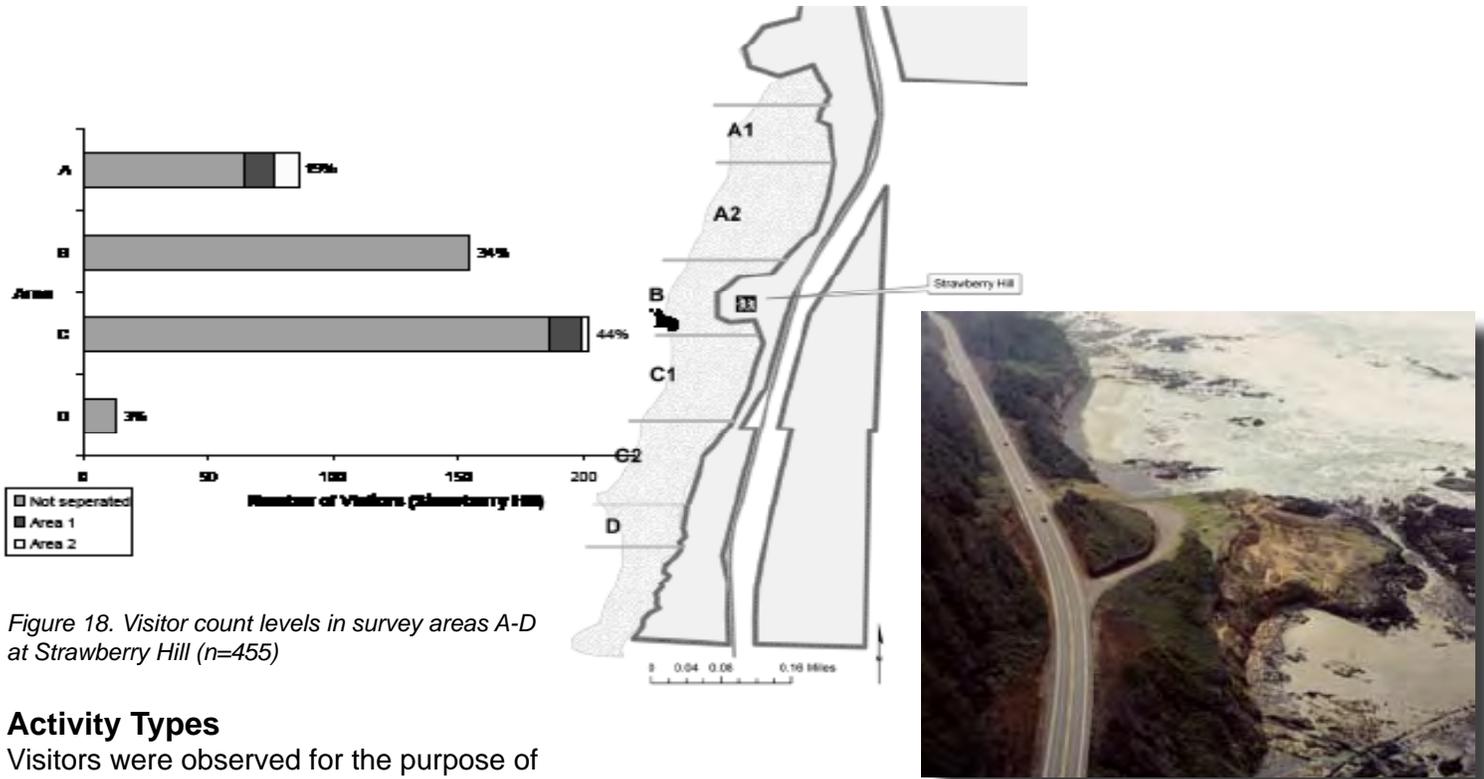


Figure 18. Visitor count levels in survey areas A-D at Strawberry Hill (n=455)

Activity Types

Visitors were observed for the purpose of counting how many people were recreation at the various intertidal areas, but also to see what types of recreational activities they participate in.

Devil's Punchbowl

Passive recreation (e.g., walking, observing, tidepooling without handling organisms or rocks) was the most common activity with 51% of visitors (figure 19). Beach activities such as walking on the beach were the second most common activity (28%), however, many of these people were observed to simply be using the beach to access other sections of the rocky shore. Unlike some of Oregon's rocky shorelines, a sandy beach fronts the majority of the intertidal of the Devil's Punchbowl area. Therefore, it is quicker and easier to move from one area to another by way of the beach. For this reason, beach (non-rocky-shore) recreation was not omitted from the survey so as not to underestimate the potential (and likely) total pressure on the area.

Educational (schoolgroup) visits make up one of the primary activities at Devil's Punchbowl

Aerial view of Strawberry Hill (Neptune SSV)

intertidal (15%), especially during the spring low tide series that coincide with end of year field trips (fig. 19). Groups visiting the site often come with pre-planned activities such as identification scavenger hunts. However, several groups were seen with

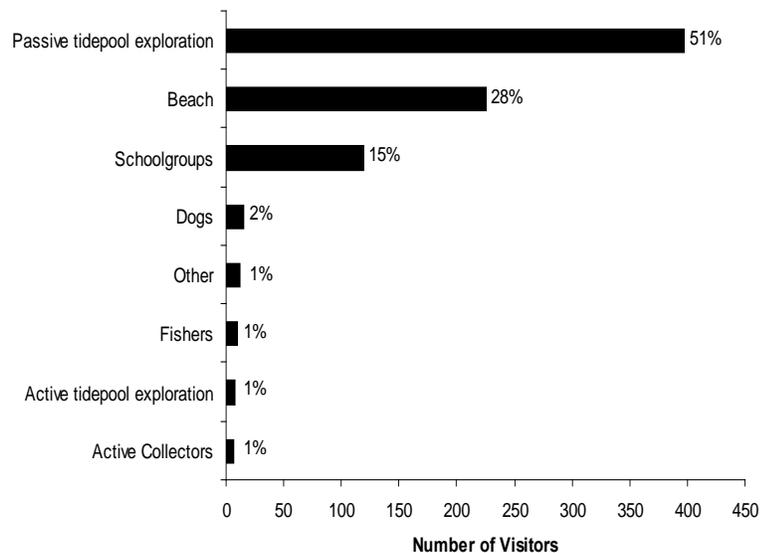


Figure 19. Recreational activities at Devil's Punchbowl (n=861)

apparently no pre-set educational plan, except for free roaming exploration by the children, moderated in part by parent volunteers. During peak low tides during the spring, especially those that occur later in the day (providing time for the school groups to travel to the site) as many as 14 school busses have been seen in the parking areas. With 14 school busses, there could potentially be over 800 people in the intertidal at one time during peak spring low tides. These numbers were not observed during the survey period.

Active rocky shore recreation (picking things up, handling organisms, touching organisms and/or turning over rocks) were far less common (1%), however, it is likely that this figure is underestimated (figure 19). This study was only able to provide a snapshot of activity and cannot possibly catch all subtle (and sometimes quick) actions such as poking a sea star, especially from a distance. Although collecting was not common at this site, it does occur. While some limited amount of collection is of living organisms (which is illegal in the marine garden), in most cases it is not possible to distinguish people collecting living vs. non-living organisms (such as urchin shells). Therefore, the figure of 1% for collecting may include some non-living items.

Seal Rock

Beach recreation was the most common activity with 41% of visitors (figure 20). Like Devil's Punchbowl, a sandy beach fronts the majority of the intertidal of the Seal Rock intertidal area and for some people the beach is a way to access other sections of the rocky shore. Passive tidepool exploration (35%) was the second most common activity (fig. 20). Educational (schoolgroup) visits make up approximately 10% of visitation at Seal Rock.

Although collecting was not common at this site during the survey period, it does occur. Collecting within legal limits is allowed at this site. Four percent of visitors were observed collecting. As with all observations, it is likely that this number is underestimated since snap-shots are unlikely to capture quick activities such as picking an item up. However, they are more likely to capture activities of people who are out there with collecting as their main purpose

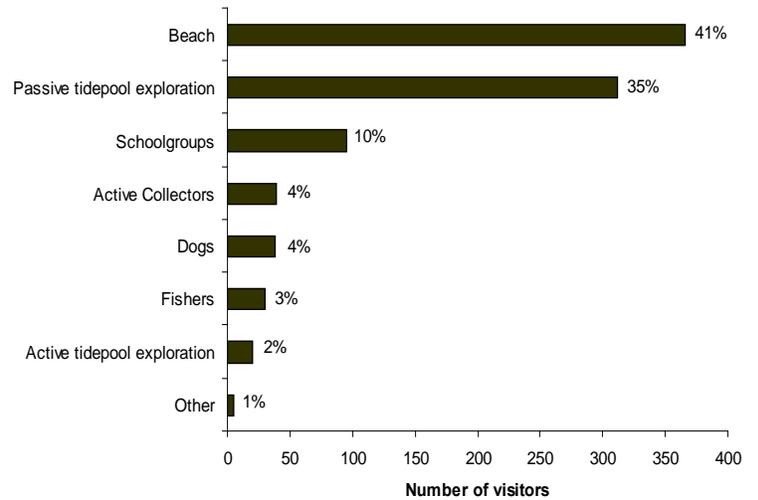


Figure 20. Recreational activities at Seal Rock (n=905)

since that takes more time and is more obvious (people tend to have equipment such as buckets for mussels, seaweed, shellfishing etc.).

Strawberry Hill

Educational (schoolgroup) visits make up the largest portion of visitation (41%) at Strawberry Hill with passive tidepool recreation following close behind at 37 percent (fig. 21). Like the other two sites, there is a sandy beach that fronts much of the rocky shoreline, although it is smaller than at the other locations. Beach recreation is much lower than at the other sites (10%) and it is likely that visitors do not go there for beach recreation.

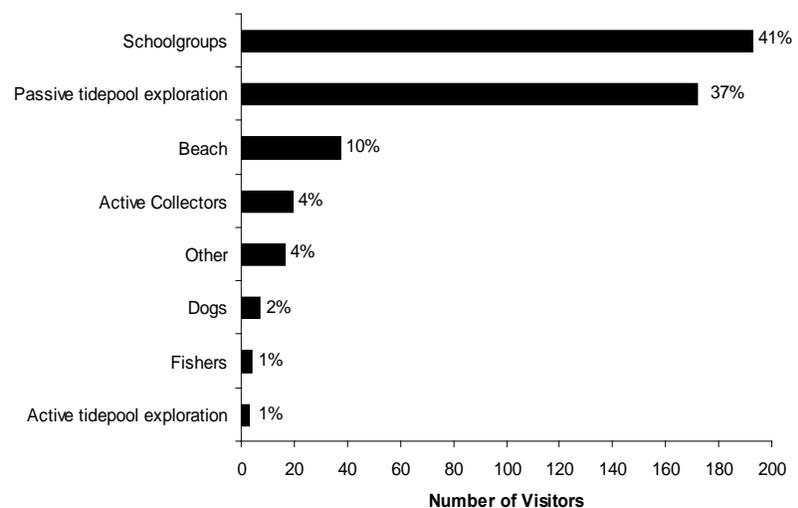


Figure 21. Recreational activities at Strawberry Hill (n=462)

Appendix A: Rocky Shore Recreation Use Study

Collecting of many species is allowed in the research reserve although some require a research permit for collection. Four percent of visitors were observed collecting at the site during the survey period (fig. 21).

Interview Period

A total of 276 visitors were interviewed during their visit at the three intertidal areas (N=91 for Devil's Punchbowl, 126 for Seal Rock and 60 for Strawberry Hill) over the course of the survey. 98% of visitors contacted agreed to participate in the interview. The following sections describe the results from the interview questions, which range from demographics of the interviewees (e.g., group size, visits per year, and distance traveled) and reasons for visiting the site to awareness of rocky shore regulations and support of intertidal protections.

Demographics of Respondents

Devil's Punchbowl

The median group size for visitors is 3 people with a range between 1-100 people (fig. 22). More than a third of visitors (42%) came in groups of two, with only seven percent traveling alone and three percent traveling in groups of 11 or more (fig. 22). Over half of the visitors (63%) were with families, with 14% traveling with friends and only seven percent visiting the intertidal area alone (fig. 23).

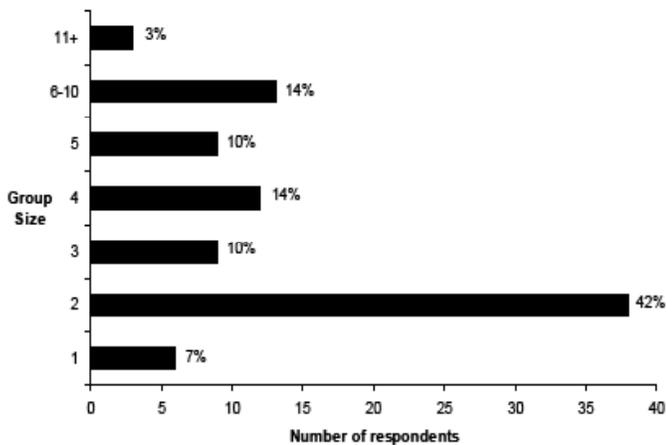


Figure 22. Group size at Devil's Punchbowl (n=91)

Three percent of the visitor groups were traveling with an educational (school) group with an average group size of 94. School groups came from schools including Canyon Creek in Billings Montana, Meadow View (Eugene) and Albany Central.

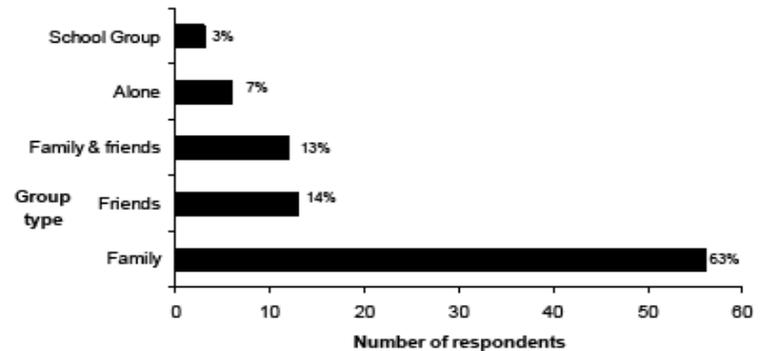


Figure 23. Group types interviewed at Devil's Punchbowl (n=91)

Over half of the visitors (59%) said they were repeat visitors to the Devil's Punchbowl intertidal area. The average visit time for return visitors is two hours with a range between one and six and a half hours (fig. 24). 39% of visitors spent between 1 to 2 hours at the site.

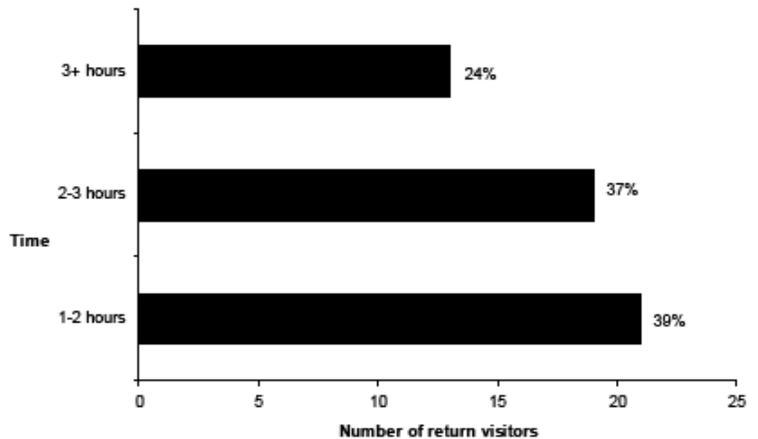


Figure 24. Time spent at Devil's Punchbowl by return visitors (n=54)

60 percent of return visitors indicated visiting the Devil's Punchbowl intertidal area between one to three times per year (fig. 25) with an average of ten visits per year and a range between one and 250 days. If the one 250 outlier is removed, the average number of visitors falls to an average of five visits per year.

Of those visitors that came to Devil's Punchbowl for

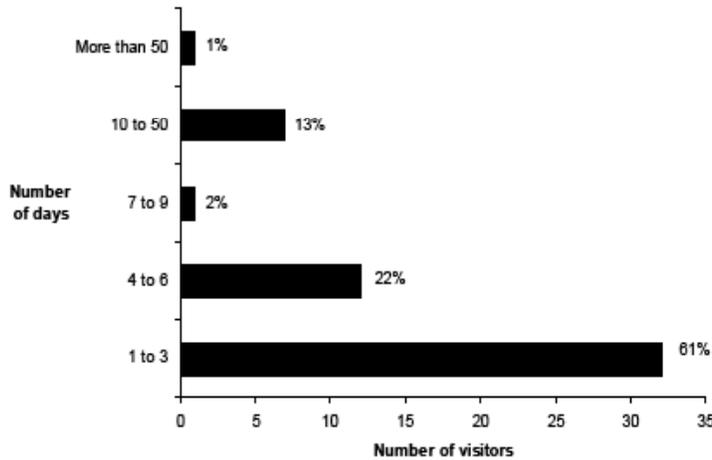


Figure 25. Days spent at Devil's Punchbowl by return visitors (n=54)

the first time, 19% indicated it was also their first visit to the Oregon Coast (fig. 26). All first-time visitors interviewed indicated they would return to Devil's Punchbowl at some time in the future. The average visit to the intertidal is 1 hour 40 minutes for first time visitors with a range of one half hour to 6 hours. Sixty percent of first-time visitors indicated they spend between one and two hours at the site.

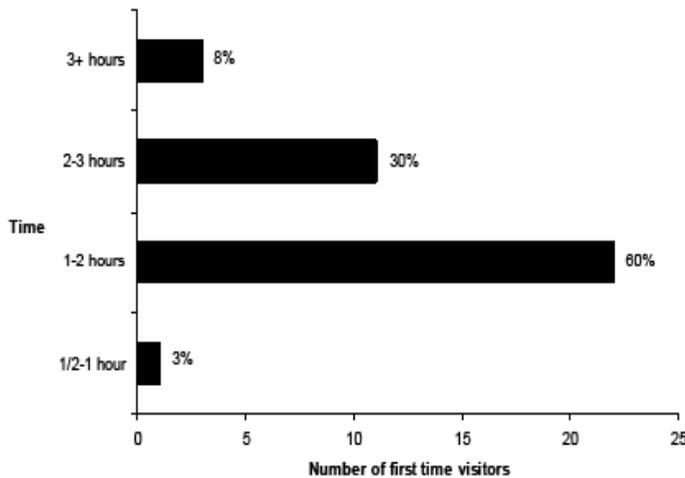


Figure 26. Time spent at Devil's Punchbowl by first-time visitors (n=37)

Seal Rock

The median group size for visitors to the Seal Rock intertidal area is two people with a range between 1-30 people. More than a third of visitors (44%) came in groups of two, with only eight percent traveling alone and six percent traveling in groups of 11 or

more (fig. 27).

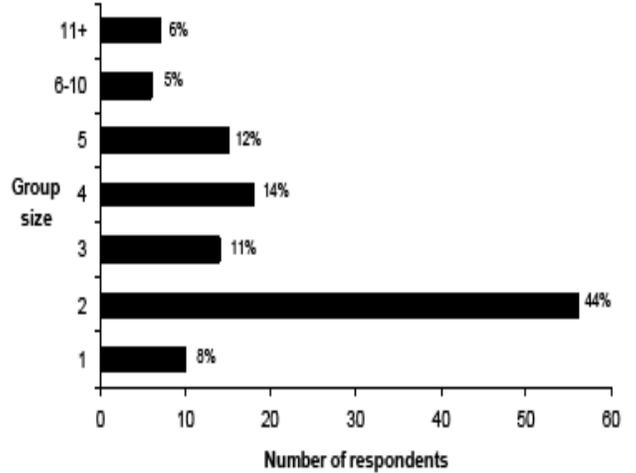


Figure 27. Group size at Seal Rock (n=126)

Approximately two thirds of visitors (66%) were with families, with 16% traveling with friends (fig. 28). School groups came from the University of Nevada at Reno and a Hatfield Marine Science Center Day-Camp.

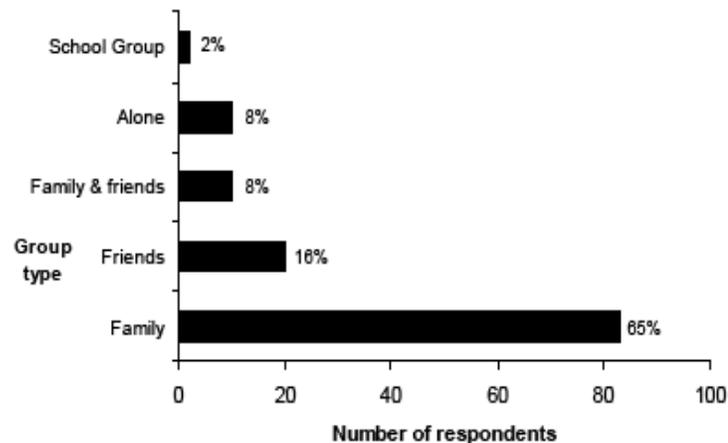


Figure 28. Group type at Seal Rock (n=126)

Over half of the visitors (56%) said they were repeat visitors to Seal Rock intertidal area. The average visit time for return visitors is one hour 48 minutes with a range between 15 minutes and 5.5 hours (fig. 29). Sixty one percent of return visitors indicated visiting the Seal Rock intertidal area between one to three times per year (figure 30) with an average of 13 visits per year and a range between one and 200 days.

Appendix A: Rocky Shore Recreation Use Study

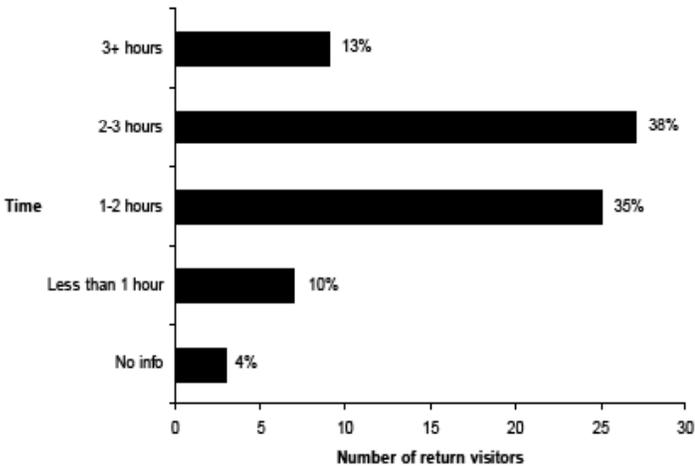


Figure 29. Time spent at Seal Rock by return visitors (n=71)

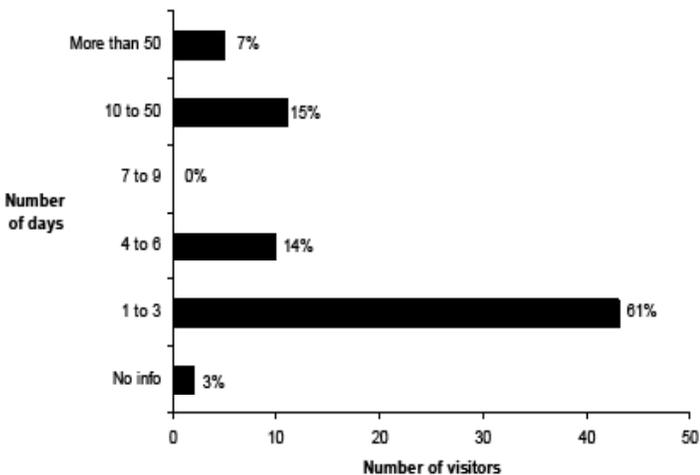


Figure 30. Days per year at Seal Rock by return visitors (n=71)

Of those visitors that came to Seal Rock for the first time, 29% indicated it was also their first visit to the Oregon Coast. An overwhelming majority (91%) of first-time visitors indicated they would return to Seal

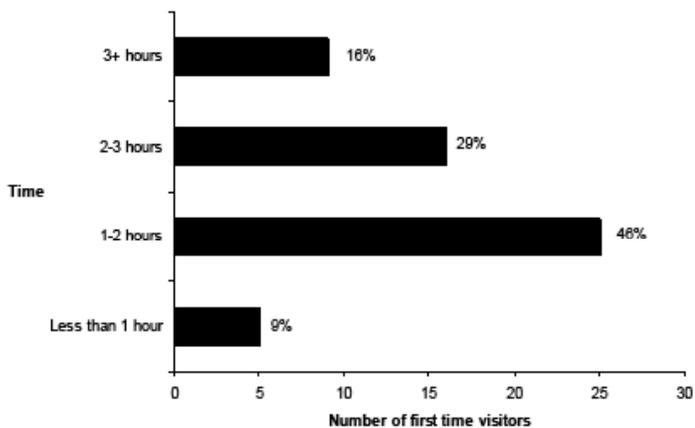


Figure 31. Time spent at Seal Rock by first-time visitors (n=55)

Rock intertidal at some time in the future. The average visit to the intertidal is one hour 50 minutes with a range of one half hour to 6 hours. 46% of visitors spend one to two hours at the site (fig. 31).

Strawberry Hill

The median group size for visitors to Strawberry Hill is two people with a range between one to 33. Half of all visitors came in groups of two, with only seven percent traveling alone and ten percent traveling in groups of 11 or more (fig. 32).

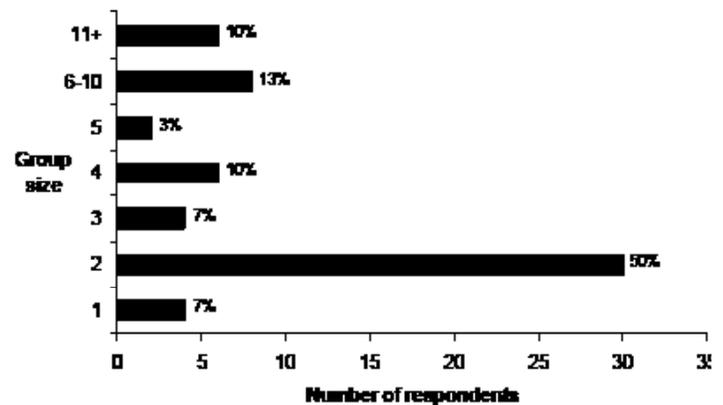


Figure 32. Group size at Strawberry Hill (n=60)

Over half of the visitors (66%) were with families, with ten percent traveling with friends (fig. 33). Twelve percent of the visitor groups were traveling with an educational (school) group with an average group size of 22. School groups came from Oregon including Eugene, Vida, Corvallis (Oregon State), Marcolla, and Cottage Grove as well as Iowa (Wartburg College).

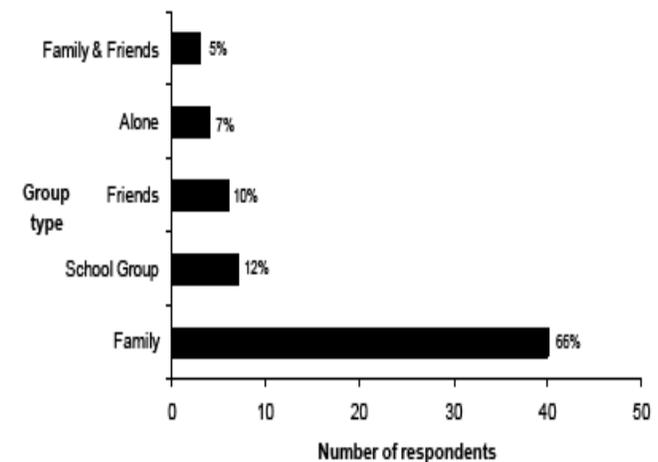


Figure 33. Group type of Strawberry Hill visitors (n=60)

Half of the visitors interviewed said they were repeat visitors to the Strawberry Hill intertidal area. The average visit time for return visitors is two hours with a range between 1/2 hour and five hours (fig. 34). 74% of visitors indicated they spend between one to three hours at the site (fig. 34).

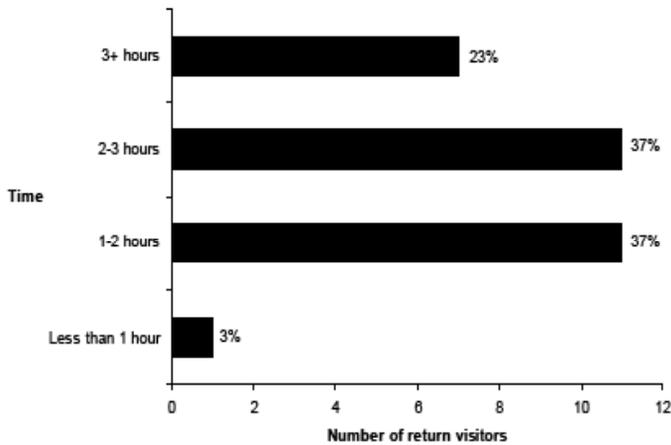


Figure 34. Time spent at Strawberry Hill by return visitors (n=30)

70% of return visitors indicated visiting the Strawberry Hill intertidal area between one to three times per year (fig. 35) with an average of six visits per year and a range between one and 45 days.

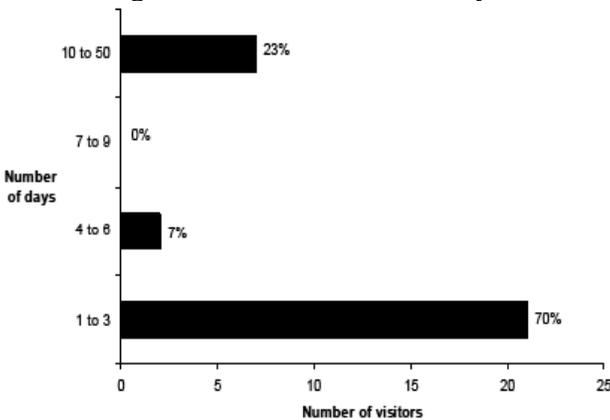


Figure 35. Days per year at Strawberry Hill (n=30)

Of the other half of the visitors that came to Strawberry Hill for the first time, thirty percent indicated it was also their first visit to the Oregon Coast. The average visit to the intertidal is one hour 36 minutes for first time visitors with a range of one-half to three hours (figure 36). The large majority (83%) of first-time visitors indicated they would return to Strawberry Hill intertidal at some time in the future.

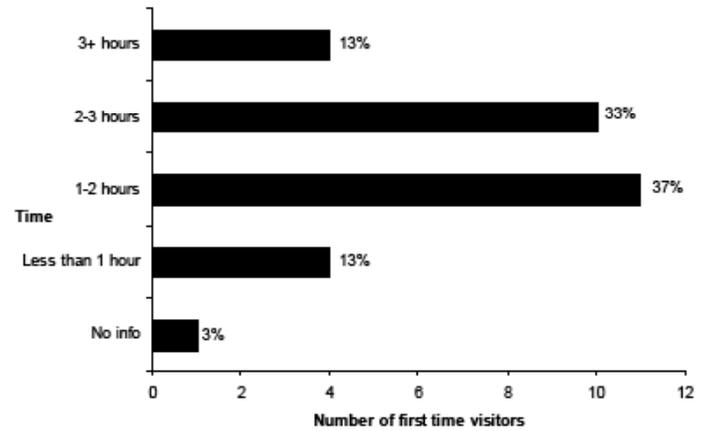


Figure 36. Time spent at Strawberry Hill by first-time visitors (n=30)

Access Points

Devil's Punchbowl

With two access points available, those interviewed either came down via the Inn at Otter Crest or the state park access stairs. Of those people interviewed there was almost a 50-50 split between which access points they used (48% for the hotel vs. 52% for the park stairs). However, the number of people in the groups coming down at the park stairs was 20% higher than those arriving from the Inn at Otter Crest stairs, due in large part to schoolgroups.

Although most schoolgroups come down at the state park, some do access the beach from the hotel. As a result, the majority of the actual individual visitors (56%) accessed the beach from the state park (257 individuals, 47 groups) with the other 44% (205 individuals, 43 groups) coming down at the Inn.

Seal Rock

With several access points available, those interviewed either came down from one of a few highway access points or the state park access trail. Of those people interviewed the majority (71%) accessed the shoreline from the state park. Additionally, the number of people in the groups coming down at the park was higher than those arriving from the highway, again, like Devil's Punchbowl, due in large part to schoolgroups. All schoolgroups appear to have come down at the state park based on the interviews of those groups.

Strawberry Hill

The park access is the only access point for

Appendix A: Rocky Shore Recreation Use Study

this portion of rocky shoreline. 100% of visitors interviewed indicated they accessed the shoreline from the state park.

Origin of Visitors

Devil's Punchbowl

The majority (68%) of visitors interviewed were Oregonians, the second largest group coming from Washington State (10%) and 1% from Canada (Table 4). The median one-way distance traveled was 110 miles with a range of less than one mile (Otter Rock, OR) to 3,076 miles (Great Barring, MA).

Table 4. Proportion of visitors from each location (n=91)

State/Country	Number of groups	Percent of visitors
Oregon	62	69
Washington	8	9
Idaho	4	4.5
Utah	4	4.5
Arizona	3	3
Canada	1	1
California	1	1
Colorado	1	1
Georgia	1	1
Kentucky	1	1
Massachusetts	1	1
Minnesota	1	1
Montana	1	1
Nevada	1	1
Texas	1	1

Forty eight percent of in-state visitors came from the Portland Metro area, 34% from the Willamette Valley, and 10% from the Oregon coast (fig. 37).

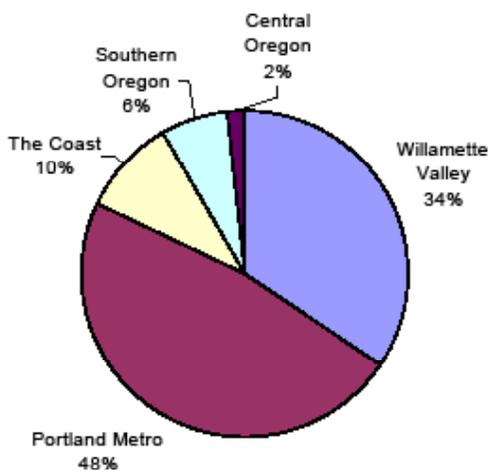


Figure 37. Origin of Devil's Punchbowl in-state visitors (n=62)

Seal Rock

Just over 50% of visitors interviewed were Oregonians with 10 percent from Washington and 2% from out of the country (Table 5). The median one-way distance traveled to reach Seal Rock was 158 miles with a range of one mile (Seal Rock, OR) to 3,330 miles (Fort Meyers, FL).

Table 5. Proportion of visitors from each location (n=126)

State/Country	Number of groups	Percent of visitors
Oregon	65	53
Washington	12	10
Idaho	9	7
California	8	7
Utah	4	3
Canada	3	2
Colorado	3	2
Alaska	2	2
Arizona	2	2
Illinois	2	2
Louisiana	2	2
New York	2	2
Arkansas	1	1
Florida	1	1
Maryland	1	1
Minnesota	1	1
Montana	1	1
New Hampshire	1	1
Nevada	1	1
South Dakota	1	1
Texas	1	1
Unaffiliated Zip	3	2

Forty nine percent of in-state visitors came from the Willamette Valley, 29% from the coast and 15% from the Portland Metro area (fig. 38). Five percent came from Central Oregon and two percent each from Eastern and Southern Oregon.

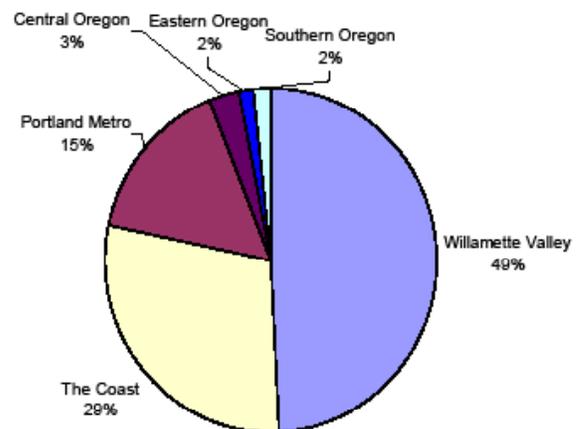


Table 38. Origin of Seal Rock in-state visitors (n=65)

Strawberry Hill

Approximately 50% of visitors interviewed were from Oregon with almost ten percent from Washington and California (Table 6). The median one-way distance travelled was 191 miles with a range of 24 miles (Florence, OR) to 3,262 miles (Nokomis, FL).

Table 6. Proportion of visitors from each location (n=58)

State/Country	Number of groups	Percent of visitors
Oregon	32	55
Washington	5	9
California	5	9
Montana	3	5
Idaho	2	3
Alaska	1	2
Arizona	1	2
Colorado	1	2
Florida	1	2
Iowa	1	2
Illinois	1	2
Kentucky	1	2
Nevada	1	2
Texas	1	2
Utah	1	2
Virginia	1	2
Invalid Zip	1	2

Fifty seven percent of in-state visitors came to Strawberry Hill from the Willamette Valley, 25% from the coast and nine percent from the Portland area (fig. 39). Six percent each came from Southern and Central Oregon.

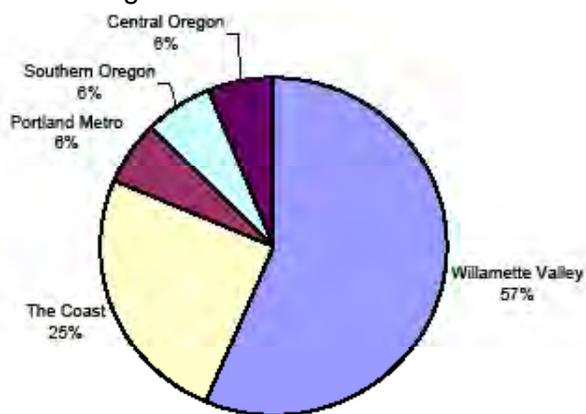


Table 39. Origin of Strawberry Hill in-state visitors (n=32)

Sources of Information

Original "discovery" of the site

Devil's Punchbowl

Since it is not highly visible, it is of interest how visitors locate the site in the first place. The primary way visitors originally found out about the site (fig. 40) is from either a family member or friend (27%). The second most common way visitors find out about the site is via some affiliation with the Inn at Otter Crest (19%). Less common sources of information include family tradition (11%), exploring (8%), guidebooks (8%), and the internet (6%).

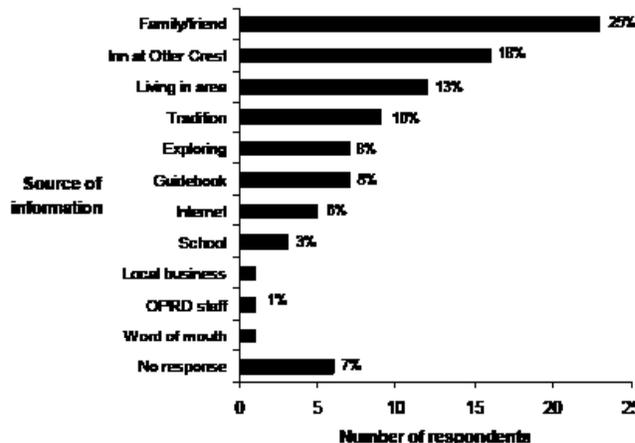


Figure 40. Method by which visitors found out about Devil's Punchbowl (n=91)

Seal Rock

Seal Rock is located directly on Highway 101 which makes it more visible than Devil's Punchbowl. Although the primary way visitors originally found out about the site (fig. 41) is also from either a family member or friend (29%), exploring (or driving by) is cited a lot more frequently (22%) than for

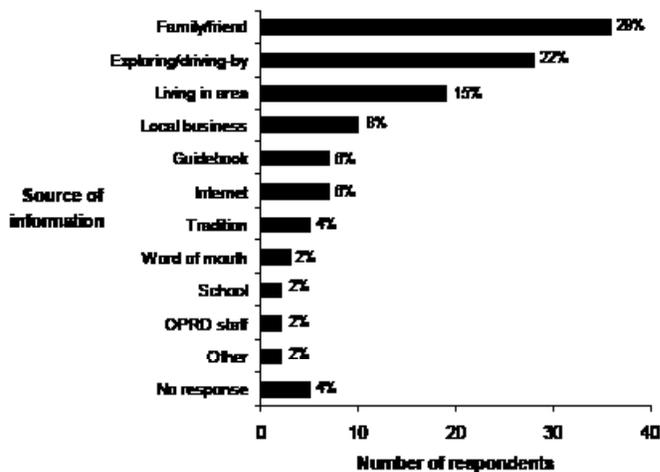


Figure 41. Method by which visitors found out about Seal Rock (n=126)

Appendix A: Rocky Shore Recreation Use Study

Devil's Punchbowl (8%). Living in the area is also a popular way of discovering the site (15%), with local businesses (such as RV Cove, mentioned four times) ranking fourth in popular sources of information.

Strawberry Hill

Also located directly on Highway 101, Strawberry Hill is largely "discovered" by people driving by (fig. 42). Tied with driving by (or exploring) for the most common way of finding out about Strawberry Hill (27%) is from family and friends, followed by local businesses (12%) and through school (8%).

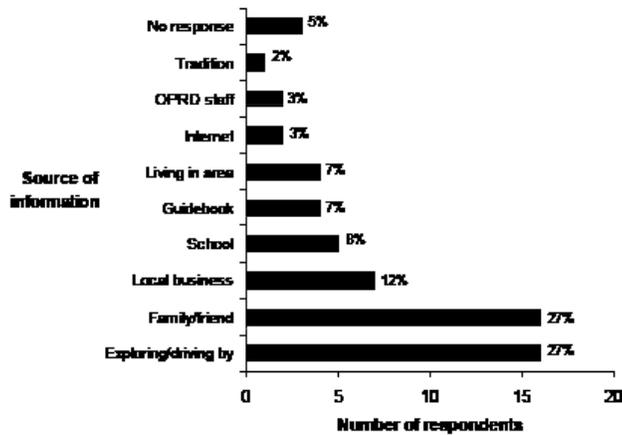


Figure 42. Method by which visitors found out about Strawberry Hill (n=60)

Time of Visit/Tidal Cycle

Many types of coastal recreation activities are not dependent on the tides; however, most rocky shore/intertidal recreation is highly dependent on how low the tide is and the time it occurs.

Devil's Punchbowl

The vast majority of the visitors (78%) based the time of their visit on the low tide. The most common sources of information for determining when low tide occurs were through tide charts (50%), the Internet (13%), and through the Inn at Otter Crest (11%). Other methods include observation (9%), through the newspaper (6%) and a variety of others such as word of mouth, and through a friend, local business person or even OPRD staff (1%).

Seal Rock

The majority of Seal Rock visitors (70%) also based their visit on the predicted low tide. Again, tide charts/tables are the most popular method (60%) used to determine the timing of a visit followed by the internet (16%) and direct observation, such as driving by (9%). Other methods include local businesses (6%), family and friends (4%), OPRD staff (2%) and school (1%).

Strawberry Hill

The large majority (82%) of visitors based the time of their visit to Strawberry Hill on the low tide although the methods are less varied than for the other sites. Forty percent of visitors used a tide chart/table, eight percent used the internet and one percent each used a school acquaintance, local business or family/friend to determine the time of low tide.

Interest in Learning More About Rocky Shores

Visitor groups were asked if they were interested in learning more about tidepools on a future visit. Those that responded in the affirmative were then asked about their preferred method of learning (i.e., what type of interpretive method).

Devil's Punchbowl

Seventy one percent of respondents indicated they were interested in learning more about tidepools on a future visit. As shown in fig. 43, the majority (57%) listed their top preference to be roving rangers. The

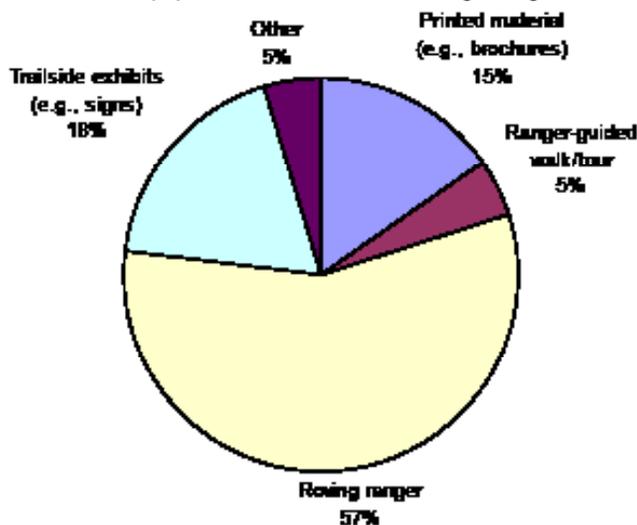


Figure 43. How visitors prefer to learn about tidepools at Devil's Punchbowl (n=65).

learning method visitors were least interested in is ranger-guided tours (5%). Other methods mentioned include information on a website (such as tidepool animal identification), a permanent sign in the



Interpretive sign on the side of the pathway to Devil's Punchbowl SNA

tidepools and a species checklist for tidepools.

Seal Rock

The majority of visitors to Seal Rock were also interested in learning more about rocky shores (fig. 44). Sixty seven percent of visitors said they would like to learn more on a future visit, with roving rangers again being the most popular option (56%) followed by printed materials (31%).

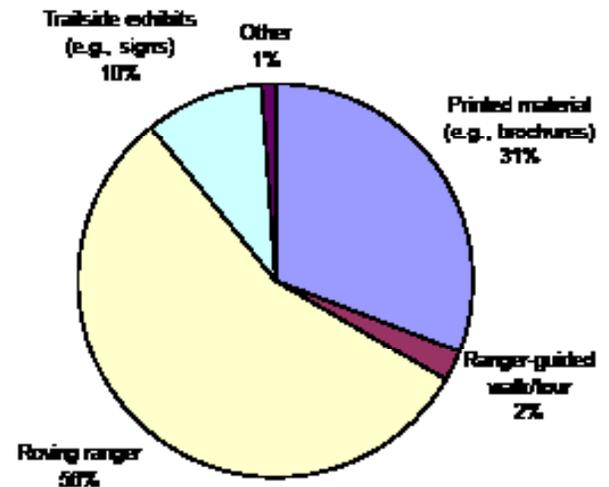


Figure 44. How visitors prefer to learn about tidepools at Seal Rock (n=84).

Again, ranger-guided walks were the least popular learning method at two percent. The internet was the only "other" type of method mentioned as the top



"Interpreter on Duty" sign at Seal Rock SRS

Appendix A: Rocky Shore Recreation Use Study

preference for learning about rocky shores at Seal Rock.

Strawberry Hill

Although slightly lower than the other two sites, the majority (53%) of visitors indicated they would like to learn more about rocky shores on a future visit. Responses by Strawberry Hill visitors are very similar to the other two sites when it comes to the top choice for interpretation. Fifty nine percent of visitors indicated that roving rangers are their top choice (fig. 45).

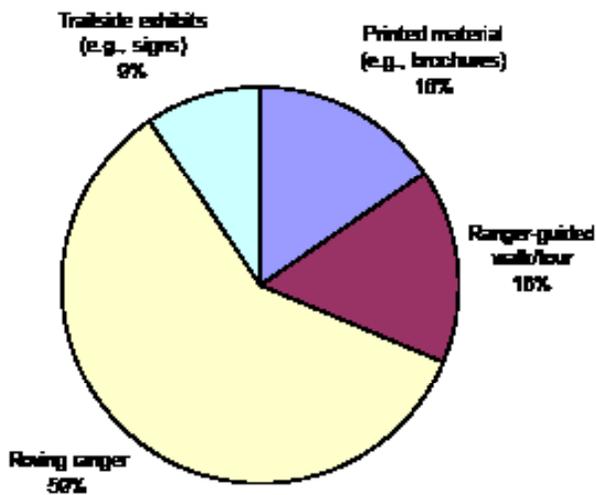


Figure 45. How visitors prefer to learn about tidepools at Strawberry Hill (n=32).

Ranger-guided walks, which were the least popular option at the other two sites, ranked second (tied with printed materials) for second place with 16% of the respondents choosing it as their favored interpretive method (fig. 45). The least popular interpretive method is trail-side exhibits.

Reason for Visit

Devil's Punchbowl

The primary reason for visiting Devil's Punchbowl is tidepooling (42%) with sightseeing (27%) and relaxation (12%) also popular reasons given by visitors interviewed (fig. 46). Nine percent of the visitors identified other activities that drew them to the site. "Other" reasons given included photography,



Roving interpretation at Strawberry Hill

research, observing seals, and looking at geology for a future home site.

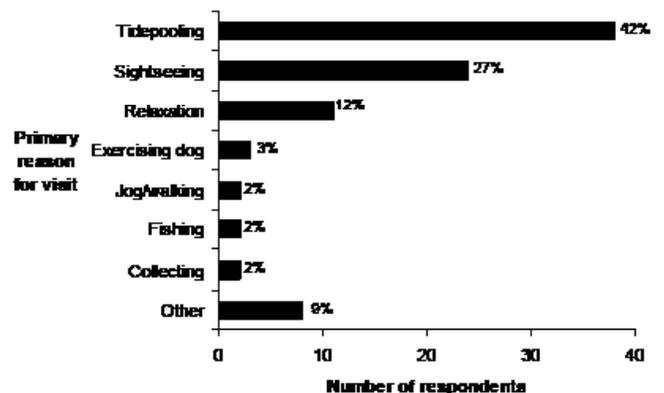


Figure 46. Primary reason for visit to Devil's Punchbowl (n=91)

Seal Rock

At Seal Rock, the primary reason visitors indicated they came to the site is tidepooling (37%) followed by sightseeing (27%) and relaxation (fig. 47). The number of “collectors” (9%) is higher than at Devil’s Punchbowl which is not surprising since the site is known as a popular clamming beach. Half of those asked what they were collecting provided a response, with mussels being the most popular, followed by clams and shells.

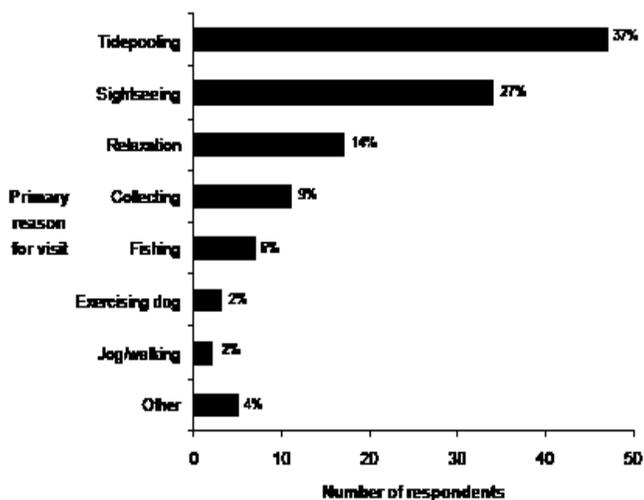


Figure 47. Primary reason for visit to Seal Rock (n=126)

Strawberry Hill

Visitors to Strawberry Hill did not deviate from those at the other two locations in their primary motivation for visiting the intertidal site (fig. 48). Again, tidepooling (50%) and sightseeing (18%) are the most popular

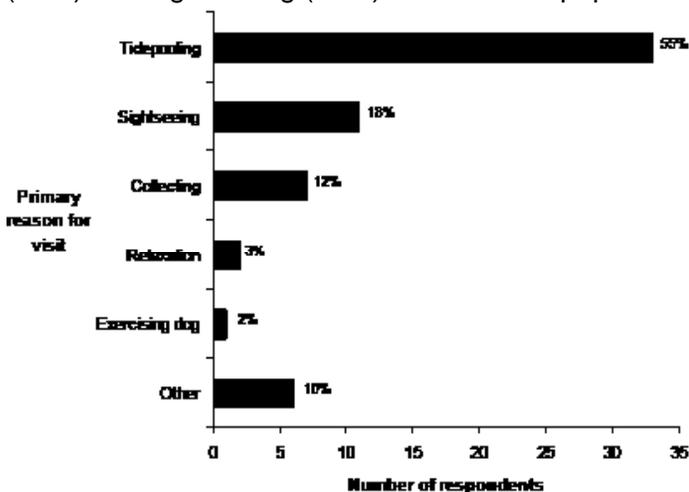


Figure 48. Primary reason for visit to Strawberry Hill (n=60)

reasons for visiting (fig. 48). Although not for the same reason as Seal Rock, collecting was quite popular (12%) at Strawberry Hill, with the majority of visitors (of the half that indicated what they were collecting) indicating agates as their goal. Other reasons for visiting include photography, taping a researcher from Oregon State University for a Oregon Public Radio show, school course, and whale-watching.

What Visitors Liked Best and Least

Devil’s Punchbowl

When asked the open ended question, “what do you like least” visitors did not have a wide array of responses as a vast majority (86%) could not come up with something they did not like about the site. Seven percent of visitors indicated they could do without the crowds, with a smattering of other responses, none getting more than a few mentions each (all are listed in the appendix).

When asked the opposite question, “what do you like best” about the site, visitors to Devil’s Punchbowl indicated that tidepools (20%) are the thing they like “best”, followed by the beauty and scenery (13%), geology (10%) and the diversity of marine life (fig. 49). Easy access and diversity of things to do at the site were also mentioned several times (6% each). A full list of favorite things is located in the appendix.

Seal Rock

When asked about their least favorite aspect of their visit to Seal Rock, like the visitor’s to Devil’s Punchbowl, people found a hard time naming something. An overwhelming majority (81%) said “nothing” was wrong with their visit, with 6% mentioning problems with access followed by 4% having problems associated with crowding. A variety of other issues ranged from the location of the rest rooms to highway noise and litter, none garnering more than 2% of the total responses. All are listed in the appendix.

At Seal Rock, visitors had somewhat similar responses to the question about their favorite aspects of the site to Devil’s Punchbowl visitors (fig. 50). Tidepools remains at the top of the list at fourteen

Appendix A: Rocky Shore Recreation Use Study

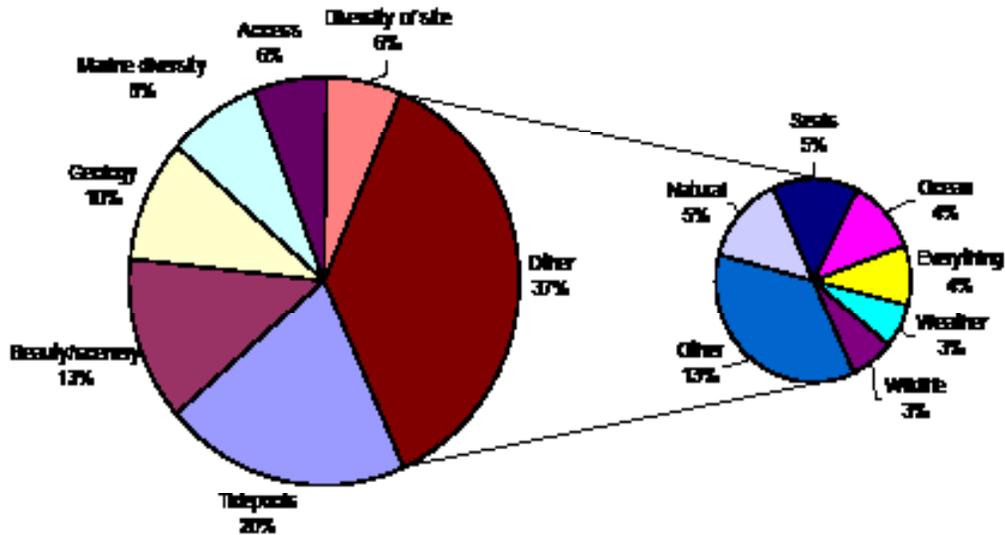


Figure 49. Favorite features at Devil's Punchbowl. Percentages may not add up to 100 due to rounding. Visitors sometimes had more than one response to this question (n=114 comments).

percent, however, they are closely followed by geology (13%), the diversity of the site along with beauty/scenery (each 12%). Marine diversity (8%) and access (7%) were also mentioned a number of times. A full list of favorite things mentioned by visitors to Seal Rock is located in the appendix.

Strawberry Hill patrons found it hard to come up with things they did not like about the site. However, at both of the other sites, the percentage of those that responded with "nothing" was over 80%, while at Strawberry Hill, more visitors (34%) were able to come up with a "least favorite" feature (fig. 51).

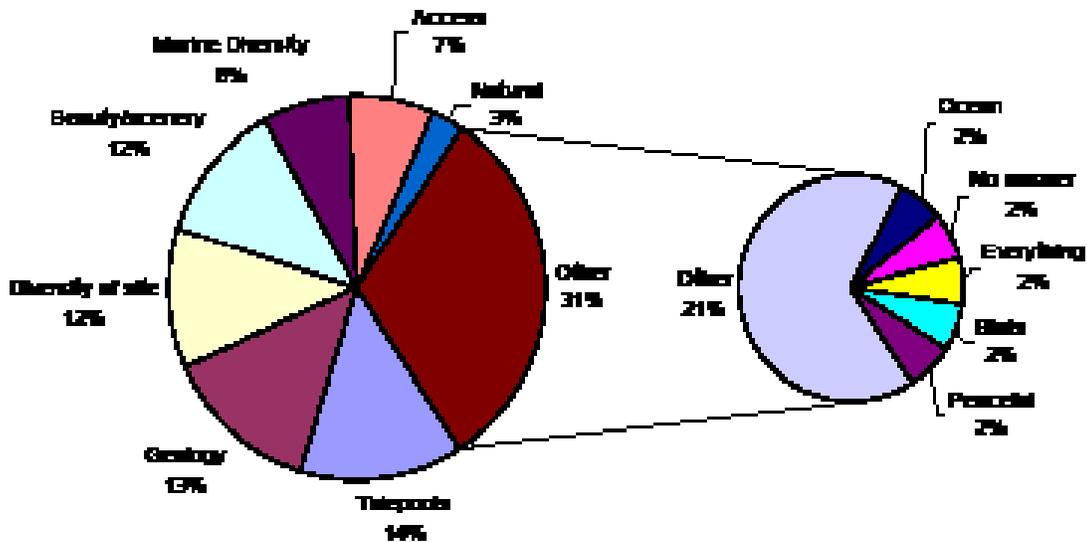


Figure 50. Favorite features at Seal Rock. Percentages may not add up to 100 due to rounding. Visitors sometimes had more than one response to this question (n=143 comments).

Strawberry Hill

As is the case with visitors to the other two sites,

Behind "nothing" which was still the answer given by the majority (66%) of visitors, access ranked second at 13%, followed by the lack of an on-site bathroom

(5%) and a variety of other answers, ranging from parking to not being able to avoid disturbing wildlife and a cougar encounter (all shown in the appendix). The only site of the three where tidepools are not the favorite feature, Strawberry Hill visitors are still drawn to essentially the same, thing “marine diversity” (fig. 52). Missing the top spot by one percentage point, tidepools (15%) rank second after marine diversity (16%) followed quite closely by seals (13%). Other reasons given (besides those shown in figure 52) range from lack of crowds, quiet, whales, shells, to accessibility and the fact that it is “not really

accessible.” A full list of favorite features is available in the Appendix.

Other Rocky Shores Visited

To get a sense of other popular rocky shore sites, visitor groups were asked, “do you visit other tidepool areas along the Oregon coast?”

Devil’s Punchbowl

Slightly under half of visitors (48%) indicated that they do visit other Oregon rocky shores with the central coast being the most popular region (Table 7). Slightly

Table 7. Other Oregon rocky shores visited by interviewees at Devil’s Punchbowl (n=78 comments). Respondents sometimes mentioned more than one location.

Rocky Shore	Times mentioned
Yaquina Head	15
Seal Rock	10
Haystack Rock	9
Strawberry Hill (Neptune SSV)	8
Cape Perpetua	5
Boiler Bay	5
Rocks Bene SRS	4
Rock State Park	5
Cape Kiwanda	3
Heceta Head	2
Fogarty Creek	2
Rocky Creek	1
Port Orford	1
Orford Reef	1
Harris Beach State Park	1
Cape Blanco	1
Cape Arago	1
D Beach	1
Cape Menzies	1
Devil’s Punchbowl	1
Not sure	2

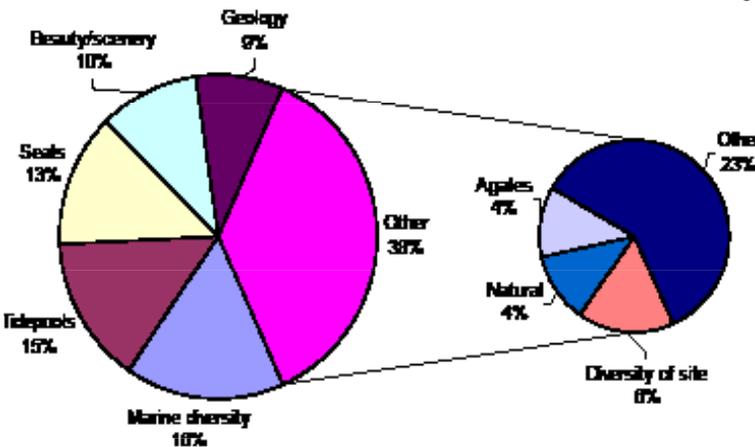


Figure 52. Favorite features at Strawberry Hill (n=68 comments). Visitors sometimes had more than one response to this question.



Seal haulout at Strawberry Hill (Neptune SSV)

under half of the sites visited by those people are on the central coast with Yaquina Head being the most frequently mentioned site, followed by Seal Rock and Strawberry Hill (Table 7).

Seal Rock

Just over half of visitors (51%) said that they visit other Oregon rocky shores with the vast majority of

Appendix A: Rocky Shore Recreation Use Study

those responses (74%) being sites on the central coast. Again, Yaquina Head is the most popularly cited location followed by Cape Perpetua and Yachats (Table 8).

Table 8. Other Oregon rocky shores visited by interviewees at Seal Rock (n=120 comments). Respondents sometimes mentioned more than one location.

Rocky Shore	Times mentioned
Yaquina Head	26
Cape Perpetua	14
Yachats	13
Devil's Punchbowl	9
Strawberry Hill	7
Haystack Rock	7
Cape Arago	7
Boiler Bay	7
Heceta Head	4
Neptune SSV	3
Cascade Head	3
Rocky Creek	2
Gerald West State Park	2
Sunset Bay	1
Tolmie Kluckman	1
South Beach Jetty	1
Smelt Sands	1
Rocky Head	1
Otter Rock	1
Crab Beach	1
Humbag Mountain	1
Harris Beach State Park	1
Goat Island	1
Fogarty Creek	1
Recla State Park	1
Cape Lookout	1
No specific answer	3

Strawberry Hill

The majority of visitors (62%) indicated that they visit other rocky shore sites (Table 9). Although popular at the other sites, Cape Perpetua did not predominate as the most popular like it does at Strawberry Hill. Just slightly hedging out Yaquina Head as the most frequently mentioned "other" rocky shore site, nearby Cape Perpetua was mentioned the most frequently. The Cape Arago headland parks follow up in a close third, which may result from Strawberry Hill being the

furthest south of the three sites. While this may be the case, central coast sites still predominate with 80% of the sites mentioned, followed by the south coast (14%) and the north coast (6%).

Table 9. Other Oregon rocky shores visited by interviewees at Strawberry Hill (n=86 comments). Respondents sometimes mentioned more than one location.

Rocky Shore	Times mentioned
Cape Perpetua	14
Yaquina Head	12
Cape Arago/Sunset Bay	10
Seal Rock	7
Heceta Head	7
Devil's Punchbowl	7
Neptune SSV	5
Yachats	4
Boiler Bay	4
Haystack Rock	3
Bob Creek	3
Rocky Creek	2
Fogarty Creek	2
Strawberry Hill	1
Stonefield Beach	1
Smelt Sands	1
Sea Lion Point	1
Gerald West SP	1
Cape Meares	1
Depoe Bay	1

Awareness of Rocky Shore Protections

The intertidal areas at Devil's Punchbowl and Strawberry Hill are part of specially managed areas (Marine Garden and Research Reserve respectively) where collection of intertidal animals is limited. To ascertain whether visitors are familiar with these protected areas or of other protected areas along the coast, interviewees were asked several questions about rocky shore restrictions and the status of intertidal protected areas along the coast.

Plant and Animal Restrictions

Devil's Punchbowl

The first question of this type asked whether they were aware of any restrictions (besides the general fish and wildlife regulations) on plants or animals in this particular section of the rocky shore. 37 percent

of visitors indicated they were aware of restrictions on plants while 71 percent said they were aware of restrictions on animals. Of the comments from

followed closely by a more specific group of answers indicating limits on collection were for living organisms (23%) only (fig. 52). Most of the other comments

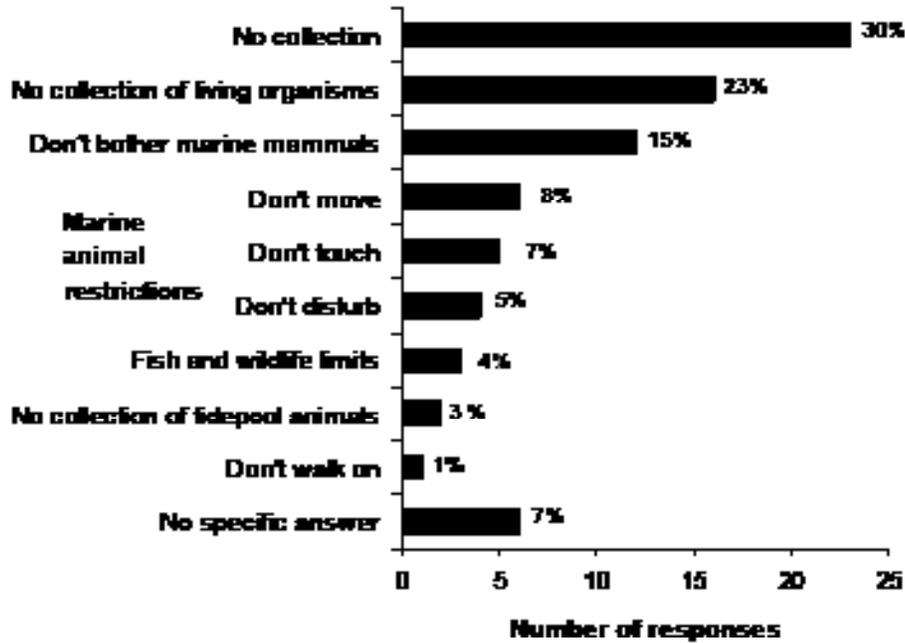


Figure 52. Restrictions visitors believe are in place for marine animals at Devil's Punchbowl intertidal (n=78 comments). Percentages may not equal 100 due to rounding. Some respondents had more than one comment.

visitors that believed restrictions were in place for animals, no collection was cited the most often (30%)

tend towards behavioral restrictions such as not bothering the marine mammals (15%), not moving (8%) or touching (7%) them. No people mentioned the marine garden specifically when asked this question. However, it is possible that some respondents were aware of the protections, but did not associate them with "restrictions". For a full list of comments, see the Appendix.



Marine Garden sign at Devil's Punchbowl

Of the 37% of visitors that indicated they believed there are restrictions on marine plants, the variety of answers is limited to only a few types of answers. The most popular response is that collection is not allowed (65%) with an additional three percent limiting that restriction to living plants. These are followed by behavioral responses such as not touching (12%) or walking on (3%) the plants. Eighteen percent of the visitors that believe there are restrictions on marine plants did not come up with any specific answer to the question about what restrictions are in place.

Appendix A: Rocky Shore Recreation Use Study

Seal Rock

At Seal Rock, while there are no additional protections on top of the general fish and wildlife

a popular answer (12%) followed by other behavioral restrictions such as not touching (8%) moving or picking things up (6%), and not disturbing seabirds

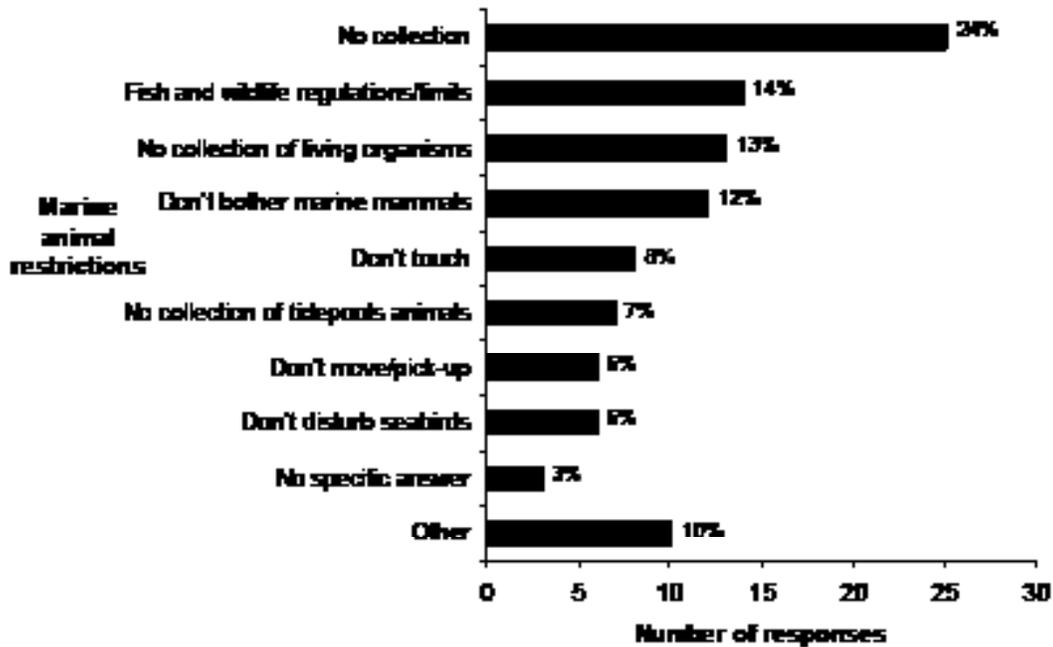


Figure 53. Restrictions visitors believe are in place for marine animals at Seal Rock intertidal (n=104 comments). Percentages may not equal 100 due to rounding. Some respondents had more than one comment.

sport fishing (shellfish) regulations, responses are quite similar to those given at Devil's Punchbowl. 67% of visitors indicated they were aware of special restrictions on animals and 29% indicated the same thing for plants at Seal Rock intertidal (fig. 53).

Of the comments of those visitors that believe there are restrictions on marine animals at Seal Rock, 24% believe that no collection is allowed. Unlike Devil's Punchbowl visitors, a relatively high percent (14%) of visitors mentioned they were aware of general fish and wildlife regulations/limits. This is followed by a similar category of responses that indicate that restrictions on collection is limited to living organisms (13%) and to tidepool animals specifically (7%) for a total of 44% of the comments indicating that visitors believe that collection of living tidepool animals is not permitted at the site.

Again, not harassing/bothering marine mammals was



Bird nesting area sign at Seal Rock

(6%) with several specific mentions of nesting birds. A full list of responses is located in the Appendix. Of the 29% of visitors that believe there are

behavioral limitations such as not touching things and not moving/picking things up (11% each). Nobody mentioned that the restrictions are due, in part, to the

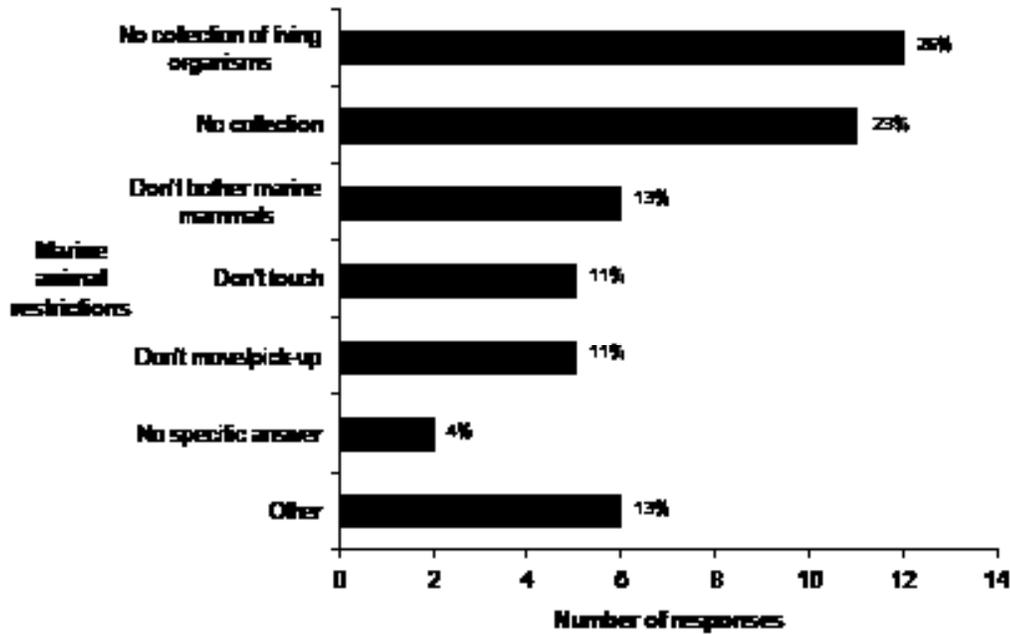


Figure 54. Restrictions visitors believe are in place for marine animals at Strawberry Hill intertidal (n=78 comments). Percentages may not equal 100 due to rounding. Some respondents had more than one comment.

restrictions on marine plant collection, the majority mentioned no collection (64%), followed by a rather large group that were not able to come up with a specific answer (19%). Other comments included a few that mention they believe there are fish and wildlife regulations and one each of the following: limits on kelp, don't bother the plants, no commercial harvest allowed, and collection limits.

Strawberry Hill

At this site, 30% of visitors indicated they are aware of restrictions on plants and 67% for animals (fig. 54). Although the number of interviewees available at this site is smaller, the percentages are quite similar to the other two sites. Again, the types of answers given by the majority of respondents involve limits on collection with 26% of comments indicating no collection of living organisms is allowed, followed closely by 23% mentioning simply that collection is not allowed. Thirteen percent of visitors mentioned not bothering marine mammals, followed by other

status of the site as an intertidal research reserve. A full list of responses is provided in the Appendix.



Research Reserve sign at Strawberry Hill

Responses for knowledge about plant restrictions is also similar (at least in the categories of responses) to those given at the other two sites. Of the 30% of respondents that indicated they feel there are restrictions on plants, 80% mentioned no collection, with one response each for the following: try to have a low impact, do not touch, do not walk on and no specific answer.

Intertidal Protected Areas

The next question about rocky shore protections asked visitors whether they are aware of tidepool areas along the Oregon Coast having any special protections. If they indicated that they were aware of protected areas, they were then asked where those areas are and what kind of protections they have. Visitors were also asked if they support protections for intertidal areas.

Devil's Punchbowl

Slightly under half of visitors (43%) indicated they believe that intertidal areas have some sort of special protections. When probed as to where those areas are and what types of protections are afforded within them, 59% of visitors that indicated they knew of some specially protected areas had a response. Yaquina Head was the most frequently mentioned protected tidepool area (50%) with Devil's Punchbowl (30%) following in second. "Other" areas mentioned were Boiler Bay, Cape Arago, Nehalem Bay, Pirates Cove, Snowy Plover areas, and Strawberry Hill.

Of those visitors that indicated they were aware of intertidal areas with special protections, fewer (44%) were able to come up with what type of protections are afforded than those that were able to name areas with protections. The most frequently mentioned types of protection are collection closures (31%) and access limitations (7%). A few respondents also mentioned bird protections and behavioral limitations such as not disturbing things and not walking on the tidepools. Nobody mentioned the status of Devil's Punchbowl as a marine garden, nor for that matter any other marine garden, research reserve or habitat refuge.

Visitors were also asked to what extent they favor or oppose having protected marine (tidepool) areas along the Oregon coast. An overwhelming majority (87%) of visitors indicated they were strongly in favor of some kind of protections for tidepools. Nobody said they oppose protections but a few (5%) said they neither favor or oppose protections.

Seal Rock

Approximately one third of visitors (33%) indicated they believe that intertidal areas have some sort of special protections. When those visitors were probed as to where those areas are, 52% indicated a response. Yaquina Head was the most frequently mentioned protected tidepool area (33%) with Devil's Punchbowl (25%) following in second (fig. X). "Other" areas mentioned, in order of popularity include Cape Perpetua, Strawberry Hill, Snowy Plover areas, Boiler Bay, signed areas, offshore islands, Neptune SSV, and Haystack Rock.

57% of those visitors that said they were aware of areas with protections actually were able to come up with what type of protections are afforded in those areas. The most commonly mentioned protection is that no collection is allowed (29%) followed by access limitations and no removal of live organisms (14% each). A smattering of other responses included collection limits, not disturbing marine wildlife and fishing regulations.

The majority (79%) of visitors indicated they were strongly in favor of some kind of protections for tidepools. Nobody said they oppose protections but a few (8%) said they neither favor or oppose protections and some (13%) somewhat favor protections.

Strawberry Hill

Much like Devil's Punchbowl, slightly under half of visitors (42%) indicated there are intertidal areas with special protections. Of those same visitors, over half (56%) indicated they know where those protected areas are. Again, Yaquina Head was the most frequently mentioned (27%) followed by Strawberry Hill (18%) and Cape Perpetua (14%). Other areas include Sunset Bay, Haystack Rock, and Boiler Bay to name a few.

Those visitors that said they were generally aware of protected areas were also asked what type of protections are afforded in those areas. Just under half (48%) said they know what types of protections are afforded within those areas. The most commonly cited response was that no collection is allowed (29%) followed by related comments such as no removal of live organisms and collection limits (12% each), not disturbing marine mammals (also 12%) and access limitations (12%). A full list of comments is in the appendix.

The majority (80%) of visitors indicated that they strongly favor protections for tidepools. Seventeen percent said they “somewhat” favor protections with one person saying they neither favor nor oppose protections. None of the visitors interviewed indicated that they oppose protections.

When the answers for all three sites are combined, the responses are similar to those from each of the separate sites (fig. 55). The majority of visitors (62%) are not familiar with the existence of intertidal protected areas. Those visitors that indicate they do know of areas that have protections, slightly over half (56%) say they know where one or more of those areas are and about the same number (58%) indicate they are aware of specific type of protections in those areas.

The main sites mentioned are also the same when the results from the three sites are aggregated together (fig. 56). Yaquina Head is the most commonly mentioned protected rocky intertidal site (38%), followed by Devil’s Punchbowl (21%) and Cape Perpetua (21%). A list of “other” sites is available in the Appendix.

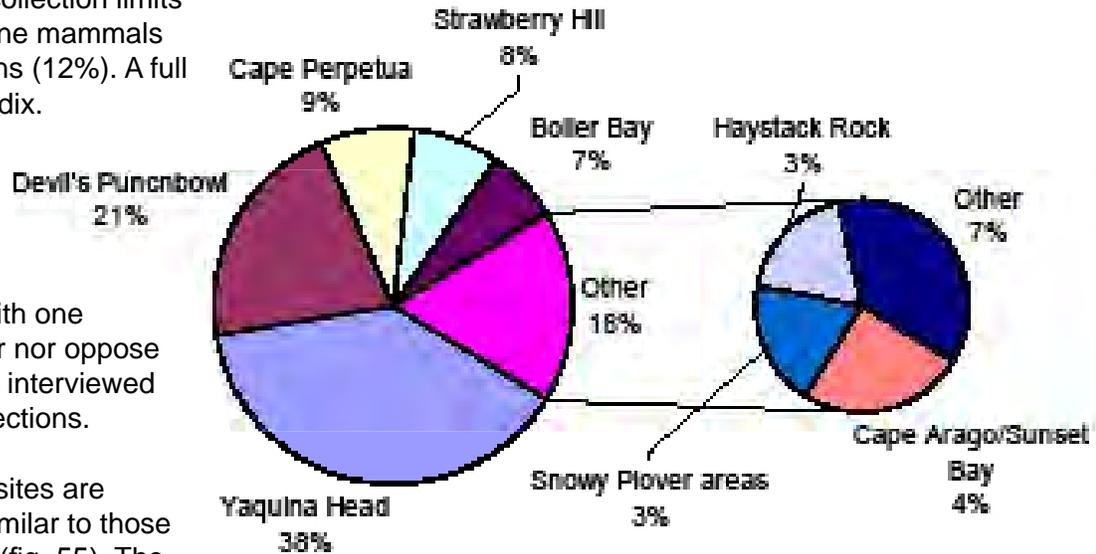


Figure 56. Intertidal (tidepool) areas visitors believe have special protections (n=91 comments). Percentages may not equal 100 due to rounding. Some respondents had more than one comment.

The types of protections that are most commonly mentioned when the information is combined for the three sites is also relatively similar (fig. 57). The

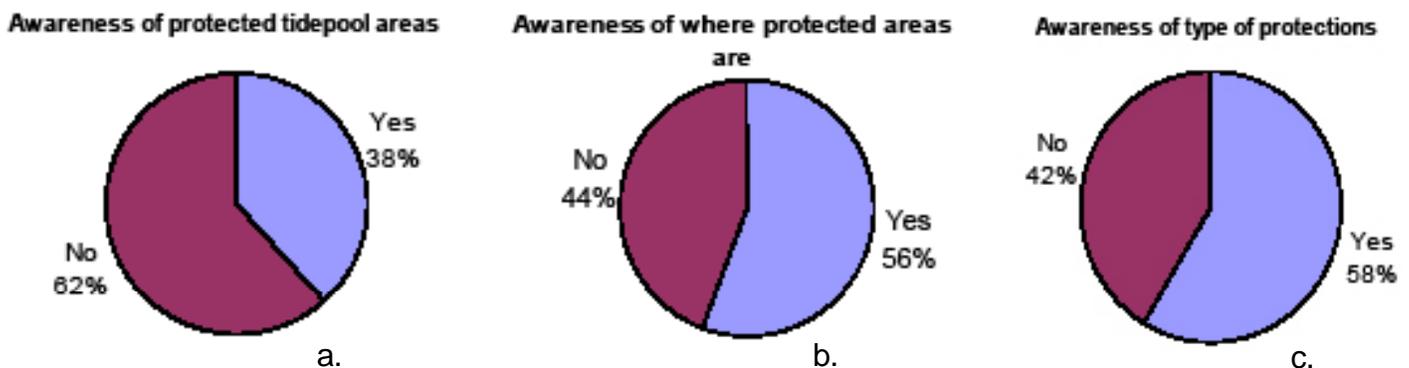


Figure 55. Types of intertidal protections visitors believe exist at some intertidal areas (n=276 for “a”, n=106 for “b” and 91 for “c”). Visitors sometimes had more than one response to this question.

Appendix A: Rocky Shore Recreation Use Study

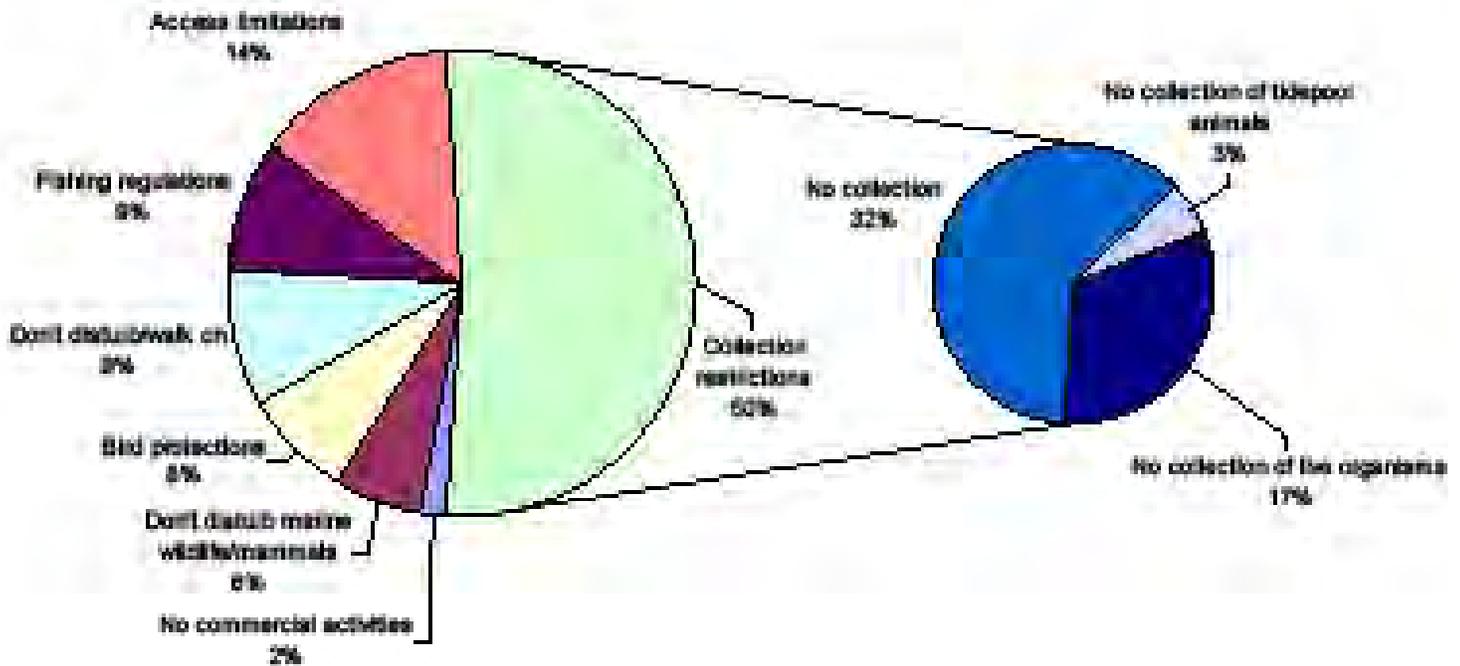


Figure 57. Types of protections visitors think that some intertidal (tidepool) areas have (n=226 comments). Percentages may not equal 100 due to rounding. Some respondents had more than one comment.

most popular answers relate to collection restrictions (50%). Of those, most people simply said that no collection is allowed, however, a few limited that restriction to only live organisms (17%) or even more specifically tidepool animals (3%). Other answers included quite a few about access limitations (14%), and some that simply said that there are fishing regulations (9%). A full list of comments is in the Appendix.

Other information

Suggestions for Improving Visit

Devil's Punchbowl

The majority of visitors did not have any suggestions for improving their visit with only 22% citing specific recommendations. The most frequently mentioned suggested involves improving access followed by increasing on-site educational opportunities (Table 9).

Seal Rock

Only 23% of Seal Rock visitors had suggestions on ways to improve their visit (Table 10). Again,

improved access was the most commonly mentioned suggestion.

Table X. Suggestions of visitors to Devil's Punchbowl (n=20 comments).

Comment	Times Mentioned
Improve access	7
Increase on-site education	6
Improve way finding	4
Continue protection	1
Increase site marketing	1
More signage about restrictions	1

Strawberry Hill

A larger percentage of visitors (42%) to Strawberry Hill had suggestions as to how to improve a future visit. Like for the other two sites, the most frequently mentioned type of comment involves improving access to the site (Table 11). The lack of bathrooms was the second most frequently mentioned issue at the site with recommendations ranging from placement of port-a-potties to full facilities.

Table 10. Suggestions of visitors to Seal Rock (n=29 comments).

Comment	Times Mentioned
Improve access	13
More garbage cans	2
More parking	2
Don't use tax-payers money on interpretive rangers	1
Golf cart/dy	1
Information about geology	1
Lots of fish to catch	1
Lower tide	1
More information on OPRD website	1
More way finding signage	1
Purchase RV cover and create underpass under highway to beach	1
Roving rangers	1
Sign on highway from north	1
Signage about erosion	1
Small bags for trash	1
Toilet paper in bathroom	1
Water quality testing on stream	1

Table 11. Suggestions of visitors to Strawberry Hill (n=25 comments).

Comment	Times Mentioned
Improve access	7
Restrooms	8
More parking	5
Keep in natural	4
Signs have too much information (keep it simple)	1
Restrict access to some state parks	1
Remove hill to increase parking and deter theft	1
Post signs about dangers (footwear etc.)	1
More signage	1
Have signs that explain exactly what you can do	1

Final Report, 2007

Oregon State Parks rocky shore species inventories

Dr. Gil Rilov, PISCO OSU

Introduction

The rocky intertidal along the Oregon coast is one of the richest temperate intertidal rocky ecosystems in the world. Its biological diversity is supported by very productive waters that hug the coast and nourish plants and animals that live on the rocks. No one site is exactly identical to others along the coast. This variability is a product of a myriad of factors including the shape of the shore, the nearshore oceanography (currents) and water productivity (nutrients, alga blooms), as well as more local conditions such as the rock type, its inclination, the surrounding environment (a long stretch of rocky shore versus rocks embedded in a sandy beach) and more. Adding to this variability is human activity, among which is human visitation. Humans can affect the shore by trampling, extracting or polluting. Distinguishing between natural and human-mediated change is a challenge marine ecologists constantly face when they try to describe the environment and its biotic components.

In light of increases in human pressure along the Oregon coast, and the projected effects of climate change on coastal ecosystems, considerable alterations of intertidal and subtidal communities along the Oregon shores seem likely. In order to document the current state of the rocky shore community along the Oregon coast and to enable the detection of future alterations to these communities, surveys of biodiversity at multiple sites were initiated by PISCO during summer of 2007 as part of a project contracted with Oregon Parks and Recreation Department to create an inventory of rocky shore communities in State Park areas.

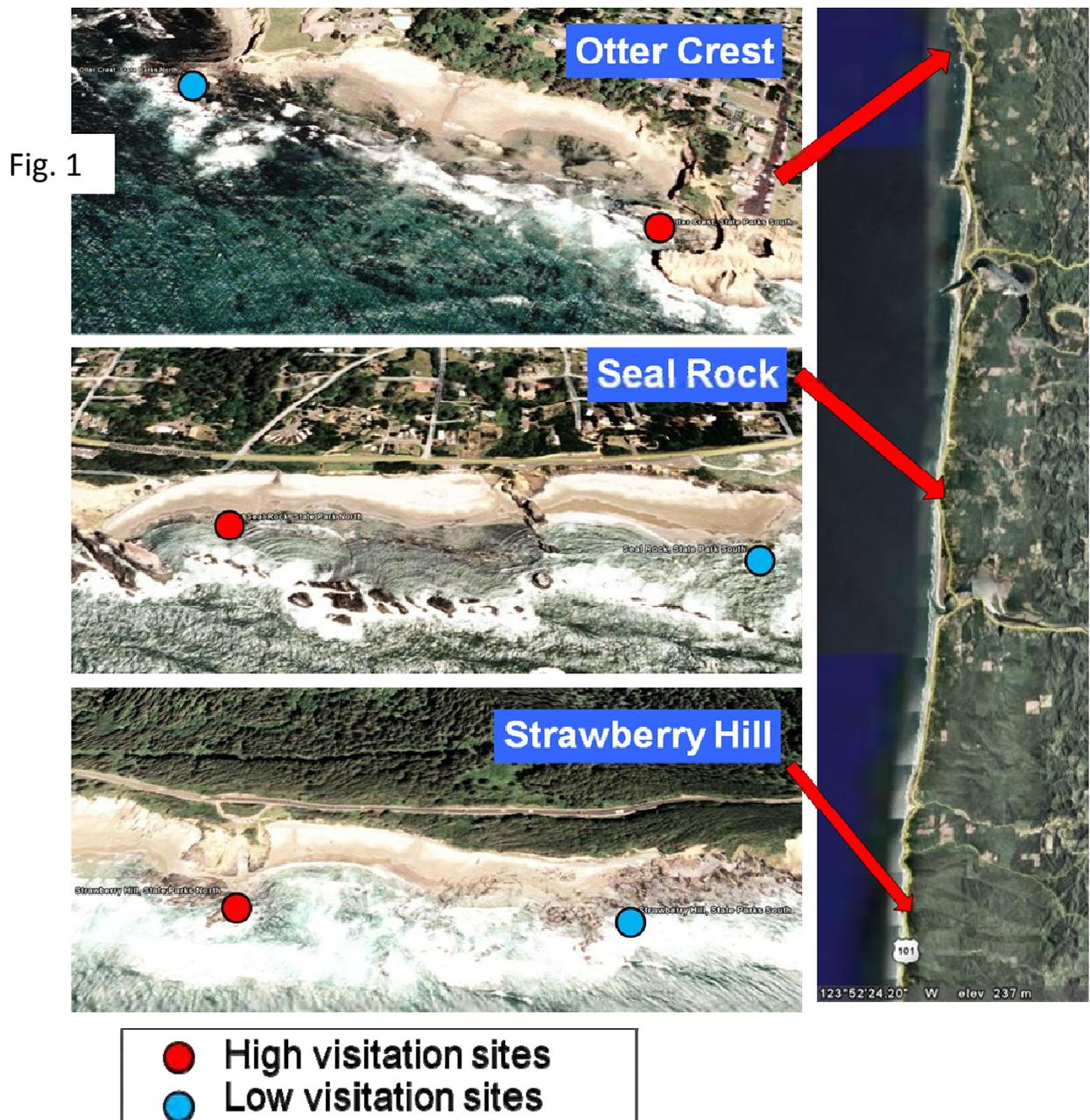
Surveys conducted during 2007

Intertidal community inventories (biodiversity surveys) were conducted over the summer of 2007 at three State Parks along the central Oregon coast: Otter Crest, Seal Rock and Strawberry Hill (Fig. 1). In each park, one high and one low human-visitation site (visitation rate based on State Park surveys) were surveyed at 3-4 shore levels (0', 3-3.5, 7-7.5, 9) in areas where the intertidal rocks have a gentle to moderate slope towards the ocean. At each shore level, fifteen 15x22 inch quadrats were marked with stainless steel lag screws along a 50 m long transect and surveyed for species numbers and densities (counted in the field and photographed for archival purposes). The location of the quadrats was permanently fixed so the exact areas can be surveyed at future years to detect potential changes. At Otter Crest, two additional sites of flat rock were surveyed at the high and low shore levels because they appeared to have a different community

assemblage. At this site, semi-quantitative surveys were also conducted in 8 rock pools. Several additional legacy PISCO sites were also surveyed using the same methodology. These sites were analyzed together with the State Park sites in the multivariate similarity analysis to demonstrate coast scale variability.

Study sites

Fig. 1 shows the general location of the 3 state parks and the study sites at each location.



Appendix B: Biodiversity Survey

Otter Crest sites: The northern, less visited study site (**OCN**, 44°45'9.67"N, 124° 3'58.11"W), is a wide rocky bench that gradually slopes from the high shore level to the low shore. Shoreward, there is a flat and wide platform that goes all the way to the cliff. At the midshore level, the northern half of the bench is flat and almost totally covered by a thick mussel bed. The southern part is more steep and structurally complex with a more varied community. The southern, more visited site (**OCS**, 44°44'52.13"N, 124° 3'55.17"W) is located north of the Devil Punch Bowl headland. It is relatively steep at the high and midshore levels. At the low-mid and low shore levels it is very flat (and frequently sand inundated) at its northern half and consists mostly of boulders at the southern half. In between these sites, the rocky shore is very flat and relatively uniform in biotic cover.



Seal Rock sites: The northern, more visited site (**SRN**, 44°29'40.72"N, 124° 5'4.92"W), is a narrow bench embedded in a sandy beach and with no high shore level. The southern, less visited site (**SRS**, 44°29'19.45"N, 124° 5'7.56"W) is an elevated platform with steep walls at the low-mid and low shore levels. It has very limited high shore zone (and thus this zone was not sampled) and it also has a sandy beach shoreward.



Strawberry Hill sites: The northern, more visited site (**SHN**, 44°15'14.21"N, 124° 6'48.06"W) is close to a seal haulout area just seaward of the public viewing area. It is steep or boulder like at the high and midshore levels and much flatter at the low-mid level. This latter zone is cut by shallow channels while the walls of those channels are at the low shore level. The landward edge of the site is either cliff or small boulders. The southern, less visited site (**SHS**, 44°14'57.90"N, 124° 6'52.54"W), is a relatively high bench where the mid and low mid shore levels are relatively flat but the low shore is steep. Shoreward there is a sandy/boulder beach.

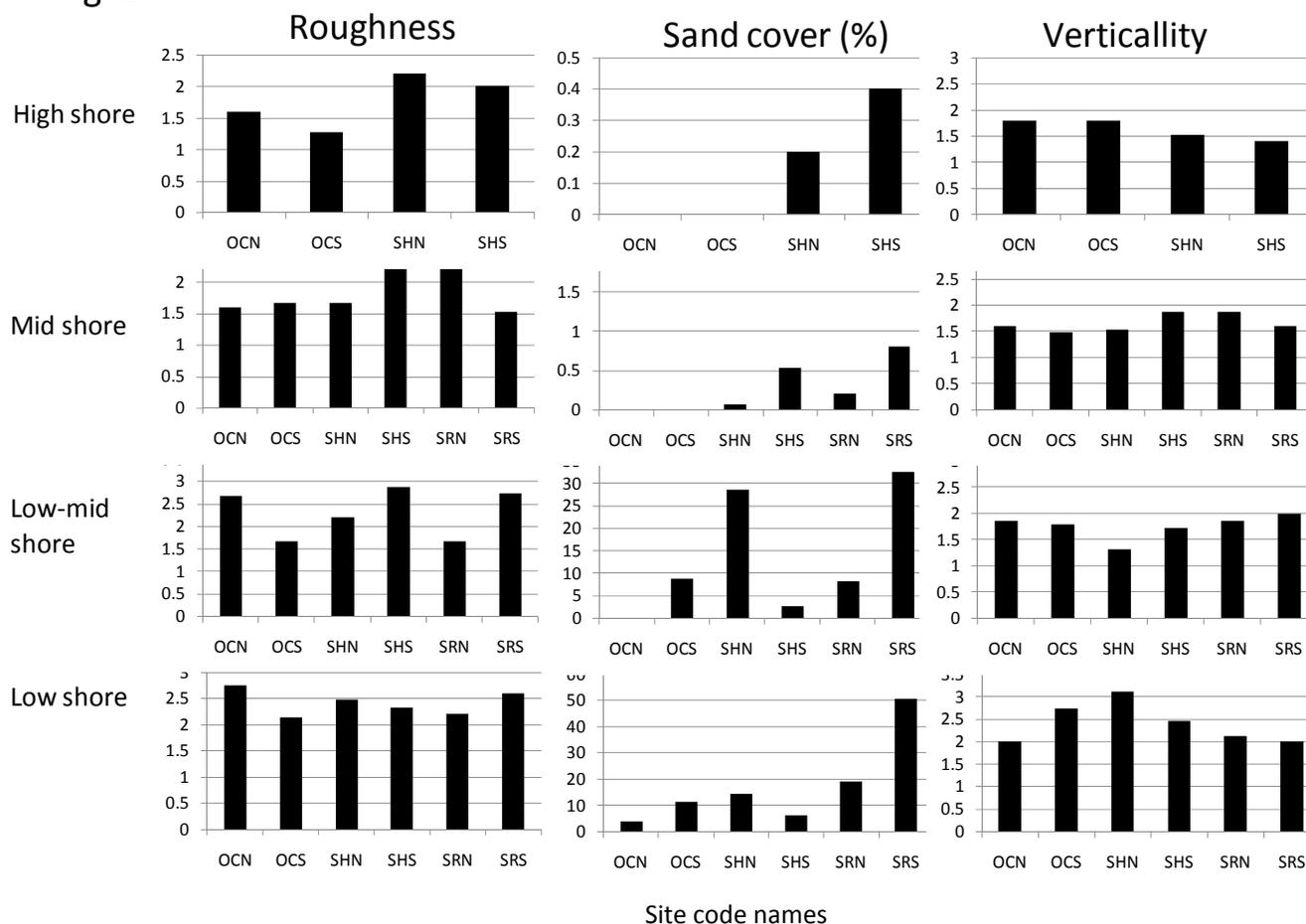


Results

Abiotic measurements

In each quadrat, three abiotic metrics were taken: (1) surface *roughness* (substratum topographic irregularity) on a scale from 0-3, 3 being the roughest; (2) *verticality*, is a ranked measure of the inclination of the surface under the quadrat ranging from horizontal (zero) to vertical (four); and (3) *sand cover*, quantified as percent of the area covered by sand. The means for each metric at each site and zone are shown in figure 2. No site stands out as very different in its small-scale physical attributes from the others except that the Seal Rock sites (especially SRS) and Strawberry Hill sites (especially SHN) had much higher sand cover at the low and low-mid shore at the time of sampling. Seal Rock is indeed embedded within a sandy beach and sand movements there are very frequent so this finding is not surprising.

Fig. 2



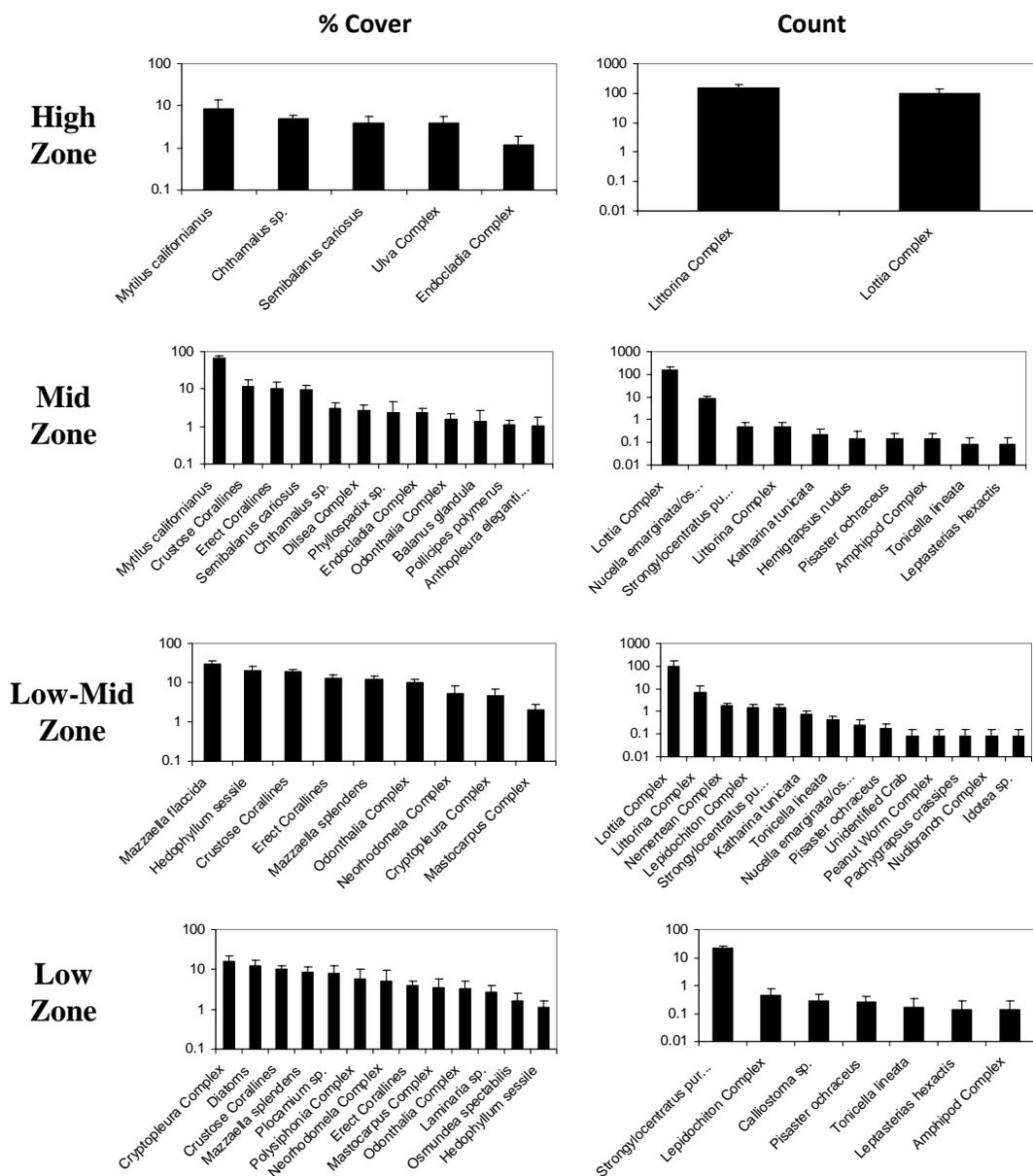
Physical attributes (surface roughness, sand cover and surface verticality) of the study sites and zones as was measured under the sampling quadrats.

Appendix B: Biodiversity Survey

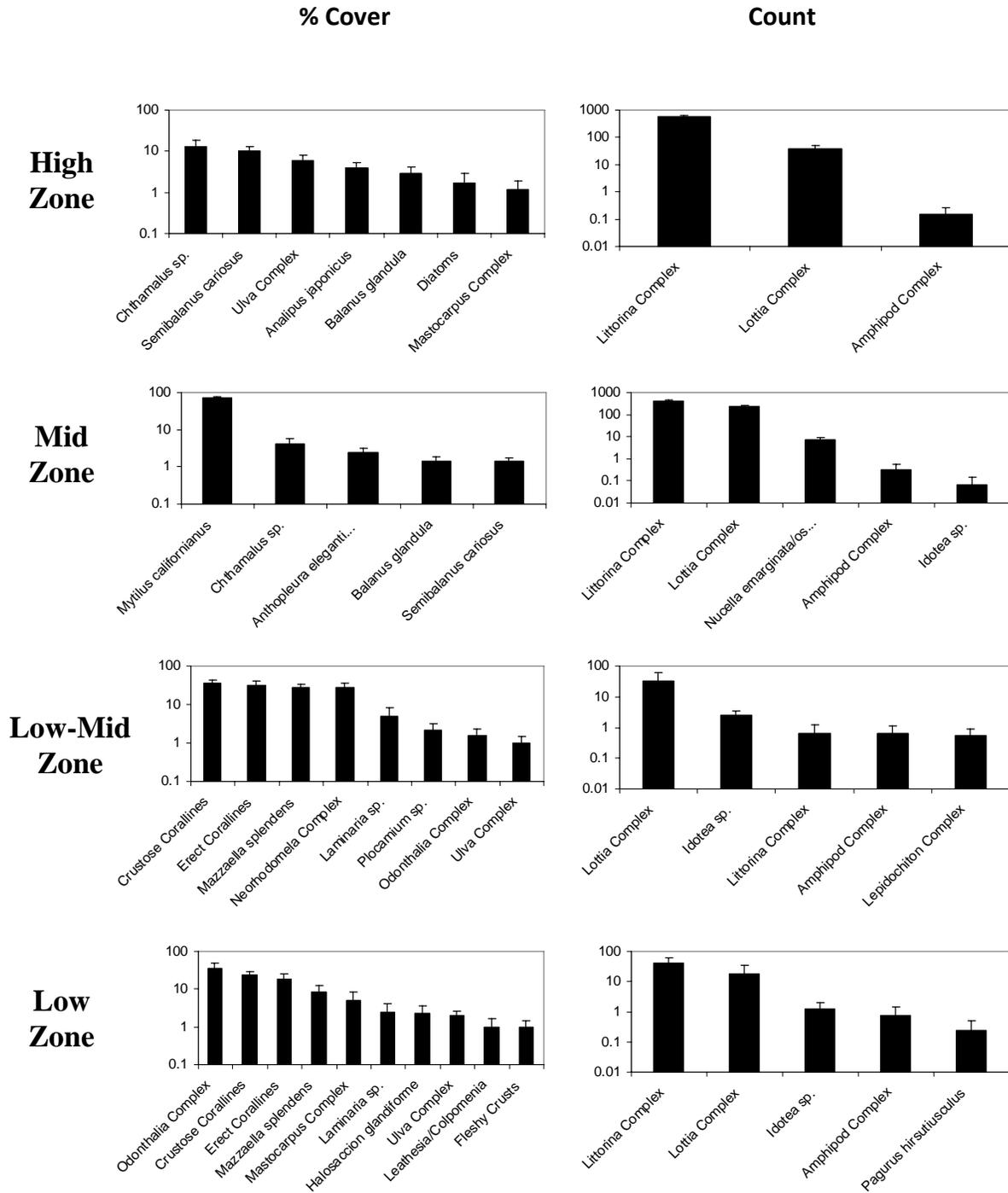
Community structure

In the preliminary report we provided the complete species list with mean abundances at each site/shore level. Here we present the species mean (\pm Standard Error) abundance per site/zone (figure 3). The species are ranked from the most abundant to the rarest. For each site/zone we present the data separately for percent cover data and for counts of mobile species. We only show percent cover for species with cover $> 0.1\%$. The data are presented in a log scale so that rare species can be visible. We also have semi-quantitative data from surveys conducted at the 8 tide pools in Otter crest. These data are provided as an appendix (Appendix 1) in an excel file.

Fig. 3 Otter Crest North



(b) Otter Crest South



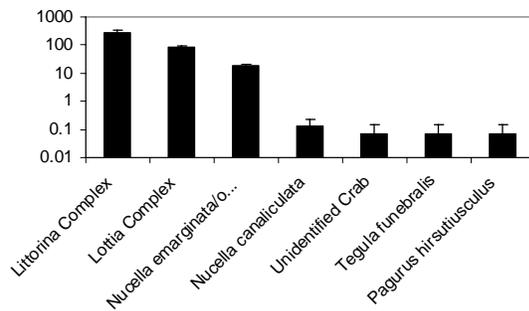
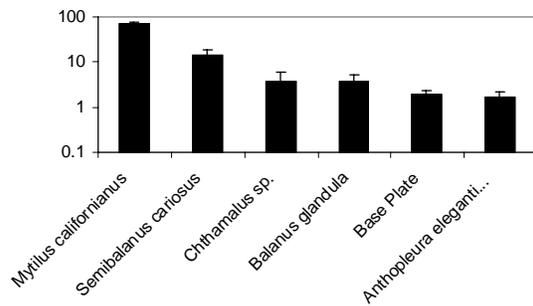
Appendix B: Biodiversity Survey

(c) Seal Rock North

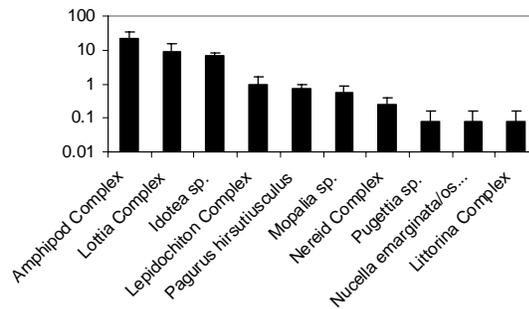
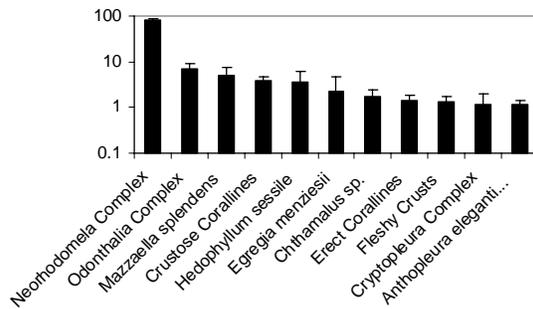
% Cover

Count

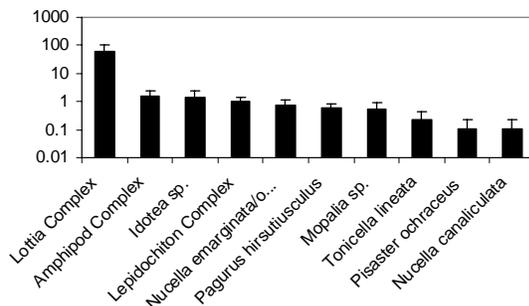
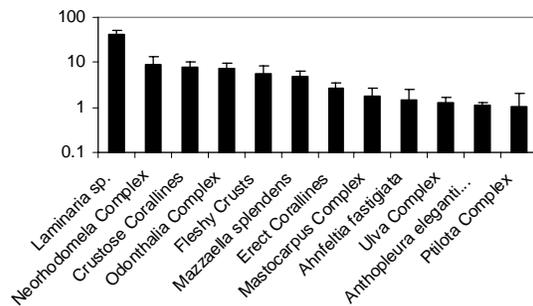
Mid
Zone



Low-Mid
Zone



Low
Zone

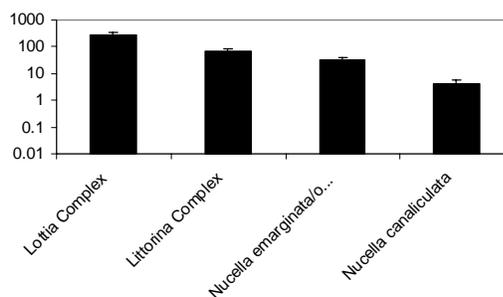
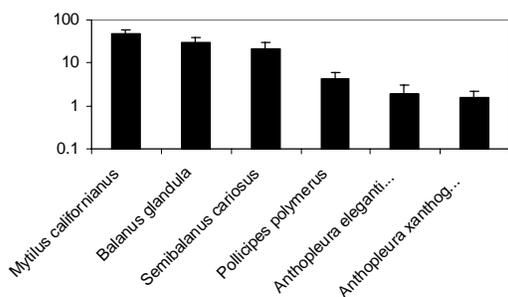


(d) Seal Rock South

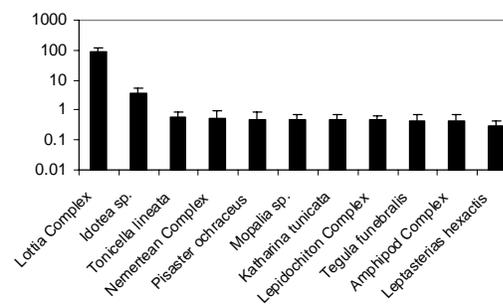
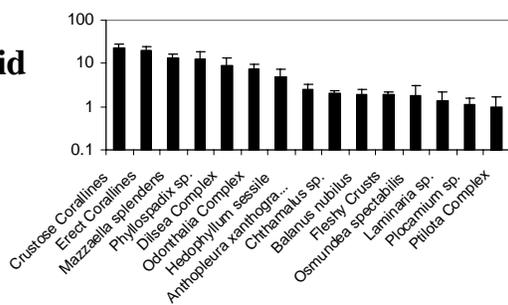
% Cover

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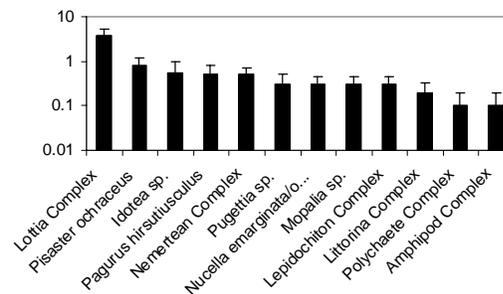
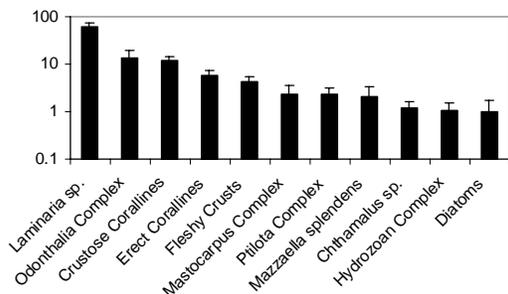
Mid Zone



Low-Mid Zone

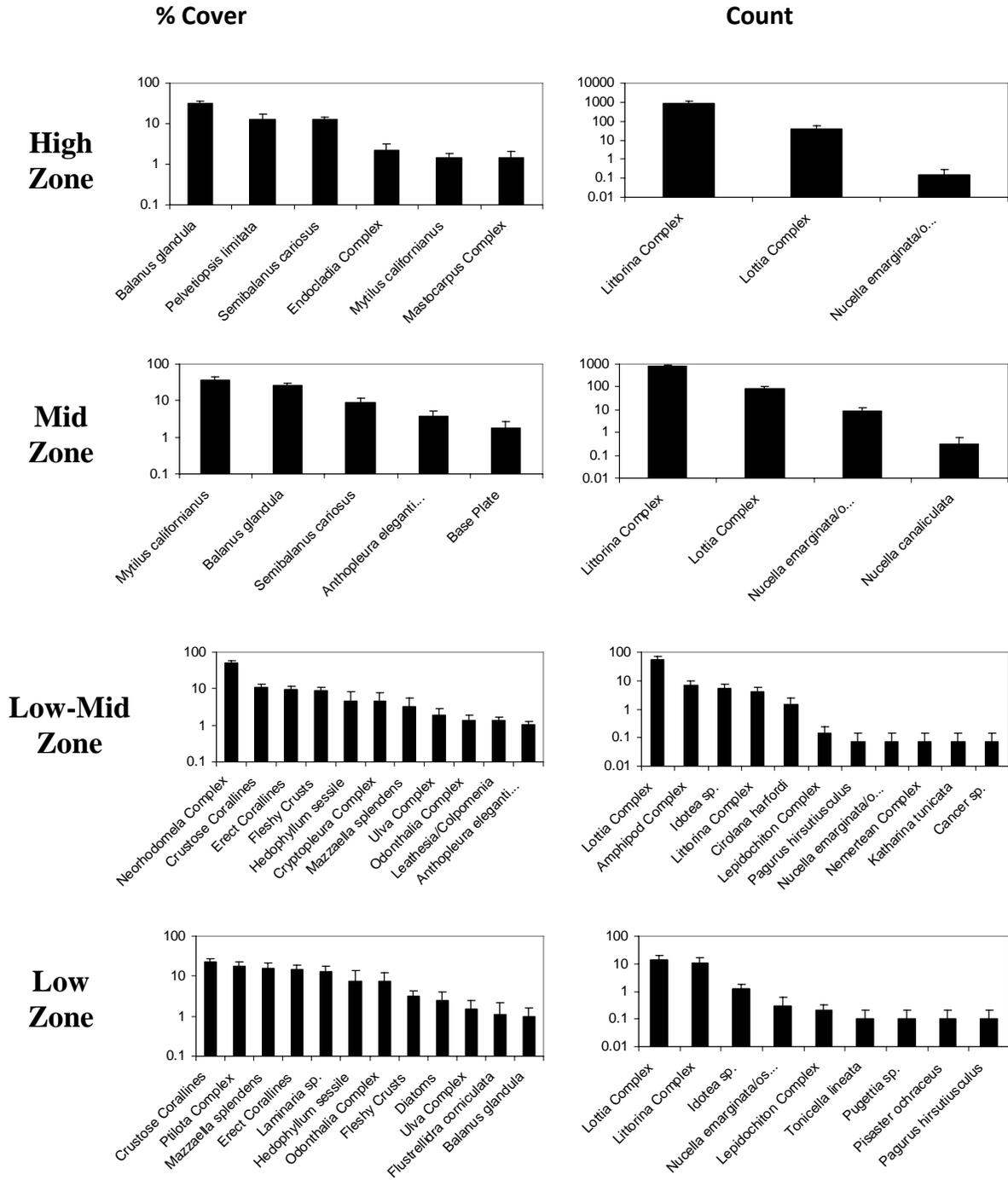


Low Zone

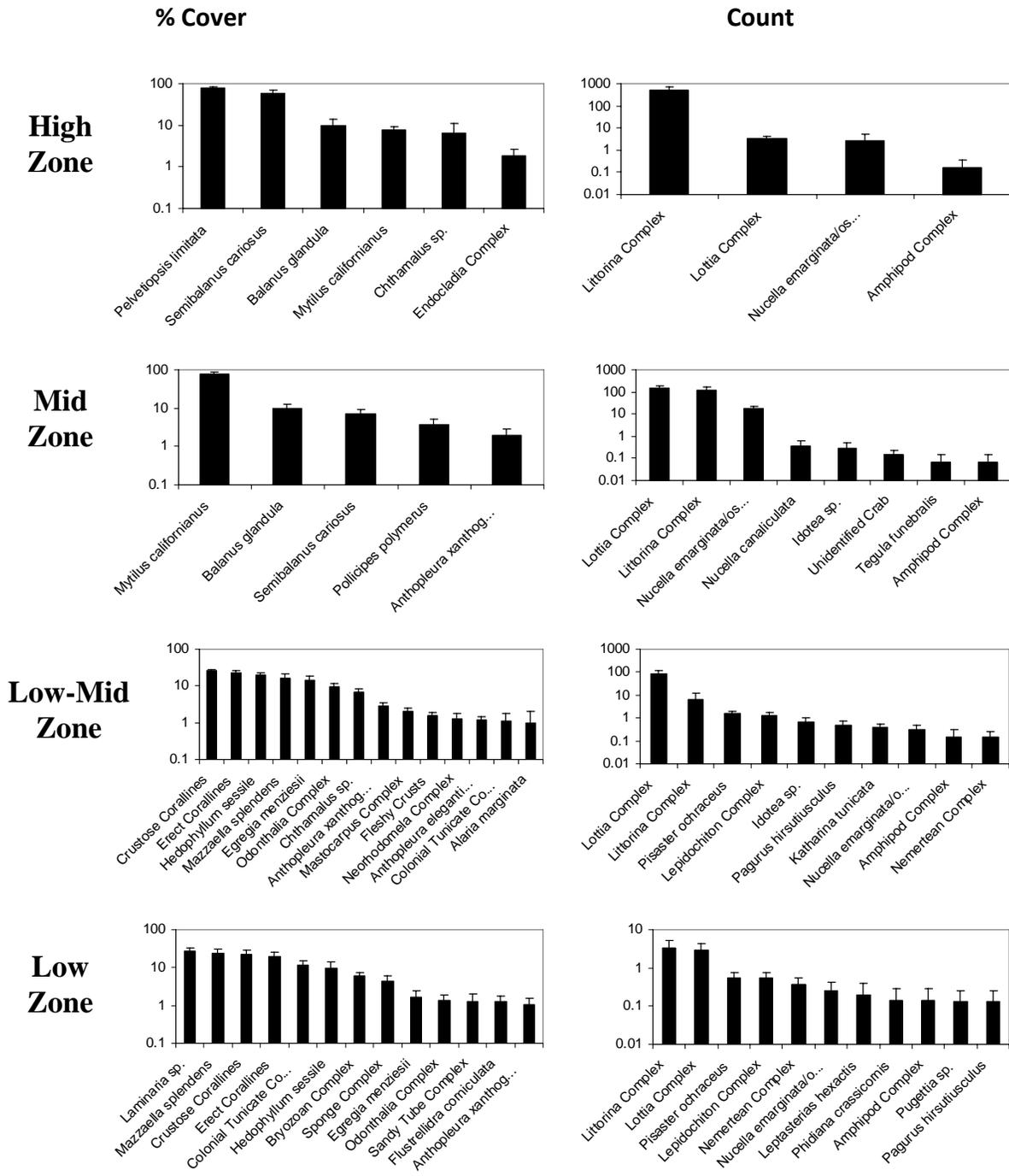


Appendix B: Biodiversity Survey

(e) Strawberry Hill North



(f) Strawberry Hill South



Appendix B: Biodiversity Survey

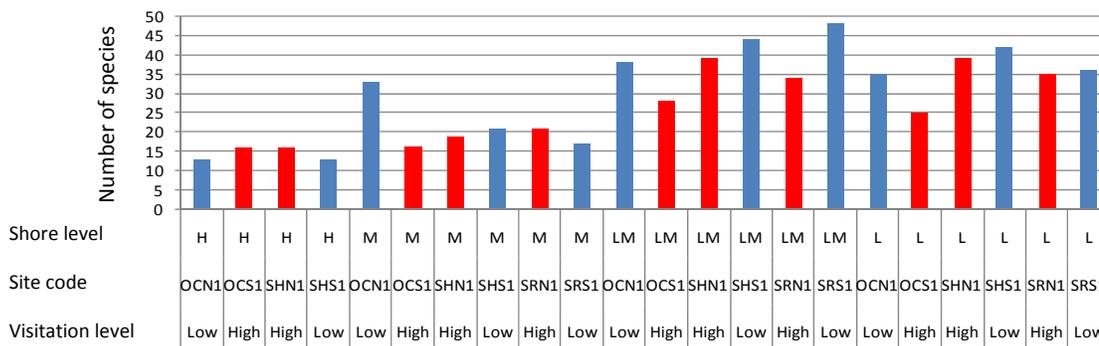
The data in fig. 3 demonstrate the high site-to-site variability in the abundance of species including the dominant ones. For example, the assemblage of sessile organisms at the low shore in Otter Crest North (OCN, fig. 3a) is dominated by a species complex of the red algae *Cryptopleura* whereas this species is completely absent from all other sites. Similarly, at the same site (OCN) and zone, the most abundant mobile invertebrate is the purple urchin *Strongylocentrotus purpuratus* (also a dominant at other Cape Foulweather sites) but at all other sites this species is absent. In contrast, the kelp *Laminaria* spp. is among the two most abundant species on the low shore at all sites except OCN. Similarly, *Lottia* (limpets) complex is absent at OCN but abundant at the low shore level at all other sites. These differences are most probably not related to human impacts because the low shore is rarely visited by humans. They may be related to the local seascape, rock type, species recruitment rates, etc. We cannot be sure at this point what drives this variability. PISCO research projects at other sites are aimed at deciphering the processes that govern this site-to-site and cape –to-cape variability.

The midshore is more exposed than the lower zones to human visitation because, due to tidal fluctuations, mid and upper levels of the shore are out of water for a greater proportion of time each day. This means that the higher levels are also more frequently exposed to trampling and harvesting effects of humans. In contrast to the variability seen on the lower shore levels, the midshore was dominated by the mussel *Mytilus californianus* at all sites. Also evident in fig. 3 is that at Otter Crest (% cover and mobile species count) and at Strawberry Hill (mobile species) there were more species in the low visitation sites than in the high visitation sites. A more in-depth analysis of the species that drive the differences between high and low visitation sites is presented below.

Biodiversity

Species richness (mean number of species per quadrat) is shown in figure 4. Richness was lowest in the high and midshore levels at most sites. Richness appears consistently higher at the low visitation sites only at the low-mid shore level.

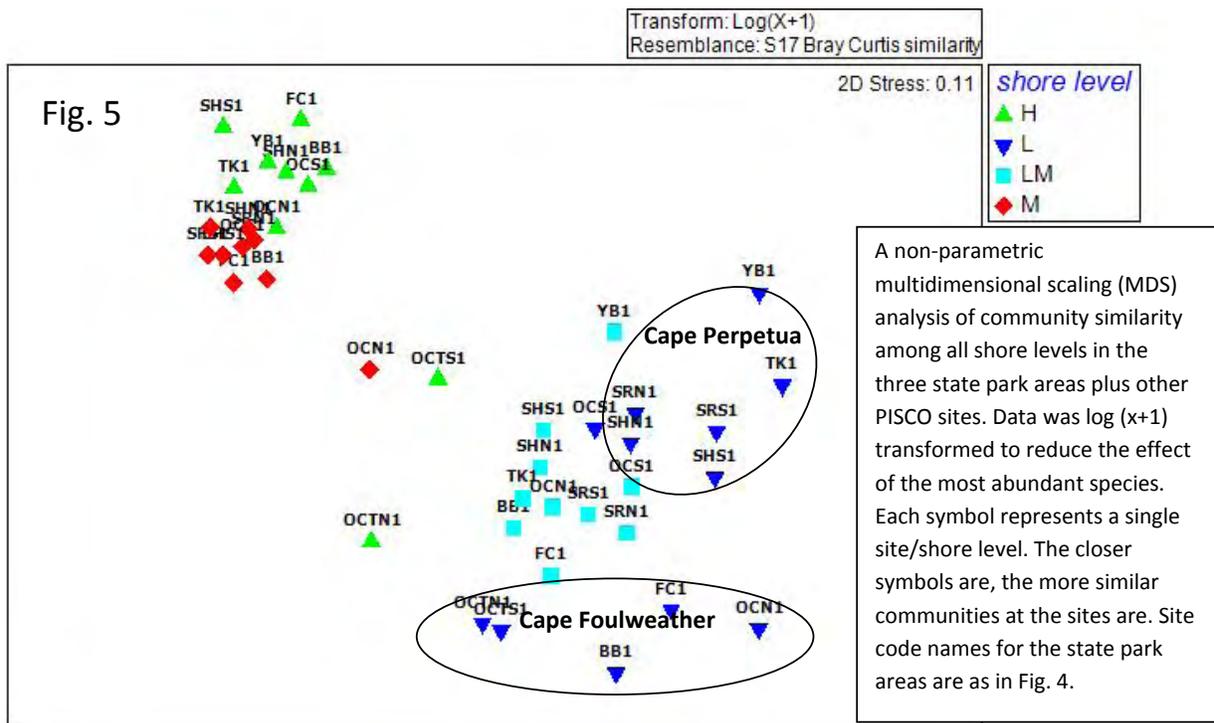
Fig. 4



High visitation sites are in red and low visitation sites are in blue. OCN1= Otter Crest North, OCS1 = Otter Crest South, SHN1= Strawberry Hill North, SHS1= Strawberry Hill South, SRN1= Seal Rock North, SRS1 = Seal Rock South. H = High Shore, M= Midshore, LM = Low-mid Shore, L = Low shore.

Community similarity

Multivariate analysis of community similarity at all shore levels at all the State Park sites plus the other PISCO sites that were surveyed over the summer shows a clear distinction (clustering) between high, mid, low-mid and low shore communities (fig. 5). Such variation is typically seen in rocky intertidal environments and was therefore expected. The reason for this pattern is complex, but generally result from the fact that the marine species that occupy rocky shores tend to drop out with elevation on the shore as conditions become more stressful and exceed their tolerances of thermal and desiccation stress. For the most part, high shore and mid shore communities were more similar (cluster more tightly) among sites than low-mid and low shore communities that are much more scattered on the MDS plane. This is probably because at the top shore levels conditions are more extreme allowing only a handful of species to exist while at the lower shore levels there is a larger pool of species that can establish there at different proportions depending on specific site characteristics and potentially stochastic events as well. The two high-shore flat rock sites in Otter Crest (OCTS1 and OCTN1) were very different from the rest of the high-shore communities that were located on more vertical surfaces. They were mostly dominated by a few algal species. The mid-shore community at Otter Crest north (OCN1) was very different from the rest of the mid-shore communities. The 50 m long mid-shore transect at this site was partially laid on a flat mussel bed and partially on a steeper bench (see above), which may have resulted in an overall more diverse community (see Fig. 3 where number of species was almost double that of the rest of the sites at the mid-shore level). At the low-shore level there is a clear separation between Cape Perpetua sites and Cape Foulweather sites (indicated by ovals in Fig. 5), except for the community on the low-shore at Otter Crest South (OCS1) that was more similar to the Cape Perpetua than the Cape Foulweather sites.



Appendix B: Biodiversity Survey

Multivariate analysis of community similarity among the main State Park sites (habitats with slopes at the State Park areas) indicates that high and low visitation sites exhibited different communities in the high, mid and low-mid shore levels (see Fig. 6). Communities in general appear more similar between high and low visitation sites at the low-shore level where access by humans is probably the lowest. Again we can see that Otter Crest North (OCN1) had a relatively different community structure at the mid and low-shore level from the rest of the sites, probably due to the heterogeneity in the topographic features mentioned above.

Fig. 6



A non-parametric multidimensional scaling (MDS) analysis of community similarity between high and low visitation sites in three state parks. Data were log (x+1) transformed to reduce the effect of the most abundant species. Each symbol represents a single site. The closer the symbols, the more similar are communities at the sites. Clustering of sites by visitation levels is apparent for the high, mid and low-mid shore levels. Site code names as in Fig. 4.

SIMPER analysis (an analysis that tests which species contribute most to the dissimilarity among categories) was conducted on the log transformed data. It indicates what species drive 90% of the dissimilarity among high and low visitation in the species matrix. We analyzed only the high, mid and low-mid shore levels because low shore levels showed minimal differences between high and low visitation sites (see Fig. 6). The data from the two (high shore) or three (mid and low-mid) regions were pooled together. The high shore analysis indicates that the average dissimilarity between high and low visitation sites was 35.52%. Information in Table 1 shows that some species on average were more abundant in the low and some in the high visitation sites with no clear overall pattern.

Table 1. Species that contributed most to the dissimilarity between high visitation and low visitation sites at the **high shore**. The higher values are highlighted in yellow. Photos show the two most influential species.

Species	Low Visitation Abundance	High Visitation Abundance	% Contribution
<i>Pelvetiopsis_limitata</i>	2.18	1.32	13.26
<i>Lottia_Complex</i>	2.72	3.57	10.86
<i>Mytilus_californianus</i>	2.19	0.69	9.33
<i>Balanus_glandula</i>	1.48	2.42	9.03
<i>Littorina_Complex</i>	5.11	6.51	8.78
<i>Semibalanus_cariosus</i>	2.85	2.51	7.71
<i>Chthamalus_sp.</i>	1.91	1.52	7.03
<i>Ulva_Complex</i>	0.8	1.02	5.94
<i>Analipus_japonicus</i>	0	0.79	4.98
Diatoms	0	0.49	3.09
<i>Mastocarpus_Complex</i>	0.36	0.83	2.98
<i>Endocladia_Complex</i>	0.92	0.72	2.74
<i>Pollicipes_polymerus</i>	0.37	0	2.39
<i>Fucus_sp.</i>	0	0.33	2.07

Pelvetiopsis



Lottia



The average dissimilarity between high and low visitation sites at the mid shore level was 28.25%. As Table 2 shows, most of the species that drive the dissimilarity had higher abundances at the low visitation sites, but the species complex that contributed most to the dissimilarity (almost 19%), the periwinkle *Littorina*, was actually more abundant in the high visitation sites.

Appendix B: Biodiversity Survey

Table 2. Species that contributed most to the dissimilarity between high visitation and low visitation sites at the mid shore. Analysis was done on the three regions pooled. The higher values are highlighted in yellow. Photos show the two most influential species.

Species	Low Visitation Abundance	High Visitation Abundance	% Contribution
Littorina_Complex	3.11	6.1	18.86
Balanus_glandula	2.24	1.9	7.84
Pollicipes_polymerus	1.32	0.27	6.8
Crustose_Corallines	0.87	0	5.4
Semibalanus_cariosus	2.53	1.98	5.35
Erect_Corallines	0.83	0	5.16
Chthamalus_sp.	0.81	1.12	4.75
Lottia_Complex	5.23	4.79	4.12
Nucella_emarginata/ostrina	2.82	2.43	4.11
Nucella_canaliculata	0.64	0.14	3.74
Anthopleura_xanthogrammica	0.75	0.27	3.62
Anthopleura_elegantissima	0.72	1.25	3.53
Endocladia_Complex	0.4	0.29	3.14
Dilsea_Complex	0.43	0	2.69
Phyllospadix_sp.	0.4	0	2.49
Odonthalia_Complex	0.31	0.19	2.36
Mytilus_californianus	4.16	4.06	1.93
Analipus_japonicus	0.1	0.21	1.56
Mazzaella_flaccida	0.18	0	1.12
Diatoms	0.17	0	1.06
Pelvetiopsis_limitata	0	0.13	0.85

Littorina

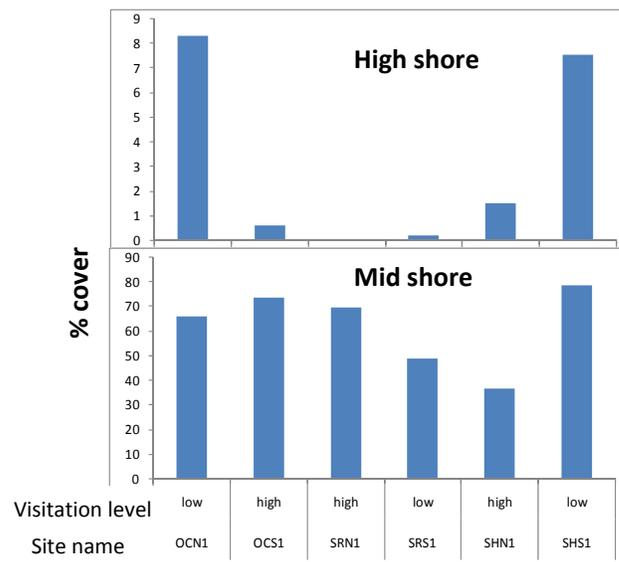


Balanus glandula



Fig. 7

Cover of the major space occupier in the mid-shore level, mussel beds of *Mytilus californianus*, did not differ between high and low visitation sites except at Strawberry Hill where mussel cover on the mid-shore was twice as high at the southern, low visitation, compared to the northern, high visitation site (Fig. 7). At the high-shore, in the two regions where it could be compared, mussel cover showed higher cover in the low visitation sites. Human trampling and/or harvesting could potentially generate those patterns.

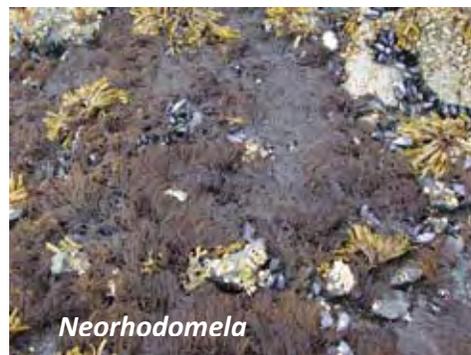


Mean percent cover of *Mytilus californianus* at the high and mid shore levels at the 6 study sites. Site code names are as in Fig. 4.

The average dissimilarity between high and low visitation sites in the low-mid shore level was the highest, 45.65%. As Table 3 shows, like in the mid-shore level, most of the species that drive the dissimilarity had higher abundances at the low visitation sites.

Table 3. Species that contributed most to the dissimilarity between high visitation and low visitation sites at the low-mid shore. Analysis was done on the three regions pooled. The higher values are highlighted in yellow.

Species	Low Visitation Abundance	High Visitation Abundance	% Contribution
Neorhodomela_Complex	0.89	3.9	9.36
Amphipod_Complex	0.15	1.76	5.01
Hedophyllum_sessile	2.61	1.08	4.83
Lottia_Complex	4.47	3.06	4.47
Mazzaella_flaccida	1.26	0.23	3.95
Erect_Corallines	2.94	2.25	3.36
Egregia_menziesii	0.9	0.4	3.2
Odonthalia_Complex	2.3	1.29	3.12
Idotea_sp.	0.66	1.54	3.11
Littorina_Complex	1.24	0.66	3.08
Mazzaella_splendens	2.71	2.22	2.88
Crustose_Corallines	3.16	2.54	2.83
Anthopleura_xanthogrammica	1.09	0.19	2.79
Phyllospadix_sp.	0.9	0	2.76
Dilsea_Complex	0.87	0.14	2.63
Cryptopleura_Complex	0.87	0.83	2.39
Chthamalus_sp.	1.21	0.58	2.37
Laminaria_sp.	0.35	0.77	2.29
Fleshy_Crusts	0.86	1.26	1.87
Mastocarpus_Complex	0.92	0.4	1.7
Plocamium_sp.	0.35	0.43	1.53
Nemertean_Complex	0.46	0.02	1.4
Ulva_Complex	0.31	0.71	1.39
Pisaster_ochraceus	0.45	0	1.38
Leathesia/Colpomenia	0	0.42	1.29
Balanus_nubilus	0.41	0	1.28
Katharina_tunicata	0.39	0.02	1.17
Lepidochiton_Complex	0.63	0.33	1.07
Osmundea_spectabilis	0.34	0	1.06
Flustrellidra_corniculata	0.38	0.13	1.04
Callithamnion_sp	0.37	0.21	1.03
Colonial_Tunicate_Complex	0.33	0	1.01
Sandy_Tube_Complex	0.35	0.14	0.95
Cirolana_harfordi	0.06	0.29	0.93
Ptilota_Complex	0.23	0.2	0.93
Anthopleura_elegantissima	0.46	0.68	0.92
Sponge_Complex	0.29	0	0.92
Endocladia_Complex	0.19	0.18	0.77
Tonicella_lineata	0.24	0	0.74
Microcladia_borealis	0.24	0.02	0.72

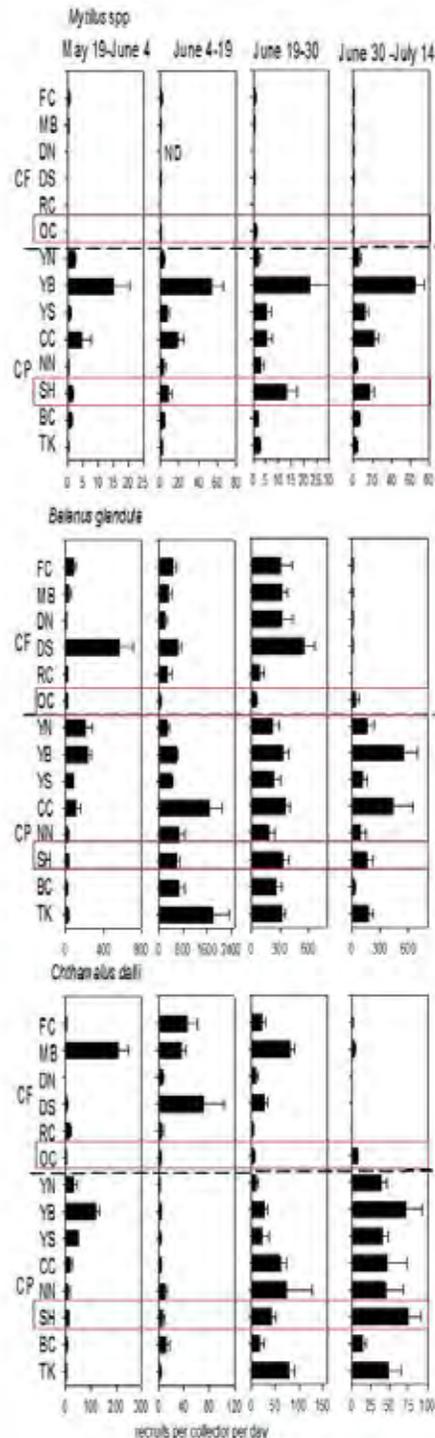


Appendix B: Biodiversity Survey

However, the two species complexes that contribute most to the dissimilarity (almost 15%), were the red algae *Neorhodomela* and amphipods, both of which were actually more abundant at the high visitation sites. *Neorhodomela* may be more resistant to trampling than other species at this zone and amphipods are small crustaceans that live in association with the algae, so it is likely that amphipod abundance responds to algal abundance.

Recruitment of mussels and barnacles

As part of this and another PISCO project, mussel and barnacle larval recruitment collectors were deployed at the mid shore level at OCN and SHS and additional 12 sites at Cape Foulweather (CF) and Cape Perpetua (CP). Sites at CF stretch from Fogarty Creek (FC) in the north to Otter Crest (OC= OCN) in the south. Sites in CP stretch from the northern part of the Yachats rocks (YN) to Tokatee Klootchman (TK) in the south. Collectors were deployed in mid May and replaced approximately every 2 weeks until the end of August. Figure 8 shows the recruitment patterns of *Mytilus* spp. (mussel recruits cannot be distinguished morphologically to species and therefore are pooled) and the two main intertidal barnacle species *Balanus glandula* and *Chthamalus dalli* over the first 4 sampling periods. The patterns demonstrate very high species-to-species, cape-to-cape, site-to-site and period-to-period variability in recruitment rates. Mussels recruited at much lower rates at CF vs. some sites at CP. The two barnacle species however seem to have had no consistent cape-to-cape patterns. Sometimes there was higher



recruitment at some sites at CF and at other times it was higher at sites at CP. In general however, Otter Crest North (OC) had low barnacle recruitment rates compared to other sites. Barnacles are important food source for other intertidal species and are also facilitators for the recruitment of other species such as mussels. The data thus suggest that at this site, relatively slow recovery rates (compared to many other sites) are expected if intense disturbance should occur there, because the supply of new young is low. Strawberry Hill South (SH) has intermediate mussel recruitment rates compared to other sites in CP. Barnacle recruitment at this site is highly variable in its ranking compared to other sites.

Summary

The results of the summer 2007 species inventory survey demonstrate the known high variability in biodiversity of rocky intertidal communities among sites at different State Park regions along the coast. The analysis comparing high and low visitation sites may indicate some human impacts on the structure of the communities, mostly at the higher shore levels. Only experimental research that includes monitoring of the community over time where humans are excluded from parts of the high visitation areas, or in controlled trampling experiments in low visitation areas, will allow us to draw more specific conclusions on this issue. Trampling effects have already been shown in Yaquina Head in central Oregon (Brosnan and Crumrine 1994) and many other regions around the world (Povey 1991, Fletcher and Frid 1996, Wynberg and Branch 1997, Keough and Quinn 1998, Brown and Taylor 1999, Schiel and Taylor 1999, Jenkins et al. 2002, Irvine 2005, Pinn and Rodgers 2005, Smith and Murray 2005, Casu et al. 2006, Van De Werfhorst and Pearse 2007). Other effects on community structure can, for example, be through disturbance (and thus reduction in abundance) of seabird activity that leads to changes in the trophic structure on the rocks (Lindberg et al. 1998). Following the communities surveyed during summer 2007 over time together with data collected on human visitation as well as other physical parameters would perhaps allow us to determine more clearly the direct impacts of humans on the shore (i.e., by trampling) and their indirect effects, for example through influences on climate change (e.g., changes in the upwelling regime, and increases in extreme storm activity that could increase disturbance to the shore and beach erosion). We hope that the surveys supported by OPRD in the next four years will help achieve that goal.

Acknowledgments

Many thanks to Justin Silbernagel and Kristen Lycett, two OSU undergraduate students, who conducted most of the field work. They went to the coast, rain or shine, and did the work with

dedication, enthusiasm and great scholarship. Thanks also to the PISCO OSU database manager, Mike Frenock, who helped develop the database and extracted from the huge database the appropriate data in the right format for analysis. Thanks as well to Laurel Hillman from OPRD for her help with selecting the sites, and for the moral support and for the human visitation data. This study was conducted with the support of a grant from Oregon Park and Recreation Department and could not have been conducted without the personnel and infrastructural support of the PISCO program that is funded by the Packard Foundation and the Moore Foundation.

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Abiotic Data from PISCO survey

Visitation	Site name	Site code	Zone	Bare_Primary_Rock	Bare_Secondary_Rock	Roughness	Sand	Verticality
Low	Otter_Crest_North	OCN1	High	11.07	0.4	1.4	71.3	1
High	Otter_Crest_South	OCS1	High	23.53	9.53	2.2	19	2.13
Low	Otter_Crest_Transect_North	OCTN1	High	3.67	1.2	2.6	50.7	2
High	Otter_Crest_Transect_South	OCTS1	High	6.87	1.07	2.47	14.4	3.13
High	Strawberry_Hill_North	SHN1	High	12.27	6.13	2.33	6	2.47
Low	Strawberry_Hill_South	SHS1	High	13.53	1.87	1.8	45.3	1.6
Low	Otter_Crest_North	OCN1	Low	24.13	0.13	2.33	75.3	1.33
High	Otter_Crest_South	OCS1	Low	5.2	3	2.2	0.33	1.6
Low	Otter_Crest_Transect_North	OCTN1	Low	4.67	1.8	2.07	0	1.33
High	Otter_Crest_Transect_South	OCTS1	Low	6.13	1.67	2.67	0	1.87
High	Seal_Rock_North	SRN1	Low	4.27	0	1.67	8.87	1.8
Low	Seal_Rock_South	SRS1	Low	8.87	4.4	1.67	8.4	1.87
High	Strawberry_Hill_North	SHN1	Low	7.33	6	2.73	32.7	2
Low	Strawberry_Hill_South	SHS1	Low	18.53	16.67	2.2	28.7	1.33
Low	Otter_Crest_North	OCN1	Low-Mid	9.53	7.6	2.87	2.67	1.73
High	Otter_Crest_South	OCS1	Low-Mid	9.93	6.8	2	48.4	1.4
High	Seal_Rock_North	SRN1	Low-Mid	16.07	15.2	1.4	56.4	1.33
Low	Seal_Rock_South	SRS1	Low-Mid	1.6	1.6	1.33	0	1.53
High	Strawberry_Hill_North	SHN1	Low-Mid	3.73	3.73	1.87	0	1.8
Low	Strawberry_Hill_South	SHS1	Low-Mid	3.93	3.93	1.13	0	1.55
Low	Otter_Crest_North	OCN1	Mid	11.07	11.07	1.67	0	1.47
High	Otter_Crest_South	OCS1	Mid	9.27	9.27	2.27	0.2	1.87
High	Seal_Rock_North	SRN1	Mid	5.07	5.07	1.53	0.8	1.6
Low	Seal_Rock_South	SRS1	Mid	17.93	17.93	1.67	0.07	1.53
High	Strawberry_Hill_North	SHN1	Mid	3.8	3.8	2.2	0.53	1.87
Low	Strawberry_Hill_South	SHS1	Mid	0.4	0.33	1.67	1.53	2

Appendix B: Biodiversity Survey

Mean Species Abundances from PISCO survey

Level	Site name	Code	Zone	<i>Acrosiphonia</i> sp.	<i>Ahnfeltia</i> fastigiata	<i>Alaria</i> marginata	Amphipod Complex	<i>Analphus</i> japonicus	<i>Anthopleura</i> elegantissima	<i>Anthopleura</i> xanthogrammica	<i>Balanus</i> glandula	<i>Balanus</i> nubilus
Low	Otter_Crest_North	OCN1	High	0	0	0	0	0	0	0	0.8	0
High	Otter_Crest_South	OCS1	High	0	0	0	0.13	3.87	0	0	2.93	0
Low	Otter_Crest_Tran_N	OCTN1	High	0.47	0	0	0	0.67	2.33	0	0.4	0
High	Otter_Crest_Tran_S	OCTS1	High	0	0	0	0.13	2.47	4.27	0	2.67	0
High	Strawberry_Hill_N	SHN1	High	0	0	0	0	0	0.27	0.2	31.33	0
Low	Strawberry_Hill_S	SHS1	High	0	0	0	0.07	0	0	0	9.8	0
Low	Otter_Crest_North	OCN1	Low	0.5	0	0.08	0.08	0	0.25	0.08	0	0
High	Otter_Crest_South	OCS1	Low	0.13	0.13	0	0.38	0	0	0	0	0
Low	Otter_Crest_Tran_N	OCTN1	Low	0	0	0	99.53	0	0.67	0	0.07	0
High	Otter_Crest_Tran_S	OCTS1	Low	0	0	0	2.33	0	0.8	0	0.27	0
High	Seal_Rock_North	SRN1	Low	0	1.47	0.33	0.93	0	1.13	0.13	0.53	0
Low	Seal_Rock_South	SRS1	Low	0	0.13	0	0.07	0	0.93	0.6	0	0
High	Strawberry_Hill_N	SHN1	Low	0	0.07	0	0	0	0.2	0.07	1	0
Low	Strawberry_Hill_S	SHS1	Low	0.07	0	0.07	0.07	0	0.73	1.07	0.6	0
Low	Otter_Crest_North	OCN1	Low-M	0	0	0	0	0	0.13	1	0	0.2
High	Otter_Crest_South	OCS1	Low-M	0	0	0	0.4	0.67	0.67	0	0	0
High	Seal_Rock_North	SRN1	Low-M	0	0	0	17.73	0.07	1.2	0.27	0.2	0
Low	Seal_Rock_South	SRS1	Low-M	0	0	0	0.4	0	0.6	2.47	0	1.87
High	Strawberry_Hill_N	SHN1	Low-M	0	0	0	6.53	0	1.07	0.4	0.73	0
Low	Strawberry_Hill_S	SHS1	Low-M	0.07	0	1	0.13	0	1.2	2.8	0.2	0
Low	Otter_Crest_North	OCN1	Mid	0	0	0	0.13	0.33	1.07	0.27	1.4	0
High	Otter_Crest_South	OCS1	Mid	0	0	0	0.33	0.87	2.4	0	1.4	0
High	Seal_Rock_North	SRN1	Mid	0	0	0	0	0	1.67	0.33	3.67	0
Low	Seal_Rock_South	SRS1	Mid	0	0	0	0	0	1.87	1.53	30.6	0.2
High	Strawberry_Hill_N	SHN1	Mid	0	0	0	0	0	3.67	0.67	25.67	0.2
Low	Strawberry_Hill_S	SHS1	Mid	0.07	0	0	0.07	0	0.47	1.93	9.8	0.13

Level	Site name	Code	Zone	<i>Bryozoan_Complex</i>	<i>Calcareous_Tube_Complex</i>	<i>Calliostoma_sp.</i>	<i>Callithamnion_sp.</i>	<i>Cancer_sp.</i>	<i>Chaetomorpha_sp.</i>	<i>Chthamalus_sp.</i>	<i>Cirolana_harfordi</i>	<i>Codium_fragile</i>
Low	Otter_Crest_North	OCN1	High	0	0	0	0	0	0	5	0	0
High	Otter_Crest_South	OCS1	High	0	0	0	0	0	0	13.27	0	0
Low	Otter_Crest_Tran_N	OCTN1	High	0	0	0	0	0	0	0.87	0.07	0
High	Otter_Crest_Tran_S	OCTS1	High	0	0	0	0	0	0	1.47	0.13	0
High	Strawberry_Hill_N	SHN1	High	0	0	0	0	0	0.47	0.47	0	0
Low	Strawberry_Hill_S	SHS1	High	0	0	0	0	0	0	6.53	0	0
Low	Otter_Crest_North	OCN1	Low	0.08	0.08	0.17	0.67	0	0	0	0	0
High	Otter_Crest_South	OCS1	Low	0	0.13	0	0	0	0	0	0	0
Low	Otter_Crest_Tran_N	OCTN1	Low	0	0	0	0	0	0.07	0	1.07	0
High	Otter_Crest_Tran_S	OCTS1	Low	0	0.27	0	0	0	0	0.2	0	0
High	Seal_Rock_North	SRN1	Low	0	0.13	0	0	0	0	0.8	0	0
Low	Seal_Rock_South	SRS1	Low	0	0.13	0	0	0	0	1.2	0	0
High	Strawberry_Hill_N	SHN1	Low	0.53	0.13	0	0	0	0	0.33	0	0
Low	Strawberry_Hill_S	SHS1	Low	6.07	0.27	0	0.07	0	0	0.27	0	0
Low	Otter_Crest_North	OCN1	Low-M	0	0.2	0	0.8	0	0	0.6	0	0
High	Otter_Crest_South	OCS1	Low-M	0	0.07	0	0	0	0	0.2	0	0
High	Seal_Rock_North	SRN1	Low-M	0.2	0.33	0	0.87	0	0	1.73	0	0.07
Low	Seal_Rock_South	SRS1	Low-M	0	0.07	0	0	0	0	2	0.2	0
High	Strawberry_Hill_N	SHN1	Low-M	0.33	0.13	0	0	0.07	0	0.73	1.4	0
Low	Strawberry_Hill_S	SHS1	Low-M	0.07	0.53	0	0.67	0	0.07	6.87	0	0
Low	Otter_Crest_North	OCN1	Mid	0	0	0	0.07	0	0	3.13	0	0
High	Otter_Crest_South	OCS1	Mid	0	0	0	0	0	0	4.07	0	0
High	Seal_Rock_North	SRN1	Mid	0	0	0	0	0	0	3.8	0	0
Low	Seal_Rock_South	SRS1	Mid	0	0	0	0	0	0	0.8	0	0
High	Strawberry_Hill_N	SHN1	Mid	0	0	0	0	0	0.07	0.2	0	0
Low	Strawberry_Hill_S	SHS1	Mid	0	0	0	0	0	0	0.53	0	0

Appendix B: Biodiversity Survey

Level	Site name	Code	Zone	<i>Codium setchellii</i>	<i>Colonial Tunicate Complex</i>	<i>Costaria costata</i>	<i>Crustose Corallines</i>	<i>Cryptopleura Complex</i>	<i>Cryptosiphonia woodii</i>	Diatoms	<i>Dilsea Complex</i>	<i>Diodora aspera</i>
Low	Otter_Crest_North	OCN1	High	0	0	0	0	0	0	0	0	0
High	Otter_Crest_South	OCS1	High	0	0	0	0	0	0	1.67	0	0
Low	Otter_Crest_Tran_N	OCTN1	High	0	0	0	1.73	0	0	0.33	0	0
High	Otter_Crest_Tran_S	OCTS1	High	0.2	0	0	24.47	0.2	0.07	1.47	0	0
High	Strawberry_Hill_N	SHN1	High	0	0	0	0	0	0	0	0	0
Low	Strawberry_Hill_S	SHS1	High	0	0	0	0	0	0	0	0	0
Low	Otter_Crest_North	OCN1	Low	0	0	0	9.92	15.42	0	12.5	0.25	0
High	Otter_Crest_South	OCS1	Low	0.38	0.25	0	23.13	0	0	0	0.13	0
Low	Otter_Crest_Tran_N	OCTN1	Low	0.07	0	0	8.4	0	0	0.67	0	0
High	Otter_Crest_Tran_S	OCTS1	Low	0	0	0	15.27	0.2	0	0	0	0
High	Seal_Rock_North	SRN1	Low	0	0.07	0	7.73	0.4	0	0	0	0
Low	Seal_Rock_South	SRS1	Low	0.53	0.93	0	12.27	0.67	0	1	0	0
High	Strawberry_Hill_N	SHN1	Low	0.73	0	0	23.27	0.07	0	2.53	0	0
Low	Strawberry_Hill_S	SHS1	Low	0	11.67	0.33	23.07	0.07	0	0.33	0	0
Low	Otter_Crest_North	OCN1	Low-M	0	0	0	19.33	4.73	0	0.8	0.33	0
High	Otter_Crest_South	OCS1	Low-M	0	0	0	35	0	0	0	0.53	0
High	Seal_Rock_North	SRN1	Low-M	0	0	0	3.87	1.2	0	0	0	0
Low	Seal_Rock_South	SRS1	Low-M	0	0.27	0.67	23.4	0.6	0	0	9.13	0
High	Strawberry_Hill_N	SHN1	Low-M	0	0	0	10.6	4.53	0	0	0	0
Low	Strawberry_Hill_S	SHS1	Low-M	0	1.13	0	25.33	0.47	0	0	0	0
Low	Otter_Crest_North	OCN1	Mid	0	0	0	11.67	0	0	0.67	2.67	0
High	Otter_Crest_South	OCS1	Mid	0	0	0	0	0	0	0	0	0
High	Seal_Rock_North	SRN1	Mid	0	0	0	0	0.2	0	0	0	0
Low	Seal_Rock_South	SRS1	Mid	0	0	0	0.07	0	0	0	0	0
High	Strawberry_Hill_N	SHN1	Mid	0	0	0	0	0	0	0	0	0
Low	Strawberry_Hill_S	SHS1	Mid	0	0	0	0	0	0	0	0	0

Level	Site name	Code	Zone	<i>Egria_menziesii</i>	<i>Endocladia_Complex</i>	<i>Epiactis_prolifera</i>	<i>Erect_Corallines</i>	<i>Fleshy_Crusts</i>	<i>Flustrellidra_corniculata</i>	<i>Fucus_sp.</i>	<i>Gymnogongrus_Complex</i>	<i>Halosaccion_glandiforme</i>
Low	Otter_Crest_North	OCN1	High	0	1.2	0	0	0	0	0	0	0
High	Otter_Crest_South	OCS1	High	0	0.33	0	0	0	0	0.93	0	0
Low	Otter_Crest_Tran_N	OCTN1	High	0	0	0	1.47	1.2	0	0	0	3.2
High	Otter_Crest_Tran_S	OCTS1	High	0	0.07	0	9.8	2.67	0	0	0	0.13
High	Strawberry_Hill_N	SHN1	High	0	2.2	0	0	0.6	0	0	0	0
Low	Strawberry_Hill_S	SHS1	High	0	1.87	0	0	0.07	0	0	0	0
Low	Otter_Crest_North	OCN1	Low	0	0	0.83	4	0.5	0	0	0	0
High	Otter_Crest_South	OCS1	Low	0	0.38	0	18.88	1	0	0	0	2.25
Low	Otter_Crest_Tran_N	OCTN1	Low	2	1.33	0	6.8	0.93	0	0	0	0.47
High	Otter_Crest_Tran_S	OCTS1	Low	0	0	0	13.8	0.2	0	0	0	0
High	Seal_Rock_North	SRN1	Low	0.67	0.07	0	2.73	5.53	0	0	0	0
Low	Seal_Rock_South	SRS1	Low	0	0	0	5.73	4.27	0.2	0	0	0
High	Strawberry_Hill_N	SHN1	Low	0	0	0	14.67	3.13	1.13	0	0.67	0.13
Low	Strawberry_Hill_S	SHS1	Low	1.6	0	0	19	0.47	1.27	0	0	0
Low	Otter_Crest_North	OCN1	Low-M	0	0	0	12.53	0.8	0	0	0	0
High	Otter_Crest_South	OCS1	Low-M	0	0.73	0	32.33	0.93	0	0	0	0.73
High	Seal_Rock_North	SRN1	Low-M	2.33	0	0	1.47	1.33	0	0	0	0
Low	Seal_Rock_South	SRS1	Low-M	0	0.2	0	19.6	1.87	0.67	0	0	0
High	Strawberry_Hill_N	SHN1	Low-M	0	0	0	9.4	8.8	0.47	0	0	0.07
Low	Strawberry_Hill_S	SHS1	Low-M	14.07	0.47	0	23.33	1.53	0.87	0	0	0
Low	Otter_Crest_North	OCN1	Mid	0	2.33	0	10.27	0.2	0	0	0	0.07
High	Otter_Crest_South	OCS1	Mid	0	0	0	0	0.07	0	0	0	0
High	Seal_Rock_North	SRN1	Mid	0	0.87	0	0	0.13	0	0	0	0
Low	Seal_Rock_South	SRS1	Mid	0.07	0	0	0.07	0.27	0	0	0	0
High	Strawberry_Hill_N	SHN1	Mid	0	0.27	0	0	0.13	0	0	0	0
Low	Strawberry_Hill_S	SHS1	Mid	0	0	0	0	0.13	0	0	0	0

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Level	Site name	Code	Zone	<i>Hedophyllum_sessile</i>	<i>Hemigrapsus_nudus</i>	<i>Hydrozoan_Complex</i>	<i>Idotea_sp.</i>	<i>Katharina_tunicata</i>	<i>Laminaria_sp.</i>	<i>Leathesia/Colpomenia</i>	<i>Lepidochiton_Complex</i>	<i>Leptasterias_hexactis</i>
Low	Otter_Crest_North	OCN1	High	0	0	0	0	0	0	0	0	0
High	Otter_Crest_South	OCS1	High	0	0	0	0	0	0	0	0	0
Low	Otter_Crest_Tran_N	OCTN1	High	0	0	0	0.53	0	0	0	0.47	0
High	Otter_Crest_Tran_S	OCTS1	High	0	0	0	0.27	0	0	0.33	0	0
High	Strawberry_Hill_N	SHN1	High	0	0	0	0	0	0	0	0	0
Low	Strawberry_Hill_S	SHS1	High	0	0	0	0	0	0	0	0	0
Low	Otter_Crest_North	OCN1	Low	1.08	0	0	0	0	2.67	0	0.25	0.08
High	Otter_Crest_South	OCS1	Low	0	0	0	0.63	0	2.38	1	0	0
Low	Otter_Crest_Tran_N	OCTN1	Low	0	0	0	0.4	0	0	0.73	0.13	0
High	Otter_Crest_Tran_S	OCTS1	Low	0	0	0	1.53	0	0	0.07	0	0
High	Seal_Rock_North	SRN1	Low	0	0	0	0.87	0	43	0.27	0.6	0
Low	Seal_Rock_South	SRS1	Low	0	0	1.07	0.4	0	62.33	0.87	0.2	0
High	Strawberry_Hill_N	SHN1	Low	7.67	0	0	0.8	0	13.13	0.07	0.13	0
Low	Strawberry_Hill_S	SHS1	Low	9.53	0	0	0	0	26.67	0	0.33	0.07
Low	Otter_Crest_North	OCN1	Low-M	19.87	0	0	0.07	0.67	0	0	1.2	0
High	Otter_Crest_South	OCS1	Low-M	0	0	0	1.47	0	4.87	0.53	0.33	0
High	Seal_Rock_North	SRN1	Low-M	3.53	0	0	5.67	0	0	0	0.8	0
Low	Seal_Rock_South	SRS1	Low-M	4.87	0	0	3.27	0.47	1.4	0	0.47	0.27
High	Strawberry_Hill_N	SHN1	Low-M	4.67	0	0	5.07	0.07	0.73	1.33	0.13	0
Low	Strawberry_Hill_S	SHS1	Low-M	19.6	0	0	0.6	0.33	0.2	0	1.07	0
Low	Otter_Crest_North	OCN1	Mid	0	0.13	0	0	0.2	0	0.07	0	0.07
High	Otter_Crest_South	OCS1	Mid	0	0	0	0.07	0	0	0	0	0
High	Seal_Rock_North	SRN1	Mid	0	0	0	0	0	0	0	0	0
Low	Seal_Rock_South	SRS1	Mid	0	0	0	0	0	0	0	0	0
High	Strawberry_Hill_N	SHN1	Mid	0	0	0	0	0	0	0	0	0
Low	Strawberry_Hill_S	SHS1	Mid	0	0	0	0.27	0	0	0	0	0

Level	Site name	Code	Zone	<i>Lessoniopsis_litoralis</i>	<i>Littorina_Complex</i>	<i>Lottia_Complex</i>	<i>Mastocarpus_Complex</i>	<i>Mazzaella_flaccida</i>	<i>Mazzaella_splendens</i>	<i>Microcladia_borealis</i>	<i>Mopalia_sp.</i>	<i>Mytilus_californianus</i>
Low	Otter_Crest_North	OCN1	High	0	127.2	89.33	0.33	0.27	0	0	0	8.27
High	Otter_Crest_South	OCS1	High	0	556.8	32.8	1.2	0.07	0	0	0	0.6
Low	Otter_Crest_Tran_N	OCTN1	High	0	2.53	93	0	0.07	4.8	0	0.07	0
High	Otter_Crest_Tran_S	OCTS1	High	0	19.4	507.2	0	0.33	0.13	0.73	0.2	0.2
High	Strawberry_Hill_N	SHN1	High	0	814.47	36.53	1.4	0	0	0	0	1.47
Low	Strawberry_Hill_S	SHS1	High	0	212.8	1.53	0.53	0	0	0	0	7.53
Low	Otter_Crest_North	OCN1	Low	0.42	0	0	3.58	0	8.58	0.33	0	0
High	Otter_Crest_South	OCS1	Low	0	20.25	9	4.88	0	8.5	0.13	0	0
Low	Otter_Crest_Tran_N	OCTN1	Low	0	1.8	7.93	0.2	0.07	3.33	0	0.07	0
High	Otter_Crest_Tran_S	OCTS1	Low	0	1.47	4.67	0	0	0.8	0	0	0
High	Seal_Rock_North	SRN1	Low	0	0	35.47	1.73	0	4.8	0	0.33	0
Low	Seal_Rock_South	SRS1	Low	0	0.13	2.47	2.41	0	1.67	0	0.23	0
High	Strawberry_Hill_N	SHN1	Low	0	6.87	9.27	0.53	0.07	16.13	0	0	0
Low	Strawberry_Hill_S	SHS1	Low	0	1.6	1.4	0.93	0	24.47	0.07	0	0
Low	Otter_Crest_North	OCN1	Low-M	0	5.2	80.67	2.07	29.73	12.07	0.53	0	0
High	Otter_Crest_South	OCS1	Low-M	0	0.4	20	0.93	0.87	28.33	0	0	0.07
High	Seal_Rock_North	SRN1	Low-M	0	0.07	7.4	0.53	0	5.2	0	0.47	0
Low	Seal_Rock_South	SRS1	Low-M	0	0.07	93.13	0.67	0.33	13.47	0	0.47	0.07
High	Strawberry_Hill_N	SHN1	Low-M	0	3.8	54.8	0.13	0.07	3.33	0.07	0	0.13
Low	Strawberry_Hill_S	SHS1	Low-M	0	5.27	86.73	2.07	0.07	16.8	0.33	0	0.2
Low	Otter_Crest_North	OCN1	Mid	0	0.4	156.27	0	0.6	0	0	0	65.87
High	Otter_Crest_South	OCS1	Mid	0	409.6	241.6	0.33	0	0	0	0	73.33
High	Seal_Rock_North	SRN1	Mid	0	273.6	82.87	0	0	0.07	0	0	69.27
Low	Seal_Rock_South	SRS1	Mid	0	71.53	282.2	0	0.07	0	0	0	48.67
High	Strawberry_Hill_N	SHN1	Mid	0	784.47	85	0.13	0	0	0	0	36.33
Low	Strawberry_Hill_S	SHS1	Mid	0	110.6	145.6	0.2	0	0	0.07	0	78.33

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Level	Site name	Code	Zone	<i>Mytilus trossulus</i> _Complex	<i>Nemertean</i> _Complex	<i>Neorhodomela</i> _Complex	<i>Nereid</i> _Complex	<i>Nucella canaliculata</i>	<i>Nucella emarginata/ostrea</i>	<i>Nudibranch</i> _Complex	<i>Odonthalia</i> _Complex	<i>Osmundea spectabilis</i>
Low	Otter_Crest_North	OCN1	High	0.33	0	0	0	0	0	0	0	0
High	Otter_Crest_South	OCS1	High	0.07	0	0	0	0	0	0	0	0
Low	Otter_Crest_Tran_N	OCTN1	High	0	0.07	0.07	0	0	0	0	0	0
High	Otter_Crest_Tran_S	OCTS1	High	0	0	0	0	0	0.07	0	0.73	0
High	Strawberry_Hill_N	SHN1	High	0	0	0.67	0	0	0.13	0	0	0
Low	Strawberry_Hill_S	SHS1	High	0	0	0	0	0	0.87	0	0	0
Low	Otter_Crest_North	OCN1	Low	0	0	5	0	0	0	0	3.33	1.67
High	Otter_Crest_South	OCS1	Low	0	0	0.13	0	0	0	0	35.38	0
Low	Otter_Crest_Tran_N	OCTN1	Low	0	0	37.13	0	0	0	0	1.93	0
High	Otter_Crest_Tran_S	OCTS1	Low	0	0.07	0	0	0	0	0	0.27	0
High	Seal_Rock_North	SRN1	Low	0	0	8.73	0	0.07	0.47	0	7.33	0
Low	Seal_Rock_South	SRS1	Low	0	0.33	0	0	0	0.2	0	13.73	0
High	Strawberry_Hill_N	SHN1	Low	0	0	0.2	0	0	0.2	0	7.6	0
Low	Strawberry_Hill_S	SHS1	Low	0	0.2	0.07	0	0	0.13	0	1.4	0
Low	Otter_Crest_North	OCN1	Low-M	0	1.4	5.27	0	0	0.2	0.07	9.8	0
High	Otter_Crest_South	OCS1	Low-M	0	0	27.4	0	0	0	0	1.6	0
High	Seal_Rock_North	SRN1	Low-M	0	0	81	0.2	0	0.07	0	6.87	0
Low	Seal_Rock_South	SRS1	Low-M	0.13	0.47	0	0.13	0	0.2	0	7.47	1.8
High	Strawberry_Hill_N	SHN1	Low-M	0	0.07	51.33	0	0	0.07	0	1.33	0
Low	Strawberry_Hill_S	SHS1	Low-M	0	0.13	1.27	0	0	0.27	0	9.87	0
Low	Otter_Crest_North	OCN1	Mid	0	0	0.2	0	0	7.07	0	1.53	0
High	Otter_Crest_South	OCS1	Mid	0	0	0	0	0	6.87	0	0	0
High	Seal_Rock_North	SRN1	Mid	0	0	0	0	0.13	18.07	0	0.07	0
Low	Seal_Rock_South	SRS1	Mid	0	0	0	0	4.07	32.47	0	0	0
High	Strawberry_Hill_N	SHN1	Mid	0	0	0.2	0	0.33	8.87	0	0.67	0
Low	Strawberry_Hill_S	SHS1	Mid	0	0	0.07	0	0.33	16.47	0	0	0

Level	Site name	Code	Zone	<i>Pachygrapsus crassipes</i>	<i>Pagurus hirsutiussculus</i>	<i>Peanut_Worm_Complex</i>	<i>Pelvetiopsis limitata</i>	<i>Phidiana crassicornis</i>	<i>Phyllospadix sp.</i>	<i>Pisaster ochraceus</i>	<i>Plocamium sp.</i>	<i>Pollicipes polymerus</i>
Low	Otter_Crest_North	OCN1	High	0	0	0	0	0	0	0	0	0.87
High	Otter_Crest_South	OCS1	High	0	0	0	0	0	0	0	0	0
Low	Otter_Crest_Tran_N	OCTN1	High	0	0.13	0	0.13	0	28.2	0	0	0
High	Otter_Crest_Tran_S	OCTS1	High	0	0.2	0	0	0	0.33	0	0.53	0
High	Strawberry_Hill_N	SHN1	High	0	0	0	13.13	0	0	0	0	0
Low	Strawberry_Hill_S	SHS1	High	0	0	0	76.67	0	0	0	0	0.13
Low	Otter_Crest_North	OCN1	Low	0	0	0	0	0	0	0.17	7.92	0
High	Otter_Crest_South	OCS1	Low	0	0.13	0	0	0	0	0	0	0
Low	Otter_Crest_Tran_N	OCTN1	Low	0	3.33	0	0	0	45.2	0	0	0
High	Otter_Crest_Tran_S	OCTS1	Low	0	0.93	0	0	0	99.27	0	0.8	0
High	Seal_Rock_North	SRN1	Low	0	0.4	0	0	0	0	0.07	0	0
Low	Seal_Rock_South	SRS1	Low	0	0.33	0	0	0	0	0.53	0	0
High	Strawberry_Hill_N	SHN1	Low	0	0.07	0	0	0	0	0.07	0	0
Low	Strawberry_Hill_S	SHS1	Low	0	0.07	0	0	0.07	0	0.33	0.33	0
Low	Otter_Crest_North	OCN1	Low-M	0.07	0	0.07	0	0	0	0.13	0.33	0
High	Otter_Crest_South	OCS1	Low-M	0	0	0	0	0	0	0	2.2	0
High	Seal_Rock_North	SRN1	Low-M	0	0.6	0	0	0	0	0	0.07	0
Low	Seal_Rock_South	SRS1	Low-M	0	0	0	0	0	12.8	0.47	1.13	0.13
High	Strawberry_Hill_N	SHN1	Low-M	0	0.07	0	0	0	0	0	0.07	0
Low	Strawberry_Hill_S	SHS1	Low-M	0	0.4	0	0	0	0.07	1.33	0	0
Low	Otter_Crest_North	OCN1	Mid	0	0	0	0	0	2.33	0.13	0.33	1.13
High	Otter_Crest_South	OCS1	Mid	0	0	0	0.47	0	0	0	0	0.2
High	Seal_Rock_North	SRN1	Mid	0	0.07	0	0	0	0	0	0	0.27
Low	Seal_Rock_South	SRS1	Mid	0	0	0	0	0	0	0	0	4.33
High	Strawberry_Hill_N	SHN1	Mid	0	0	0	0	0	0	0	0	0.47
Low	Strawberry_Hill_S	SHS1	Mid	0	0	0	0	0	0	0	0	3.6

Appendix B: Biodiversity Survey

Level	Site name	Code	Zone	<i>Polychaete</i> _Complex	<i>Polysiphonia</i> _Complex	<i>Porphyra</i> _sp.	<i>Prionitis</i> _Complex	<i>Ptilota</i> _Complex	<i>Pugettia</i> _sp.	<i>Sandy_Tube</i> _Complex	<i>Schizymenia</i> _Complex	<i>Semibalanus</i> _cariosus
Low	Otter_Crest_North	OCN1	High	0	0	0.13	0	0	0	0	0	3.93
High	Otter_Crest_South	OCS1	High	0	0	0.07	0	0	0	0	0	10.13
Low	Otter_Crest_Tran_N	OCTN1	High	0	0	4.2	0	0	0	0.07	0	0.4
High	Otter_Crest_Tran_S	OCTS1	High	0	0	3.07	0	0	0	0	0.2	0.67
High	Strawberry_Hill_N	SHN1	High	0	0	0	0	0	0	0	0	12.6
Low	Strawberry_Hill_S	SHS1	High	0	0	0	0	0	0	0	0	60
Low	Otter_Crest_North	OCN1	Low	0	5.83	0	0	0	0	0	0	0
High	Otter_Crest_South	OCS1	Low	0	0	0	0	0	0	0	0	0
Low	Otter_Crest_Tran_N	OCTN1	Low	0	0	4.33	0	0	0.2	0.07	0	0.07
High	Otter_Crest_Tran_S	OCTS1	Low	0	0.13	0.07	0	0	0.07	0	0	0.2
High	Seal_Rock_North	SRN1	Low	0	0	0	0	1.07	0	0.4	0	0.13
Low	Seal_Rock_South	SRS1	Low	0.07	0	0	0	2.27	0.2	0.73	0	0.07
High	Strawberry_Hill_N	SHN1	Low	0	0	0.07	0	17.73	0.07	0.27	0	0.2
Low	Strawberry_Hill_S	SHS1	Low	0	0	0	0	0	0.07	1.27	0.2	0
Low	Otter_Crest_North	OCN1	Low-M	0	0	0	0	0	0	0	0	0.27
High	Otter_Crest_South	OCS1	Low-M	0	0	0	0.2	0.53	0	0	0	0.07
High	Seal_Rock_North	SRN1	Low-M	0	0	0	0	0.2	0.07	0.2	0	0.33
Low	Seal_Rock_South	SRS1	Low-M	0	0	0	0	1	0	0.8	0	0.53
High	Strawberry_Hill_N	SHN1	Low-M	0	0	0.33	0.07	0	0	0.27	0	0.6
Low	Strawberry_Hill_S	SHS1	Low-M	0	0	0.13	0.33	0	0	0.6	0	0.8
Low	Otter_Crest_North	OCN1	Mid	0	0	0	0	0	0	0	0	9.6
High	Otter_Crest_South	OCS1	Mid	0	0	0	0	0	0	0	0	1.4
High	Seal_Rock_North	SRN1	Mid	0	0	0	0.07	0	0	0	0	14.4
Low	Seal_Rock_South	SRS1	Mid	0	0	0	0	0	0	0	0	21.67
High	Strawberry_Hill_N	SHN1	Mid	0	0	0	0	0	0	0	0	9.13
Low	Strawberry_Hill_S	SHS1	Mid	0	0	0	0	0	0	0	0	7.2

Level	Site name	Code	Zone	<i>Sponge Complex</i>	<i>Strongylocentrotus purpuratus</i>	<i>Styela montereyensis</i>	<i>Tegula funebris</i>	<i>Tonicella lineata</i>	<i>Ulva Complex</i>	<i>Unidentified Blade</i>	<i>Unidentified Crab</i>
Low	Otter_Crest_North	OCN1	High	0	0	0	0	0	3.93	0	0
High	Otter_Crest_South	OCS1	High	0	0	0	0	0	5.8	0	0
Low	Otter_Crest_Tran_N	OCTN1	High	0	0	0	4.4	0	55.27	0	0.6
High	Otter_Crest_Tran_S	OCTS1	High	0	0	0	1.13	0	15.6	0	0
High	Strawberry_Hill_N	SHN1	High	0	0	0	0	0	0.13	0	0
Low	Strawberry_Hill_S	SHS1	High	0	0	0	0	0	0	0	0
Low	Otter_Crest_North	OCN1	Low	0.42	17.92	0	0	0.08	0.33	0.25	0
High	Otter_Crest_South	OCS1	Low	0.13	0	0	0	0	2	0	0
Low	Otter_Crest_Tran_N	OCTN1	Low	0	0	0	2.53	0	0.27	0	0
High	Otter_Crest_Tran_S	OCTS1	Low	0	0	0	0	0	2.47	0	0.07
High	Seal_Rock_North	SRN1	Low	0.27	0	0	0	0.13	1.27	0	0
Low	Seal_Rock_South	SRS1	Low	0.47	0	0	0	0	0.33	0	0
High	Strawberry_Hill_N	SHN1	Low	0.2	0	0	0	0.07	1.47	0	0
Low	Strawberry_Hill_S	SHS1	Low	4.33	0	0.07	0	0	0.27	0	0
Low	Otter_Crest_North	OCN1	Low-M	0.67	0.47	0	0	0.33	0.27	0.07	0.07
High	Otter_Crest_South	OCS1	Low-M	0	0	0	0	0	1	0	0
High	Seal_Rock_North	SRN1	Low-M	0	0	0	0	0	0.47	0	0
Low	Seal_Rock_South	SRS1	Low-M	0.13	0.2	0	0.4	0.53	0.07	0	0.07
High	Strawberry_Hill_N	SHN1	Low-M	0	0	0	0	0	1.87	0	0
Low	Strawberry_Hill_S	SHS1	Low-M	0.27	0	0	0	0	0.87	0	0
Low	Otter_Crest_North	OCN1	Mid	0	0.4	0	0	0.07	0.27	0	0
High	Otter_Crest_South	OCS1	Mid	0	0	0	0	0	0	0.07	0
High	Seal_Rock_North	SRN1	Mid	0	0	0	0.07	0	0.27	0	0.07
Low	Seal_Rock_South	SRS1	Mid	0	0	0	0	0	0	0	0
High	Strawberry_Hill_N	SHN1	Mid	0	0	0	0	0	0.07	0	0
Low	Strawberry_Hill_S	SHS1	Mid	0	0	0	0.07	0	0	0	0.13

Appendix B: Biodiversity Survey

Otter Crest Tidepool Survey

		North				South				
		Quad:	1	2	3	4	5	6	7	8
Inverts	Urchins	<i>S. purpuratus</i>	273			253				
Inverts	Anemones	<i>A. elegantissima</i>		R	R		R	R	R	R
Inverts	Anemones	<i>A. xanthogrammica</i>	R		R	R	R	R	L	
Inverts	Anemones	<i>Epiactis prolifera</i>	R	R		R				
Inverts	Stars	<i>Pisaster ochraceus</i>	1	1		2				
Inverts	Chitons	<i>Hairy Chitons</i>						1	1	
Inverts	Chitons	<i>Smooth Chitons</i>	1	1						
Inverts	Chitons	<i>Tonicella lineata</i>	7			3				
Inverts	Crabs	<i>Cancer sp.</i>							1	
Inverts	Crabs	<i>Pagurus hir.</i>	9	9	2	45	6	5	5	8
Inverts	Crabs	<i>Pugettia sp.</i>		1	1			2		
Inverts	Polychaetes	Sandy Tubes	R							
Inverts	Polychaetes	Calcareous Tubes				R				
Inverts	Limpets	<i>Lottia Complex</i>	9	34		187		24	1	71
Inverts	Snails	<i>Littorina/Lacuna</i>						2		
Inverts	Snails	<i>Tegula funnebralis</i>	1	3		42	2			2
Inverts	Nudibranch	<i>Nudibranch Complex</i>	1							
Inverts	Sponge	<i>Sponge Complex</i>	R					R		
Inverts	Crabs	<i>Petrolisthes sp.</i>	2			1				
Inverts	Tunicate	Colonial Tunicate	R							
Inverts	Shrimp	<i>Shrimp Complex</i>	2							
Inverts	Isopod	<i>Idotea sp.</i>		1						
Inverts	Hydroid	<i>Hydroid Complex</i>						R		R
Inverts	Barnacle	<i>Semibalanus cariosus</i>					R			
Inverts	Barnacle	<i>Chthamalus sp.</i>								R
Inverts	Mussel	<i>Mytilus californianus</i>					R	R		
Algae	Greens	<i>Leathesia/Colpomenia</i>					R		R	R
Algae	Greens	<i>Ulva sp.</i>	R	R	R	R	R	R	R	R
Algae	Kelps	<i>Egregia menzessii</i>							L	
Algae	Branched Reds	<i>Microcladia borealis</i>							R	
Algae	Branched Reds	<i>Neorhodomela larix</i>				R	R		R	R

		Quad	1	2	3	4	5	6	7	8
Algae	Branched Reds	<i>Odonthalia Complex</i>	V	R		H				
Algae	Branched Reds	<i>Osmundea spectabilis</i>			R		R		R	
Algae	Branched Reds	<i>Plocamium sp.</i>					R	L	R	R
Algae	Branched Reds	<i>Polysiphonia Complex</i>		R		R		R		
Algae	Branched Reds	<i>Prionitis Complex</i>								
Algae	Branched Reds	<i>Ptilota/Neoptilota sp.</i>				R		R	R	
Algae	Red Blades	<i>Constantinea simplex</i>								
Algae	Red Blades	<i>Cryptopleura Complex</i>	R		R	R	R	R		
Algae	Red Blades	<i>Dilsea Complex</i>								
Algae	Red Blades	<i>Mastocarpus papillatus</i>					R		L	
Algae	Red Blades	<i>Mazzaella flaccida</i>	R							
Algae	Red Blades	<i>Mazzaella splendens</i>	R	L	R		L	R	R	
Algae	Other Reds	Corallines (erect)	R	L	M	L	V	L	V	V
Algae	Other Reds	Corallines (crust)	M	L	M	M	V	L	V	V
Algae	Other Reds	Fleshy Crusts		R		R	R			R
Algae	Other Reds	<i>Halosaccion glandiforme</i>	L	R	R					
Algae	Diatom	Diatoms	R							
Algae	Red Blades	Unidentified Red Blade		R						
Algae	Grass	<i>Phyllospadix sp.</i>		L	V	R	R	V	R	R
Algae	Kelps	<i>Analipus japonicus</i>		R						
Vertabrate	Fish	<i>Gunnel sp.</i>								X
Vertabrate	Fish	<i>Sculpin sp.</i>	X	X		X	XX	X	X	X
Other	Physical Measure	Maximum Length (m)	4.9	7.9	3.4	3.8	3.7	4.4	2.5	2.9
Other	Physical Measure	Maximum Width (m)	3	0.4	2.3	2.5	0.8	3.4	2.4	0.7
Other	Physical Measure	Maximum Depth (m)	0.3	0.1	0.2	0.3	0.2	0.3	0.2	0.2

R	Rare: 1-5%
L	Low: 5-20%
M	Medium: 20-50%
H	High: 50-80%
V	Very High: 80-100%