

# B. Oregon's Rocky Habitat

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## 1. Defining Oregon's Rocky Coast

Rocky habitats account for approximately 41% of Oregon's 362-mile coastline and 6% of the state's subtidal area. These areas include headlands, tidepools, rocky beaches and cliffs, as well as offshore rocks, islands, and reefs. Manmade rocky habitats (i.e. jetties, riprap, etc.) are not within the purview of the Rocky Habitat Management Strategy.

### a. Rocky Substrate Definitions

The rock in rocky habitat consists of geologic substrate comprised of:

- Bedrock, or
- megaclasts (rock >4 meters or ~13 feet in diameter), or
- rock fragments, boulders, or cobble which, individually, are greater than 64 millimeters (~2.5 inches) in diameter, or
- any combination of the above.<sup>6</sup>

The rocks can comprise the majority of the substrate surface, rise above the substrate surface, or in some cases be covered with a thin layer of sand or mud (e.g. in the case of some surfgrass beds, the surfgrass is anchored on rock but the presence of surfgrass can cause a thin layer of sand to be deposited on the rock, thus obscuring the rock from the view on the surface).

Rocky habitat consists of outcrops or deposits of the above-described materials either along the shoreline or in submerged areas. The individual rock structures or fragments within a rocky habitat area are often interspersed with gravel or sediment and overlain with biogenic habitat features. This creates a complex mix of substrate characteristics that all contribute to the form and function of the rocky habitat. Thus, rocky habitat can have non-rock (sand, gravel, biological) components. These habitats are variously referred to as rocky reefs, rocky banks, rocky beaches, rocky intertidal areas, rocky subtidal areas, boulder fields, rocky debris fields, benches, rock pavement, sea stacks, wash rocks, pinnacles, and many other names (see Figure 1).

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<sup>6</sup> Federal Geographic Data Committee. (2012). FGDC-STD-018-2012: Coastal and marine ecological classification standard. FGDC, Reston, VA.

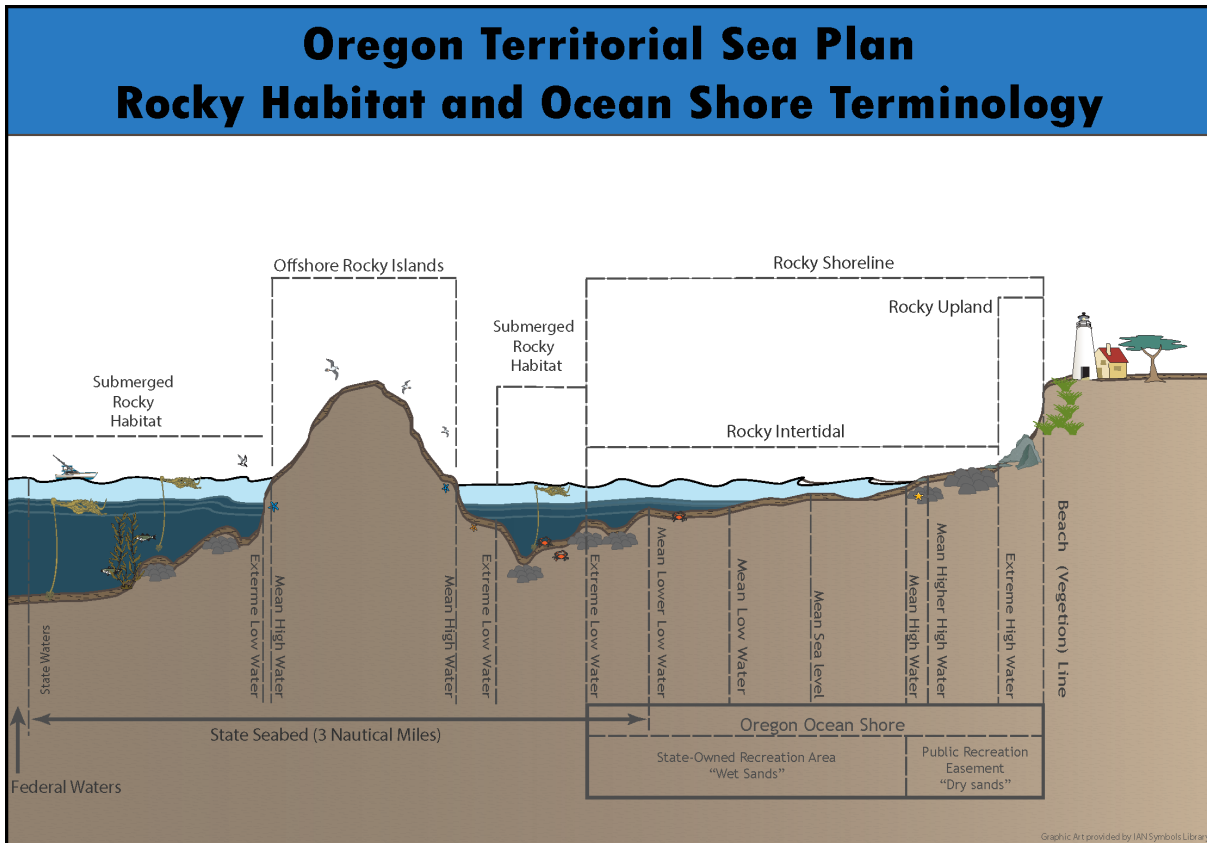


Figure 1. Rocky habitat and ocean shore terminology as defined by Oregon's Territorial Sea Plan.

## b. Rocky Habitat Type Classifications

To appropriately manage the resources within these rocky areas, the differences and similarities between the many rocky habitat types must be recognized. For the purpose of this management strategy, Oregon's rocky habitats are grouped into three major classifications based on proximity to shore, jurisdictional boundaries, and ecological zone (Figure 2). Within these main classifications, many other sub-classifications may be present including rocky intertidal and subtidal, cliffs, tidepools, etc. Additional descriptions of rocky habitat environments can be found in Appendix B.

- a. **Rocky Shoreline** – all rocky habitat between the statutory vegetation line described in ORS 390.770 and extreme low water (encompasses cliffs, tidepools, and rocky intertidal). These areas may be reached by foot from shore (regardless of hazard or convenience).
  - i. **Rocky Upland** – rocky habitat area between the statutory vegetation line and extreme high water line. In unvegetated areas, this is delineated at the 16-foot elevation contour.

- ii. Rocky Intertidal – rocky habitat area between extreme high water line and extreme low water line.
- b. Submerged Rocky Habitat – all rocky habitat below extreme low water, out to the deepest limits of the territorial sea. This area includes submerged rocky reefs, shallow rocky subtidal, and other submerged rocky habitats.
- c. Offshore Rocks and Islands – any rock or landform within the territorial sea separated from the mainland at mean high water which remains above the surface of the sea at mean high water<sup>7</sup>.

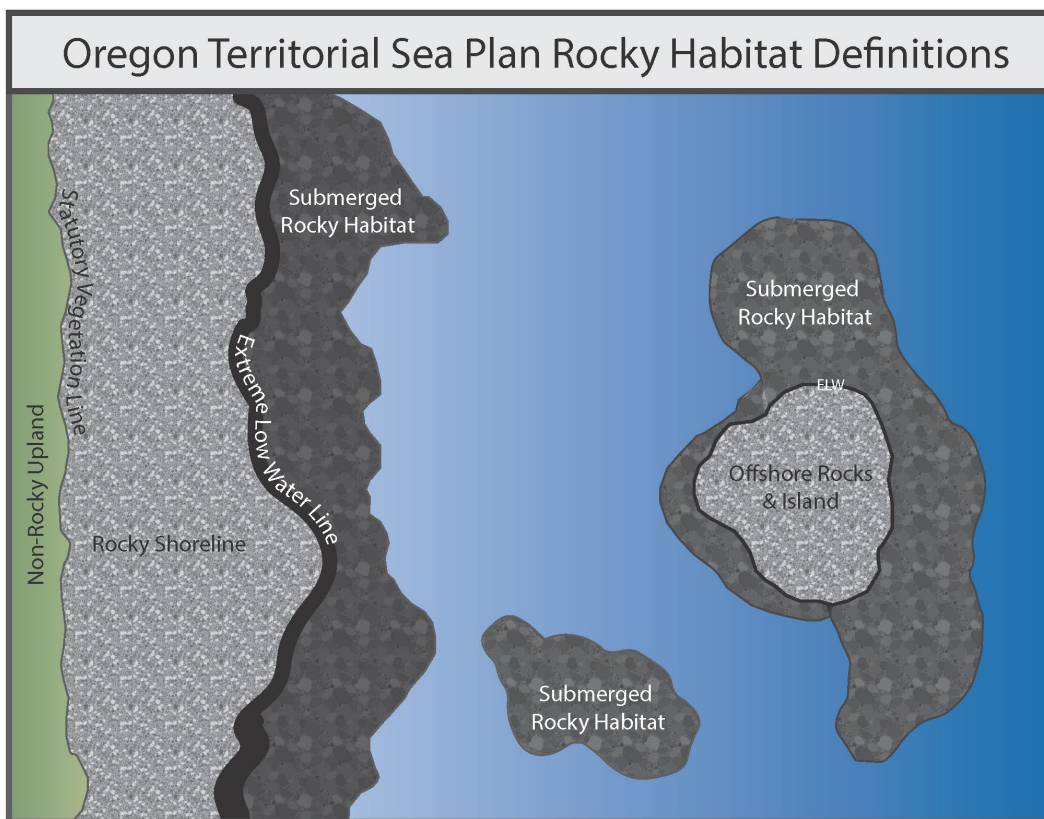


Figure 2. Idealized representation of different rocky habitats on the Oregon Coast.

<sup>7</sup> As defined by the U.S. Fish and Wildlife Service.

## 2. Setting Context

This section provides a contextual overview of some key factors that influence and shape rocky habitats along the Oregon Coast.

### a. Ocean Currents

Oregon's rocky coast is part of the California Current Large Marine Ecosystem (CCLME), an eastern boundary upwelling system situated at the land-sea interface. This dynamic system is responsible for making Oregon's broader territorial sea immensely productive, yet vulnerable to disturbance. Scientific study and exploration has taken place to better understand this system, yet the unique ocean currents, geology, and ecology of the area are still being actively investigated. More information is needed to build a better understanding of the system and potential impacts to the rich ecological and economic resources associated with the CCLME.

Oregon's coastal waters are part of the much larger CCLME oceanographic current system that connects cold subarctic waters from the Gulf of Alaska with tropical waters near the equator. The California Current is responsible for moving water southward along the Oregon Coast, while a deeper countercurrent, called the Davidson Current, moves water northward. In the most general sense, the California Current, along with seasonal northerly winds, are responsible for spring/summer deepwater upwelling in the narrow ribbon of sea along the coast<sup>8</sup>. This nutrient-rich upwelling water frequently leads to drastic increases in seasonal nearshore primary productivity, and provides a strong ecological basis for supporting the region's fertile coastal ecosystems and fisheries. Although this upwelling underpins seasonal productivity regimes in the nearshore environment, it also makes the Oregon Coast more vulnerable to hypoxic events, and exacerbates the impacts of ocean acidification. This risk is due to ongoing ocean deoxygenation associated with climate change and the naturally elevated carbon dioxide in the surfacing deep sea water. The addition of excess carbon dioxide being absorbed from the atmosphere results in decreased buffering capacity of the system to moderate primary productivity and respiration in these surface waters<sup>9</sup>. The impacts of climate change effects on the CCLME and Oregon's coastal waters are being actively

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<sup>8</sup> A wide array of characteristics may impact local and regional upwelling including bathymetry, terrestrial inputs, etc.

<sup>9</sup> Hypoxic conditions occur when oxygen levels in the water column become too low for marine life to survive, while ocean acidification describes a suite of changes in seawater carbon chemistry that may include a decrease in seawater pH, and can create conditions where marine organisms have difficulty forming calcium carbonate structures (e.g. shell material).

researched by scientists locally and around the world in order to better understand and predict impacts to marine resources.<sup>10</sup>

## **b. Geology**

Much like the ocean currents that support Oregon's coast, the region's rocky formations are also complex and have been evolving over geologic timescales. The prominent headlands that protrude into the sea along the coast, including Yaquina Head, Cape Lookout, and Seal Rock, are composed primarily of basalt. Many of the offshore rocks and islands in this area were once headlands that have since been eroded by wind and waves, leaving only the disconnected hard basalt islands behind. Some of the most iconic of these remnant structures include Haystack Rock (both Cannon Beach and Pacific City), Gull Rock, and Otter Rock.

The geomorphology changes as you move down the Oregon Coast. Cape Arago, south of Coos Bay on the south-central coast, is composed of uplifted and tilted sedimentary rock. South of the Coquille River, rocky headlands and offshore rocks are primarily composed of ancient metamorphic rock<sup>11</sup>. Although the coast has seen millennia of oceanographic processes, more episodic events have also helped to form the coast as we know it today. This has included the rise and fall of sea level, tectonic uplift and subsidence, and periodic earthquakes and tsunamis from the Cascadia subduction zone as well as distant faults.

## **c. Biology**

Oregon's rocky coast is home to uniquely adapted organisms that have evolved to live in the harsh environment on the border of land and sea. Rocky habitat plants and animals are often exposed to disturbances including high wave energy, changing water levels, freshwater inflow, and many others. Distribution of these organisms is often dependent on physical factors including temperature and exposure (to air, water, and sunlight), as well as biological factors such as predation and competition. These factors often help to characterize the rocky intertidal and subtidal into distinct zones. The zones are often based on dominant species such as mussels, barnacles, sea stars, anemones, urchins, and algae. These zones can also be used to define less common organisms such as nudibranchs, limpets, and sponges. Management pertaining to highly mobile species must also be considered in rocky habitats, including Pinnipeds

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<sup>10</sup> Acknowledgement – Ocean Currents section reviewed for accuracy by Dr. George Waldbusser (Oregon State University).

<sup>11</sup> Metamorphic features on the south coast have been dated to have been in the region for over 200 million years.

(seals and sea lions), Cetaceans (whales), marine fishes, and seabirds, which also utilize rocky habitats for feeding, reproduction, and protection.

An exhaustive list of rocky habitat organisms is outside the scope of this document, and species are actively being discovered and identified. The full scope of biological diversity living on or near Oregon's rocky coast is still not fully understood. Continued scientific study will reveal the magnitude of variety in this dynamic niche environment.

#### **d. Stressors & Sustainability**

The environment that sustains rocky habitats also makes the resources in these areas uniquely vulnerable to trampling, pollution, marine debris, and changing oceanographic conditions. The Rocky Habitat Management Strategy acknowledges the fragility of rocky habitat areas and is focused on promoting sustainable and adaptable management and conservation of rocky habitat areas and associated resources. Additionally, since these sensitivities and stressors may be increased by the effects of climate change, adaptive standards of protection for Oregon's marine resources are warranted and should be reviewed as more data and information is discovered about potential impacts.

As coastal populations increase and Oregon becomes a more popular tourist destination, concerns regarding degradation of coastal resources are becoming exacerbated. Although rocky intertidal organisms are adapted to living in a harsh and dynamic environment, they are also susceptible to human trampling, or impacts from pets and bicycles. As these areas become more accessible to foot traffic, visitor awareness of their impact on the ecosystem becomes increasingly important.

Recreational and commercial harvest of organisms, as well as collection of organisms for scientific and educational purposes, often raises concerns about overuse. Currently, harvest of rocky intertidal organisms is primarily recreational. Although there is little active commercial harvest of marine organisms in rocky intertidal areas, this strategy recognizes that harvest species and techniques are dynamic and the future may bring new commercial ventures and recreational harvest interests. Developing fisheries and plant harvest should be well-studied and understood, prior to the implementation of broad-scale open harvest, to avoid stress on the ecosystem and species.

More recently, the potential impacts of unmanned aerial vehicles (i.e. drones) have been recognized in rocky areas. Drones provide visitors a glimpse into rocky habitat areas never seen from public viewpoints, and help managing agencies to better understand areas with limited access. However, recreational drones may inadvertently disturb seabird colonies and Pinnipeds, possibly impacting reproductive success and animal health.

Oceanographic stressors, such as ocean acidification and hypoxia, disease outbreak, warming waters, and increased frequency of severe storms, will also have a growing

impact on rocky habitats. It is estimated that rocky habitats may be the first areas to see change due to these shifting regional and global trends. These changes may also increase opportunities for non-native and invasive species to colonize rocky habitat areas. Land-based runoff and pollution, along with marine debris can increase the susceptibility of rocky ecosystems to other stressors. The cumulative impact of these stressors can affect the ecological health of Oregon's iconic rocky areas.

This strategy encompasses a broad view of the entire Oregon Coast to provide a larger ecosystem context for meeting local management needs and setting priorities for action. An ecosystem-based approach is important due to the inherent interconnection between sites on the coast, as well as throughout the Pacific Ocean. The management and use of one site can affect the ecological function and resiliency of another site. This requires management actions to be scale-dependent, with applications ranging from site level, to the regional or coastwide scale.

### 3. Rocky Habitat Uses

#### a. Tribal Significance

Tribes all along the coast have origin stories, telling of the creation of the earth. While there is scientific evidence that can trace Tribal settlement to at least 15,000 years ago, Tribes recognize that they have occupied the land since time immemorial. Oregon's rocky habitats are unique features of history long predating European settlement. The tribes of Oregon have a meaningful connection to the rocky areas along the coast. Much like mudflats in estuaries, many rocky habitats were accessible areas where resources (such as shellfish and marine aquatic vegetation) could be gathered predictably. Additionally, these places are locations for ceremonies, traditional cultural practices, and a general sense of identity. The Rocky Habitat Management Strategy cannot begin to appropriately summarize the rich lineage of tribal use of the coast and traditional connection to rocky habitats. The appropriate tribes should be contacted to learn more about the individual cultural history surrounding these areas<sup>12</sup>. Additional information may be found in the Oregon Department of Education's *Essential Understandings of Native Americans in Oregon*<sup>13</sup>.

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<sup>12</sup> Visit the Legislative Commission on Indian Services to learn more about and get contact information for Oregon Tribes at: <https://www.oregonlegislature.gov/cis>

<sup>13</sup> Oregon Department of Education (n.d.) Essential Understandings of Native Americans in Oregon. Oregon Educator Network. <https://www.oregonednet.org/groups/sb-13-tribal-historyshared-history/resources/essential-understandings-native-americans-oregon>

## **b. Significance to Oregonians and Visitors**

Oregonians, as well as out-of-state visitors, continue to be attracted to the dynamic rocky habitats along the coast. These areas provide a variety of opportunities for different onlookers including tidepooling, SCUBA diving, harvesting, and wildlife viewing. These activities often provide a window into the sea where onlookers can learn firsthand about the exotic marine life hiding just below the water's surface. Even for those visitors unable to leave the pavement, Oregon's rocky coastline is often visually accessible from Highway 101, which runs parallel to much of the Oregon Coast, and includes a multitude of overlooks allowing drivers and cyclists to easily enjoy the inspiring views. Regardless of activity, visitors quickly find a place-based connection to the coastline and its diverse habitats and organisms, which has helped to shape Oregon's shared cultural values that are tied to the land, resources, and history of the coast.

Overall, the landscape of Oregon's rocky coast is one of tradition, recreation, discovery, inspiration, and learning. This strategy intends to honor the significance surrounding rocky habitat resources and to respect traditional uses in consultation with tribal partners.

## **c. Recreation**

Rocky habitat areas account for millions of annual visits to the Oregon Coast. Oregon's rocky habitats are a tremendous resource for recreation, exploration and hands-on, field-based learning, especially the easily accessible rocky intertidal areas (e.g. tidepools). Like sandy beaches, access to these rocky shoreline resources is critical to the bioregional identity of Oregonians. With ecotourism and experience-based vacations becoming more popular, the number of visitors to rocky coastal areas continues to increase along with the potential ecological impacts of recreation. This strategy recognizes that recreation in rocky habitat areas is critical to Oregonians and coastal economies. Balanced management is needed to ensure long-term stewardship of these important resources. The strategy further recognizes that it is the diversity of landscapes and natural resources that drives this strong recreational interest, supporting the need for a balanced approach.

Offshore rocky reefs contain some of Oregon's premier recreational fishing grounds in the territorial sea. Recreational fishers primarily target various rockfish species, lingcod, and cabezon on offshore reefs. Oregon's recreational charter boat industry also depends on healthy fish populations on these reefs. In addition to providing a recreational resource, these fisheries are essential to the coastal economy.



## **d. Research & Monitoring**

Credible information is necessary to prepare, carry out, and evaluate management programs. Oregon's coastal rocky habitats have long provided a location for scientific discovery and research. Research at rocky habitat sites has improved our understanding of marine environments and illuminated some of the defining ecological principles of marine ecosystems. Long-term monitoring in Oregon's rocky habitats has allowed us to better understand coastal ecosystems, and observe changes from natural and human-caused events, including climate change and ocean acidification.

This strategy recognizes that the key to effective assessment and adaptive management is active, responsive research and monitoring programs. The strategy encourages additional support for existing research and monitoring programs as well as the development of new programs capable of detecting and responding to rapidly emerging challenges.

## **e. Education**

For many Oregonians, exploring rocky shores is often the first and sometimes only place they may encounter the rich biodiversity of the Pacific Ocean. Providing a living classroom like no other marine ecosystem can, coastal rocky habitats inspire a sense of wonder and spark curiosity in children and adults alike.

The Oregon Coast has long supported the educational missions of schools, aquariums, universities, and life-long learners. Rocky habitats are living laboratories which host a suite of these institutions year-round. Educational programs directly aid the management efforts of these diverse and fragile rocky ecosystems by helping to instill knowledge and a stewardship ethic.

An informed citizenry, with a strong connection to and sense of personal stewardship of the resource, will be the most effective means of managing, protecting, and conserving Oregon's rocky habitat resources. The strategy supports education and interpretation initiatives that increase awareness of and engagement with marine resources.

Overall, this strategy recognizes that to meet increasing visitation and impact challenges in rocky habitat areas, a robust, coastwide awareness and engagement strategy is essential. This strategy encourages additional support for existing education and interpretation programs, as well as the development of new programs, as necessary.

## **f. Commercial Uses**

Oregon's offshore rocky reefs support vibrant commercial fisheries. The primary commercial fisheries occurring on offshore reefs in the territorial sea include the nearshore groundfish fishery and sea urchin fishery. The nearshore groundfish fishery

targets a number of rockfish species, kelp greenling, cabezon, and other rocky reef species. Fishermen sell the fish to both live fish and fresh fish markets. A number of other commercial fisheries occur in the territorial sea, but not necessarily on rocky reefs, including Dungeness crab, salmon, trawl-caught groundfish, and sardine. Commercial fisheries occurring in the territorial sea and beyond have long been an integral part of the fabric of Oregon coastal communities, and are critical to Oregon's coastal economy.

In contrast to the use of offshore rocky areas for commercial fishing, commercial harvest in rocky shoreline areas has historically focused around invertebrate fisheries, with mussels being the most common commercially harvested species over the past 30 years. Past commercial harvest has also included sea stars and other invertebrates for gift shops and the aquarium trade. Total harvest of invertebrates in rocky shoreline areas has decreased dramatically from 20,000–40,000 pounds per year in the early 1990s to <100–1,800 pounds per year since 2010. This strategy recognizes that adapting global markets and changing environments may ignite interest in the development of more substantial commercial ventures in these habitats. For example, recent interest in gooseneck barnacle harvest has initiated discussion of the needs required to manage a sustainable commercial fishery. Impacts of commercial harvest of rocky shoreline species, or use of the rocky habitats, requires an extensive understanding of potential risks and impacts to the ecosystem as a whole.