

# 1 NEARSHORE HABITATS

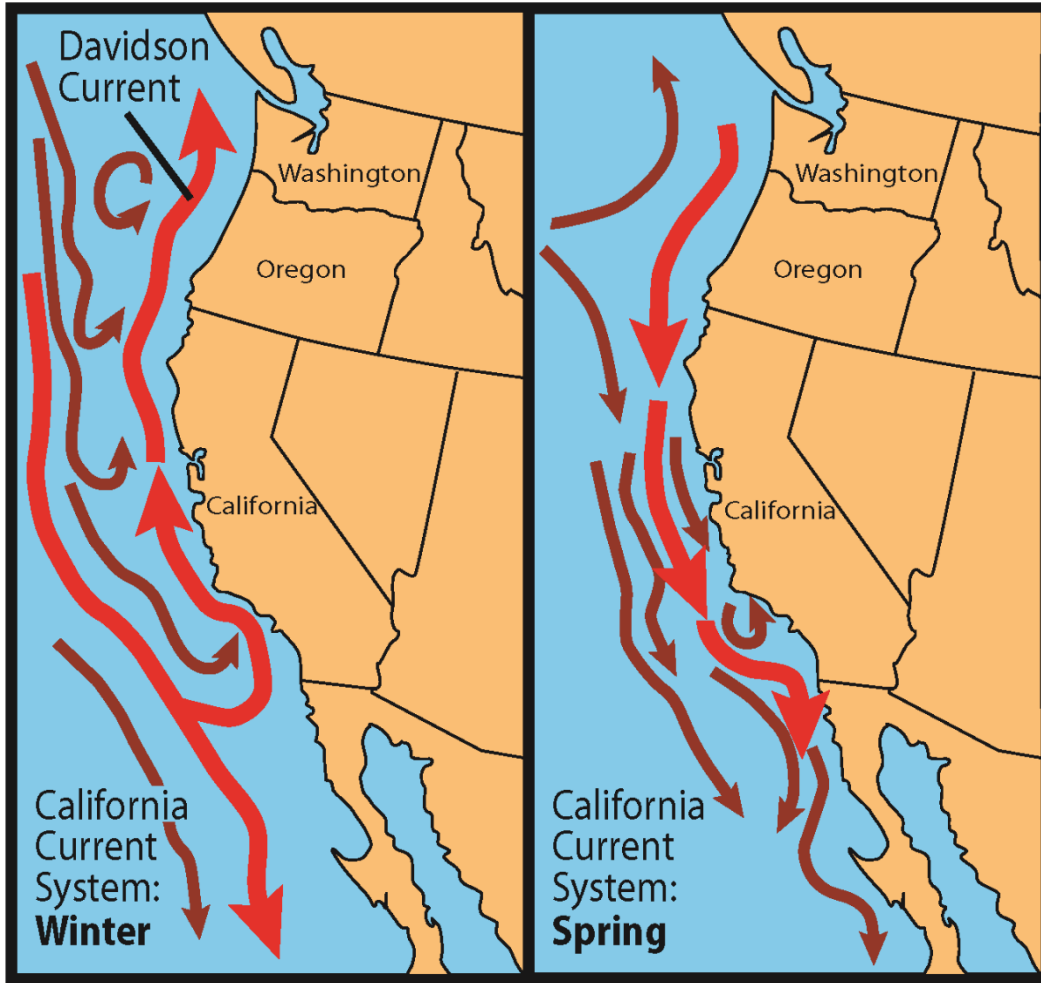
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3 The coastal and marine habitats described here encompass the area from the 3 nautical mile outer limit  
4 of Oregon’s territorial sea, where water depths average 66 m and range from 17 m to 194 m (56 to 308  
5 ft), to the supratidal areas of the shoreline affected by wave spray and overwash at extreme high tides  
6 and the portions of estuaries where species depend on the saline waters which enter from the Pacific  
7 Ocean. These are the waters and habitats that define the Nearshore ecoregion and are the focus of the  
8 SWAP. This chapter describes habitat classifications and the major habitat types found in Oregon’s  
9 nearshore, including: neritic, soft bottom subtidal, rocky subtidal, rocky shore, sandy shore and  
10 saltwater portions of estuaries. Riverine portions of estuaries are covered elsewhere.

## 11 12 *Oceanographic Context – the California Current System*

13 The distinct suite of oceanographic features and physical forcing agents that help define the Nearshore  
14 ecoregion include the northern portion of the California Current System and the annual seasonal  
15 upwelling/downwelling cycle that are responsible for its high productivity (Figures 6.1 and 6.2). The  
16 eastern boundary current called the California Current System is a part of the North Pacific gyre that  
17 moves cold water from the North Pacific toward the equator. It has a southward flowing current over  
18 Oregon’s shelf and slope and a northward flowing undercurrent over the slope in spring and summer. In  
19 winter, the current over the shelf consists primarily of the northward flowing Davidson current (Figure  
20 6.1).

21 During spring and summer, winds blowing from a northerly direction drive an upwelling system that  
22 brings cold, nutrient-rich, and oxygen-poor waters from depth up onto the continental shelf (Figure  
23 6.2a). The upwelling process is highly variable on many time scales and is generally stronger and more  
24 persistent on the south Oregon coast and more intermittent on the central and northern Oregon coast.  
25 In addition to nutrients derived from upwelling, river discharge from the Columbia River provides a  
26 major source of nutrients to the Oregon continental shelf, especially along the north coast. The  
27 upwelling and river-plume nutrients fuel high phytoplankton productivity which drives an extremely  
28 productive marine ecosystem off Oregon. In the fall and winter months winds blowing from a southerly  
29 direction cause seasonal downwelling that bring well oxygenated water from the surface downward in  
30 the water column (Figure 6.2b).

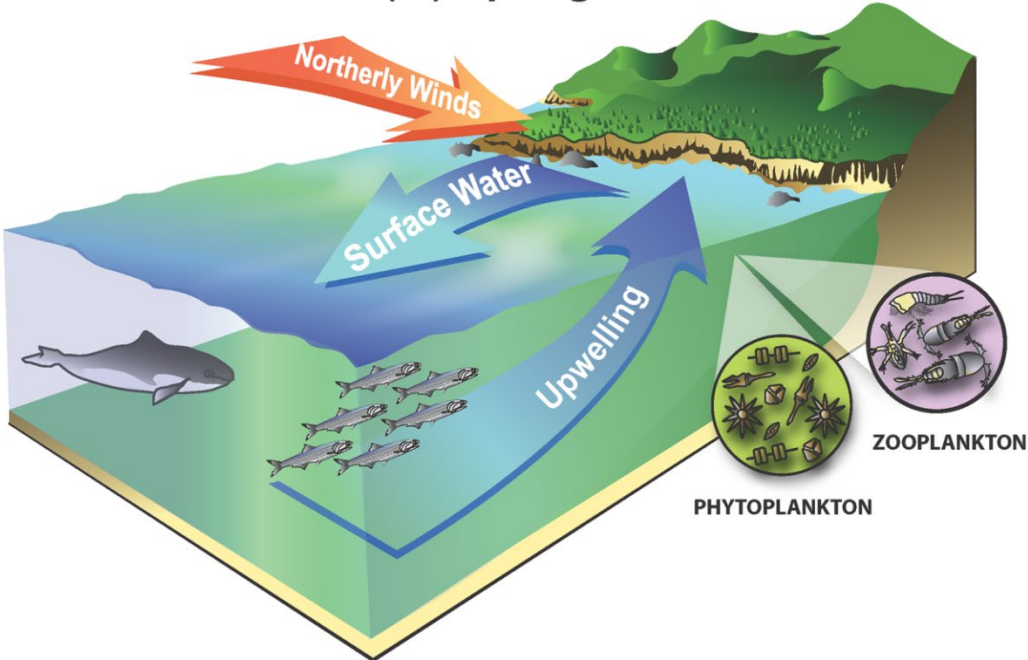
31 Superimposed on these large-scale processes are smaller scale eddies, gyres, fronts, and other  
32 oceanographic phenomena, which together serve to create a complex spatially and temporally dynamic  
33 ecosystem.



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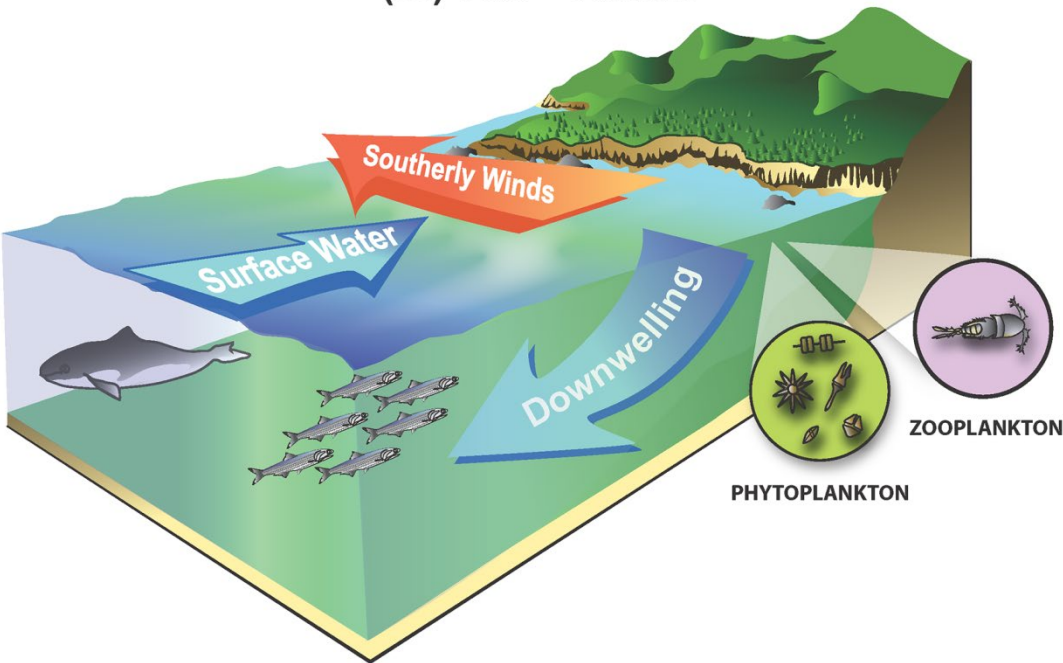
2 Figure 6.1. The California Current System typically varies seasonally. (Source P. T. Strub).

(a.) Spring - Summer



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(b.) Fall - Winter



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3 Figure 6.2. Annual seasonal cycle of spring-summer upwelling and fall-winter downwelling.

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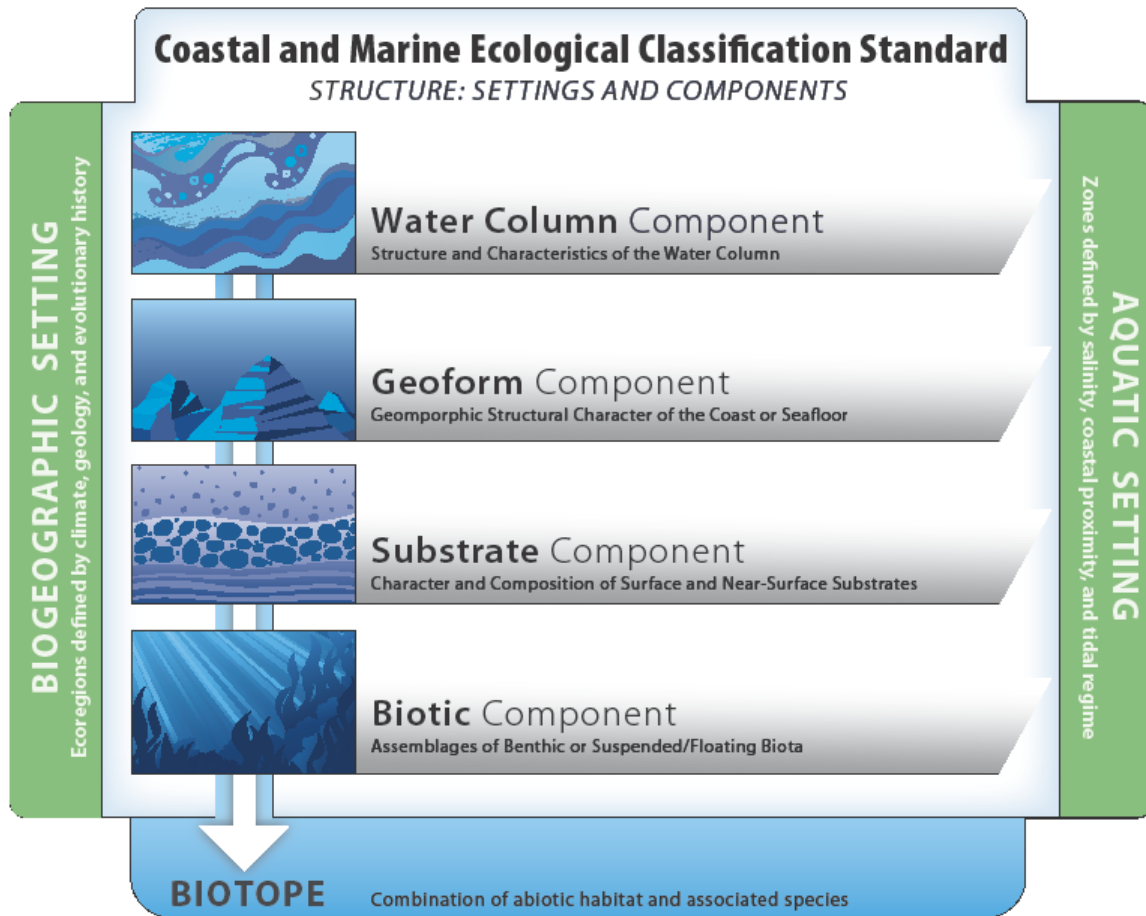
## 1 **CMECS Framework**

2 In 2012 the Coastal and Marine Ecological Classification Standard (CMECS) was adopted in the United  
3 States (Federal Geographic Data Committee 2012) as a means to provide a common framework for  
4 describing habitat, using a simple, standardized classification scheme and common terminology (Figure  
5 6.3). The goal of using CMECS is to both enhance scientific understanding and to advance ecosystem-  
6 based and place-based resource management through better communication. As the name implies,  
7 CMECS is increasingly being incorporated into scientific descriptions and being used in management  
8 documents. Components of the CMECS classification framework have been incorporated into the SWAP  
9 – in particular, the CMECS approach to evaluating and describing habitats.

10 The CMECS framework is flexible. It allows classification and description of habitat using one or both of  
11 its two broad based settings and one or more of its components. Not all settings or components need be  
12 used for all purposes. It is designed so that the components selected can effectively describe the  
13 ecological units observed to the level of detail needed by a broad range of users across a wide variety of  
14 spatial and temporal scales. The components utilized may vary depending on the objective, but the  
15 common system of standards provides comparability. For example, both anthropogenic and naturally-  
16 occurring physical structures in an environment are geoform components in CMECS. Geoform  
17 components describe the physical structure of the environment across spatial and temporal scales  
18 without affecting the larger classification of the system, subsystem, or zone. Biotopes, the combination  
19 of abiotic habitat and associated species in the CMECS framework have yet to be fully described for  
20 most coastal and marine waters in the U. S. including Oregon.

21 In 2024, the Pacific Marine & Estuarine Partnership (PMEP) launched the West Coast Estuary and  
22 Nearshore Habitat Viewer. This interactive mapping tool provides estuary and nearshore habitat data  
23 that were published at the time of tool development. Habitat data are classified to CMECS biotic habitat  
24 and substrate habitat components. The Viewer supports user-imported spatial data and online data for  
25 overlay analysis in support of resource management, habitat conservation and restoration. These very  
26 useful PMEP data products and applications for both estuarine and ocean waters off the west coast can  
27 be found and explored at <https://www.pacificfishhabitat.org/data>.

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2 **Figure 6.3. Overview of the Coastal and Marine Ecological Classification Standard framework (Source**  
3 **FGDC 2012).**  
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6 The Biogeographic Settings have a hierarchical structure composed of Realm, Province, and Ecoregion.  
7 The hierarchical structure of Aquatic Settings are composed of System, Subsystem and Tidal Range.  
8 Tables 6.1 and 6.2 provide the reader with an overview of the Biogeographic and Aquatic Settings for  
9 the species and their habitats in Oregon’s coastal and marine waters encompassed in the SWAP.

10  
11 The descriptions of familiar Nearshore habitats (below) will include some of the relevant CMECS  
12 components for each habitat described. Use of CMECS will evolve over time as it is put to more use and  
13 information that has been collected is put into the framework. This is a work in progress that is  
14 anticipated to benefit scientific research and monitoring efforts, management decisions and  
15 conservation efforts and actions over the decades to come.  
16

1 **Table 6.1. Overview of the hierarchical structure of the Biogeographic Setting for Oregon’s Coastal and Marine Habitats**

Hierarchical Level	Definition <sup>1</sup>	Oregon’s Coastal and Marine Habitats
Realm	Very large regions of coastal, benthic, or pelagic ocean across which biota are internally coherent at higher taxonomic levels, as a result of a shared and unique evolutionary history. Realms have high levels of endemism, including unique taxa at generic and family levels in some groups. Driving factors behind the development of such unique biota include water temperature, historical and broad scale isolation, and the proximity of the benthos.	Temperate Northern Pacific
Province	Large areas defined by the presence of distinct biota that have at least some cohesion over evolutionary time frames. Provinces will hold some level of endemism, principally at the level of species. Although historical isolation will play a role, many of these distinct biota have arisen as a result of distinctive abiotic features that circumscribe their boundaries. These may include geomorphological features (isolated island and shelf systems, semi-enclosed seas); hydrographic features (currents, upwellings, ice dynamics); or geochemical influences (broadest-scale elements of nutrient supply and salinity).	Cold Temperate Northeast Pacific
Ecoregion	Areas of relatively homogeneous species composition, clearly distinct from adjacent systems. The species composition is likely to be determined by the predominance of a small number of ecosystems and/or a distinct suite of oceanographic or topographic features. The dominant biogeographic forcing agents defining the eco-regions vary from location to location but may include isolation, upwelling, nutrient inputs, freshwater influx, temperature regimes, ice regimes, exposure, sediments, currents, and bathymetric or coastal complexity.	Oregon, Washington, Vancouver Coast and Shelf

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<sup>1</sup> The definitions in CMECS were drawn from Spalding et al. 2007.

1 **Table 6.2. Overview of the hierarchical structure of Aquatic Settings for Oregon’s Coastal and Marine habitats**

System	Subsystem	Tidal Range	Oregon’s Coastal and Marine Habitats <sup>2</sup>
<p><u>Marine</u><sup>3</sup></p> <p>Defined by salinity which is typically ~ 35 parts per thousand, but may vary considerably especially in areas near river mouths. Includes all non-estuarine waters from the coastline to the central oceans. The landward boundary of this system is either the linear boundary across the mouth of an estuary or the limit of the supratidal splash zone affected by breaking waves.</p>	<p><u>Offshore</u></p> <p>Extends from the 30 meter depth contour to the continental shelf break, which generally occurs between 100 - 200 meters depth.</p>	<p><u>Subtidal</u></p> <p>The substrate is continuously submerged in this zone and includes those areas below MLLW.</p>	<p>Neritic</p> <p>Rocky Subtidal</p> <p>Soft Bottom</p>
	<p><u>Nearshore</u></p> <p>Extends from the landward limit of the Marine System to the 30 meter depth contour.</p>	<p><u>Subtidal</u></p> <p>The substrate is generally continuously submerged in this zone and includes those areas below Mean Lower Low Water (MLLW).</p>	<p>Neritic</p> <p>Rocky subtidal</p> <p>Soft Bottom</p>
		<p><u>Intertidal</u></p> <p>The substrate is regularly and periodically exposed and flooded by tidal action. This zone extends from MLLW to Mean Higher High Water (MHHW).</p>	<p>Rocky Shores</p> <p>Sandy Beaches</p>
		<p><u>Supratidal</u></p> <p>This zone includes areas above MHHW that are affected by wave splash and overwash but does not include areas affected only by wind-driven spray. This zone is subjected to periodic high wave energy, exposure to air, and often to variable salinity.</p>	<p>Rocky Shores</p> <p>Sandy Beaches</p>

<sup>2</sup> The habitats identified here are described and classified by additional Water Column, Geofom and/or Substrate Components.

<sup>3</sup> The Oregon Ocean Management Plan established that the marine interest of Oregon and its citizens extends to seaward to the continental margin which includes the Offshore and portions of the Oceanic CMECS subsystems, which fall outside the focus of the Nearshore Strategy which focuses on species and habitats within the Oregon Territorial Sea.

System	Subsystem	Tidal Range	Oregon's Coastal and Marine Habitats <sup>2</sup>
<p><u>Estuarine</u><sup>4</sup></p> <p>The Estuarine System is defined by salinity and geomorphology. This System includes tidally influenced waters that (a) have an open-surface connection to the sea, (b) are regularly diluted by freshwater runoff from land, and (c) exhibit some degree of land enclosure. The Estuarine System extends upstream to the head of tide and seaward to the mouth of the estuary. Head of tide is identified as the inland or upstream limit of water affected by a tide of at least 0.2 foot (0.06 meter) amplitude. The mouth of the estuary is defined by an imaginary line connecting the seaward-most points of land that enclose the estuarine water mass at MLLW. Islands are included as headlands if they contribute significantly to the enclosure.</p>	<p><u>Estuarine Open water</u></p> <p>The Estuarine Open Water Subsystem includes all waters of the Estuarine System with a total depth greater than 4 meters, exclusive of those waters designated Tidal Riverine Open Water.</p>	<p><u>Estuarine Open Water Subtidal</u></p> <p>The substrate is generally continuously submerged in this zone and includes those areas below MLLW.</p>	Estuaries
	<p><u>Estuarine Coastal</u></p> <p>The Estuarine Coastal Subsystem extends from the supratidal zone at the land margin down to the 4 meter depth contour in waters that have salinity greater than 0.5 (during the period of average annual low flow).</p>	<p><u>Estuarine Coastal Subtidal</u></p> <p>The substrate is generally continuously submerged in this zone and includes those areas below MLLW.</p>	Estuaries
		<p><u>Estuarine Coastal Intertidal</u></p> <p>The substrate in this zone is regularly and periodically exposed and flooded by tides. This zone extends from MLLW to MHHW. The Coastal Intertidal is exposed regularly to the air by tidal action.</p>	Estuaries
		<p><u>Estuarine Coastal Supratidal</u></p> <p>This zone includes areas above MHHW; areas in this zone are affected by wave splash and overwash. It does not include areas affected only by wind-driven spray, which may extend further inland.</p>	Estuaries

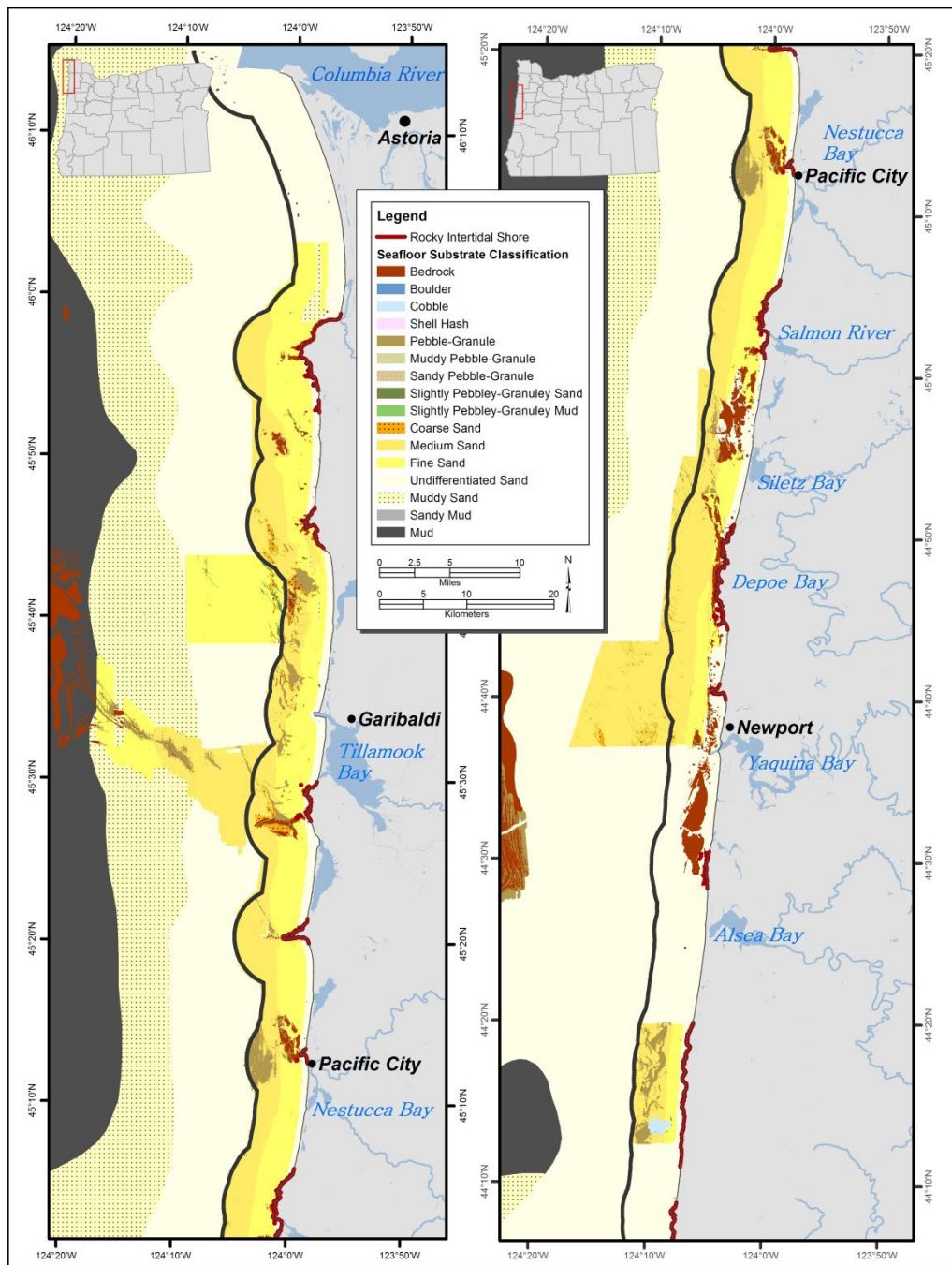
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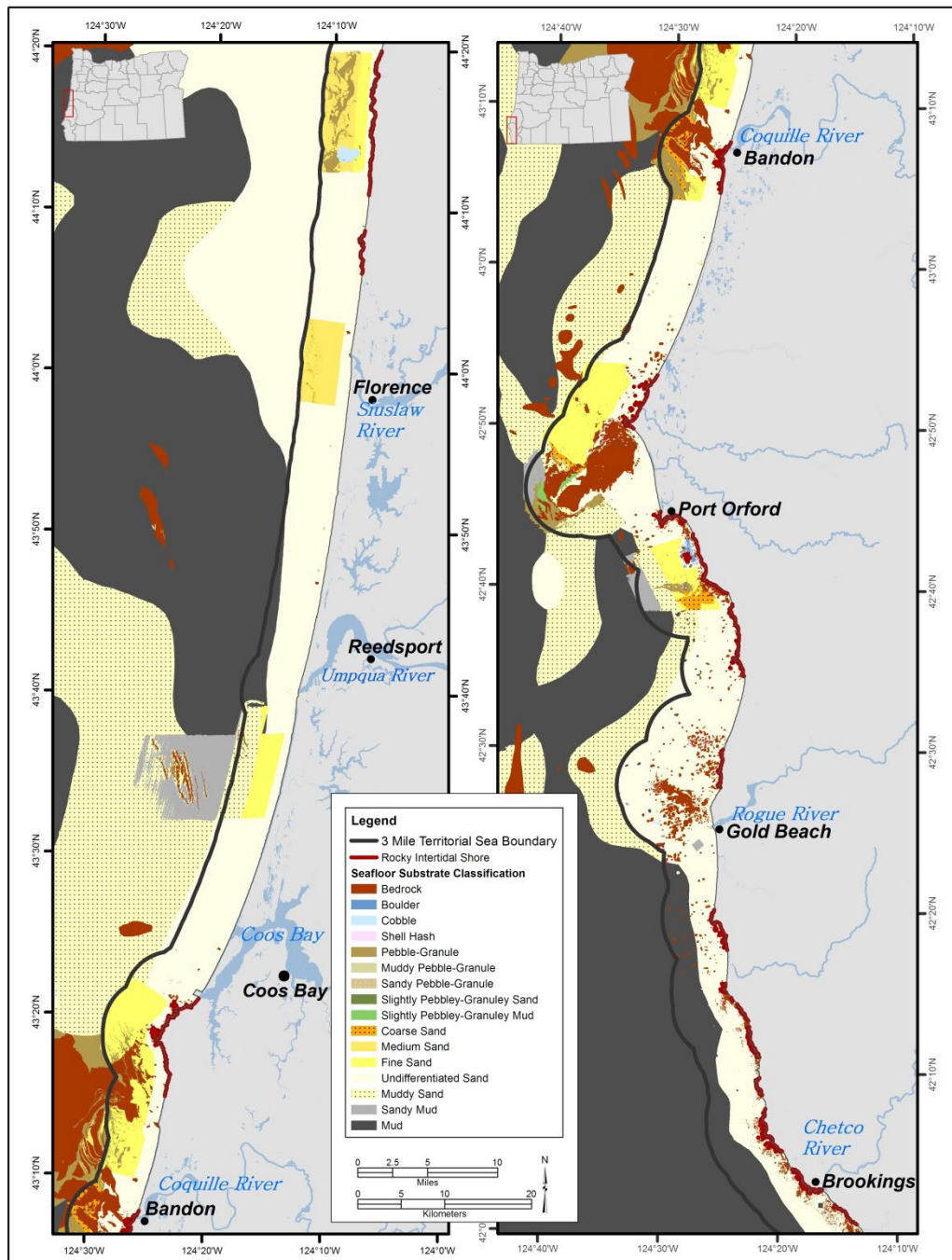
<sup>4</sup> The Riverine Open Water and Riverine Coastal subsystems are parts of the Estuarine Strategy Habitat not addressed in this document. Although these subsystems are critically important to the ecology of estuaries, they are not the primary habitat for the species covered here. Riverine portions of estuaries are addressed in Estuary Strategy Habitat section of the Oregon Conservation Strategy.

1 ***Nearshore Habitat Mapping***

2 Seafloor mapping data, collected using modern high-resolution sonar technologies, now cover  
3 approximately 53% of Oregon’s Territorial Sea. This is a major improvement from the approximately 6%  
4 of the Territorial Sea that had been mapped with these advanced technologies, when the original  
5 Nearshore Strategy was published in 2006. Habitat maps using these new data and the CMECS substrate  
6 classification have been created (Figures 6.4a and 6.4b) and are a significant improvement over previous  
7 maps. The areas that have now been mapped were chosen strategically and include almost all of  
8 Oregon’s rocky subtidal reefs. Similarly, recent mapping efforts have updated previous estuary maps  
9 completed in the 1970’s with more recent data and have started to map some of the CMECS  
10 components (see the estuaries section of this chapter).



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 2 **Figure 6.4a. North Oregon coast bottom substrates in marine system. Note that several abrupt**  
 3 **boundaries evident on the map are artifacts of surveys locations not abrupt substrate changes.**



1  
 2 **Figure 6.4b. South Oregon coast bottom substrates in marine system. Note that several abrupt**  
 3 **boundaries evident on the map are artifacts of surveys locations not abrupt substrate changes.**

1 ***Species-Habitat Associations***

2 Habitat associations for Nearshore SGCN, Watch List Species, and commonly associated species are  
3 identified to provide insight into the biological communities affiliated with specific habitats. This  
4 combination of abiotic habitat information and their associated species will help define the CMECS  
5 biotopes (areas of uniform environmental conditions, habitat, and assemblages of animals and plants)  
6 for Oregon’s coastal and marine environment.

7 Habitat association matrices for specific life history stages of SGCN provide information about the  
8 distribution of these species in the Nearshore (Table 6.3). SGCN that have any part of their life history  
9 commonly occur in a specific habitat are included in the species-habitat association. Readers should  
10 assume that information provided on species-habitat associations is based on published literature for  
11 the west coast of the U. S. and may or may not specifically be known for Oregon. However, there is  
12 Oregon-specific information available for many species such as cabezon (Figure 6.5). General habitat  
13 association matrices for Watch List Species and commonly associated species can be found in Appendix  
14 E and F, respectively.

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17 **Figure 6.5. Cabezon in subtidal rocky reef habitat. Photo NOAA.**

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1 Table 6.3. Species of Greatest Conservation Need habitat usage, by life history phase: Adult (A), Spawning/Mating (S/M), Eggs/Parturition (E/P),  
 2 Larvae (L), Juveniles (J)

3 NOTE: This table will need to be updated once Species of Greatest Conservation Need are finalized but has proposed species.  
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SGCN	Rocky Shore	Sandy Beach	Rocky Subtidal	Soft Bottom Subtidal	Neritic	Estuarine	Habitat Unknown	Comments
<b>Birds</b>								
<b>Black brant</b> <i>Branta bernicla nigricans</i>						A		Estuaries used by wintering and staging adults; feeds on marine and estuarine vegetation.
<b>Black oystercatcher</b> <i>Haematopus bachmani</i>	A, S/M, J	A, S/M, J				A, J		Breeding pairs use same territory over many years; feeds on small mollusks and invertebrates. Nests primarily above the supratidal zone on both islands and rocky headlands.
<b>California brown pelican</b> <i>Pelecanus occidentalis californicus</i>					A			Breeds and nests near coast but not in nearshore area. Feeds primarily on small marine fish.
<b>Cassin's auklet</b>	S/M, J				A			Nests in small burrows on offshore islands. Adults feed on zooplankton and dive to depths of at least about 100 feet.
<b>Caspian tern</b> <i>Hydroprogne caspia</i>		A, S/M, J			A	A, S/M, J		Forages in bays and estuaries for fish. Nests on estuarine islands.

SGCN	Rocky Shore	Sandy Beach	Rocky Subtidal	Soft Bottom Subtidal	Neritic	Estuarine	Habitat Unknown	Comments
<b>Fork-tailed storm petrel</b> <i>Oceanodroma furcata</i>	S/M, J				A			Breeds and nests in rocky cliffs or sandy burrows primarily on offshore islands. Forages at ocean surface.
<b>Leach's storm petrel</b> <i>Oceanodroma leucorhoa</i>	S/M, J				A			Breeds and nests on offshore islands. Forages by hovering or skimming over water; feeds primarily on small crustaceans.
<b>Marbled murrelet</b> <i>Brachyramphus marmoratus</i>					A			Nests inland in old growth forests. Forages by diving; feeds on small fishes.
<b>Rock sandpiper</b> <i>Calidris ptilocnemis</i>	A, J					A, J		Forages in nearshore waters during winter.
<b>Tufted puffin</b> <i>Fratercula cirrhata</i>	S/M, J				A			Winters at sea, spends spring and summer months in the nearshore; nests on coastal headlands and offshore islands.
<b>Western snowy plover</b> <i>Charadrius alexandrinus nivosus</i>		A, S/M, J						Resident or short-ranged migrant.
<b>Fishes</b>								
<b>Big skate</b> <i>Raja binoculata</i>				A, S/M, E/P, J				Soft seafloor spawning habitat. May be affected by wave energy development.
<b>Brown rockfish</b> <i>Sebastes auriculatus</i>			A, S/M, E/P, J			A, S/M, E/P, L, J		

SGCN	Rocky Shore	Sandy Beach	Rocky Subtidal	Soft Bottom Subtidal	Neritic	Estuarine	Habitat Unknown	Comments
<b>Cabezon</b> <i>Scorpaenichthys marmoratus</i>	J		A, S/M, E/P, J		L, J	A, S/M, E/P, L, J		
<b>Chinook salmon</b> <i>Oncorhynchus tshawytscha</i>			A		A, J	A, J	A, J	Anadromous; substantial data gaps regarding habitat usage in nearshore waters; sometimes caught near rocky reefs and in open neritic waters.
<b>Chum salmon</b> <i>Oncorhynchus keta</i>					A, J	A, J	A, J	Anadromous; substantial data gaps regarding habitat usage in nearshore.
<b>Coastal cutthroat trout</b> <i>Oncorhynchus clarkii clarkii</i>					A, J	A, J	A, J	Anadromous; substantial data gaps regarding habitat usage in nearshore waters.
<b>Coho salmon</b> <i>Oncorhynchus kisutch</i>					A, J	A, J	A, J	Anadromous; substantial data gaps regarding habitat usage in nearshore waters.
<b>Green sturgeon</b> <i>Acipenser medirostris</i>	A		A	A	A	A, S/M, E/P, L, J		Northern DPS listed as species of concern. Uses all nearshore waters and estuaries. Most marine-oriented of sturgeon species.
<b>Eulachon</b> <i>Thaleichthys pacificus</i>					A, L, J	A, S/M, E/P, L, J		Anadromous; spawn in fresh water. Also school offshore.
<b>Longfin smelt</b> <i>Spirinchus haleichthys</i>					A, J	A, S/M, E/P, L, J		Anadromous; spawn in fresh water. Also school offshore.

SGCN	Rocky Shore	Sandy Beach	Rocky Subtidal	Soft Bottom Subtidal	Neritic	Estuarine	Habitat Unknown	Comments
<b>Northern anchovy</b> <i>Engraulis mordax</i>					A, S/M, E/P, L, J			Pelagic forage fish; commonly found in nearshore kelp beds and bays.
<b>Pacific lamprey</b> <i>Entosphenus tridentatus</i>							A	Anadromous. Requires fine gravel beds in freshwater for spawning. Gaps in knowledge of habitats used in marine life history phase.
<b>Pacific sand lance</b> <i>Ammodytes personatus</i>				A	A	A, S/M, E/P, L, J		Live from the intertidal area to at least depths of 330 feet. Can bury into soft bottom substrates. Ecologically important forage fish.
<b>Pacific sardine</b> <i>Galeorhinus galeus</i>					A, S/M, E/P, L, J			Pelagic forage fish ecologically important. Known for boom and bust population cycles.
<b>Surf smelt</b> <i>Hypomesus pretiosus</i>		S/M, E/P		S/M	A, L, J	A		Extremely specialized habitat requirements for spawning beaches (temperature for substrate and air, light). Intertidal spawning habitat on beaches.
<b>Soupin shark</b> <i>Sardinops sajax</i>					A		J	Soupin sharks make extensive migrations as adults, but habitat use for all life stages is not well known, but females occur here based on tagging studies. Mating and pupping thought to occur off California.

SGCN	Rocky Shore	Sandy Beach	Rocky Subtidal	Soft Bottom Subtidal	Neritic	Estuarine	Habitat Unknown	Comments
<b>Western river lamprey</b> <i>Lampetra aryesii</i>							A	Anadromous. Movements and habitat use of adult life stage for the approximately 10 weeks they are in marine habitats are poorly understood, but thought to be limited to nearshore and estuarine areas.
<b>White sturgeon</b> <i>Acipenser transmontanus</i>				A		A, L, J		Anadromous. Movements in marine habitats poorly understood.
<b>Yelloweye rockfish</b> <i>Sebastes ruberrimus</i>			A, E/P, J				S/M, L	Will inhabit artificial reefs. Juvenile usage of nearshore.
<b>Invertebrates</b>								
<b>Blue mud shrimp</b> <i>Upogebia pugettensis</i>						A, S/M, J		Marine water dependent estuarine species.
<b>California mussel</b> <i>Mytilus californianus</i>	A, S/M, J		A, S/M, J		E/P, L			Rocky intertidal, pilings.
<b>Dungeness crab</b> <i>Cancer magister</i>		A, E/P, J		A, S/M, E/P, J	L	A, S/M, J		Oceanic conditions linked to larval survival. Will inhabit pilings.
<b>Flat abalone</b> <i>Haliotis walallensis</i>			A, E/P, J		S/M, E/P, L			Rocky subtidal, gaps in life history knowledge.
<b>Native littleneck clam</b> <i>Leukoma staminea</i>	A, J	A, J		A, J	S/M, E/P, L	A		Marine water dependent estuarine species. Distinct from introduced Manila littleneck clam ( <i>Venerupis philippinarum</i> ).

SGCN	Rocky Shore	Sandy Beach	Rocky Subtidal	Soft Bottom Subtidal	Neritic	Estuarine	Habitat Unknown	Comments
<b>Morning sun star</b> <i>Solaster dawsonii</i>			A	A	S/M, E/P, J			Usually found on rocky surfaces once settled from the water column but can be found on other bottom types.
<b>Ochre sea star</b> <i>Pisaster ochraceus</i>	A, J		A, J		S/M, E/P, L	A		Rocky intertidal and subtidal. Keystone species. Recent population decline due to sea star wasting syndrome.
<b>Pinto abalone</b> <i>Haliotis kamtschatkana</i>	A, E/P, J		A, E/P, J		S/M, E/P, L			Rocky intertidal and subtidal habitat near kelp.
<b>Razor clam</b> <i>Siliqua patula</i>		A, J		A, J	S/M, E/P, L			Susceptible to disease and natural events such as El Niño. Increased occurrence of closures due to domoic acid concentrations in recent years.
<b>Red abalone</b> <i>Haliotis rufescens</i>	A, E/P, J		A, E/P, J		S/M, E/P, L			Do not mate at northern end of range (Cape Argo, OR).
<b>Red sea urchin</b> <i>Mesocentrotus franciscanus</i>	A, J		A, J		S/M, E/P, L			Adjacent to kelp forest habitat.
<b>Rock scallop</b> <i>Crassadoma giganteus</i>	A, S/M, J		A, S/M, J		S/M, L, J		E/P	Will inhabit pilings and jetties.

SGCN	Rocky Shore	Sandy Beach	Rocky Subtidal	Soft Bottom Subtidal	Neritic	Estuarine	Habitat Unknown	Comments
<b>Striped morning star</b> <i>Solaster stimpsoni</i>	A		A		S/M, E/P, J			Usually live on rocky surfaces once settled from water column, but occasionally found in low intertidal zone.
<b>Sunflower star</b> <i>Pycnopodia helianthoides</i>			A	A	S/M, E/P, J			Wide ranging habitats primarily subtidal once settled out from the water column. Keystone predator.
<b>Algae and Plants</b>								
<b>Bull kelp</b> <i>Nereocystis luetkeana</i>			A, S/M, E/P, J		S/M, E/P			Shallow subtidal. Reproduce by spores, with alternating generations.
<b>Native eelgrass</b> <i>Zostera marina</i>				A, S/M, E/P, J	S/M, E/P	A, S/M, E/P, J		Angiosperm. Shallow estuarine and marine waters with muddy or sandy bottoms. Requires clear waters.
<b>Sea palm</b> <i>Postelsia palmaeformis</i>	A, S/M, E/P, J				S/M, E/P			Mid to low intertidal. Reproduce by spores, with alternating generations.
<b>Surf grass</b> <i>Phyllospadix spp.</i>	A, S/M, E/P, J				S/M, E/P			Low intertidal and shallow subtidal. Areas exposed to high wave action. Angiosperm.
<b>Marine Mammals</b>								

SGCN	Rocky Shore	Sandy Beach	Rocky Subtidal	Soft Bottom Subtidal	Neritic	Estuarine	Habitat Unknown	Comments
<b>Gray whale</b> <i>Eschrichtius robustus</i>			A, J	A, J	A, J			Mating and parturition occurs within lagoons in Baja California. Feed in soft bottom. Animals from Pacific coast feeding group summer in OR waters will also feed on zooplankton near rocky reefs.
<b>Harbor porpoise</b> <i>Phocoena phocoena</i>				A	A, S/M, E/P, J		A, S/M, E/P, J	
<b>Humpback whale</b> <i>Megaptera novaeangliae</i>					A, J			Make extensive migrations, with mating and birthing occurring outside OR waters.
<b>Killer whale</b> <i>Orcinus orca</i>					A, S/M, E/P, J	A, J	A, S/M, E/P, J	Southern resident DPS have been tracked in OR waters.
<b>Northern elephant seal</b> <i>Mirounga angustirostris</i>		A, S/M, E/P, J	A, J		A, J	A		Mating and parturition is on sandy beaches. In OR pups have been born at Cape Arago.
<b>Pacific harbor seal</b> <i>Phoca vitulina</i>	A, J	A, S/M, E/P, J	A, J		A, S/M, J	A, S/M, E/P, J		
<b>Sea otter</b> <i>Enhydra lutus</i>			A	A	A	A		Not currently a resident reproductive population in OR waters, but sightings of individuals have occurred in these habitats.
<b>Marine Reptiles</b>								

SGCN	Rocky Shore	Sandy Beach	Rocky Subtidal	Soft Bottom Subtidal	Neritic	Estuarine	Habitat Unknown	Comments
<b>Leatherback sea turtle</b> <i>Dermochelys coriacea</i>					A			Makes extensive migrations, with Nearshore OR waters designated as critical habitat for foraging adults.

1

## 1 ***Neritic Habitat (Open Water)***

2 The neritic habitat includes the waters and biological communities living in the water column over the  
3 continental shelf. The neritic habitat is characterized by CMECS as including the nearshore and offshore  
4 marine subsystems, and includes the surface, upper water column, pycnocline, and lower water column  
5 layers. Neritic habitat also occurs beyond the planning area, westward to deeper oceanic habitats that  
6 start at the continental shelf break at approximately the 200 m depth contour. The waters of the neritic  
7 habitat are in constant motion. The California Current System, seasonal upwelling and downwelling, El  
8 Niño/La Niña events and changes in the Pacific Decadal Oscillation are all examples of physical events  
9 that move the waters in this habitat over varying time scales. The water is replaced many times over  
10 during an average human lifetime. The setting for the CMECS biotic component of this habitat is  
11 planktonic biota and the plankton varies with the water mass. The ecology of the neritic habitat is  
12 affected by processes taking place at scales varying from global to local. The dynamics of the neritic  
13 habitat affect all of the other habitats described later in this section.

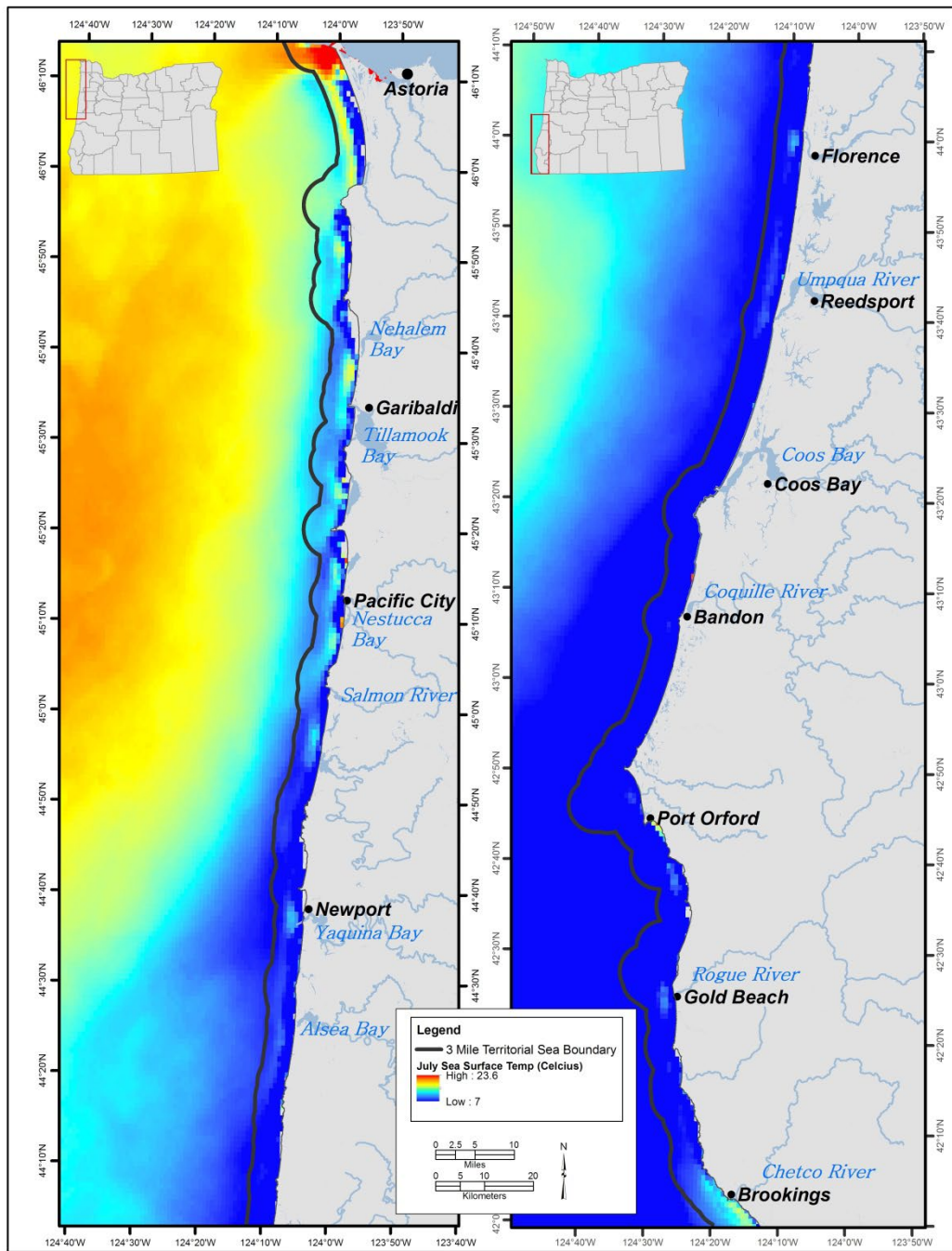
### 14 Physical Environment

15 Many physical and chemical environmental factors affect neritic ecology. These factors include but are  
16 not limited to solar light and radiation influence, salinity, temperature, layer position, physical mixing,  
17 hydrostatic pressure, biogeochemical composition, atmospheric exposure and influence, surface and  
18 underwater currents, swells, waves, and water mass movements. Many of these factors can change by  
19 location and time of year. The neritic habitat encompasses many water column habitats that shift,  
20 expand, and contract over time and space in both predictable and stochastic patterns.

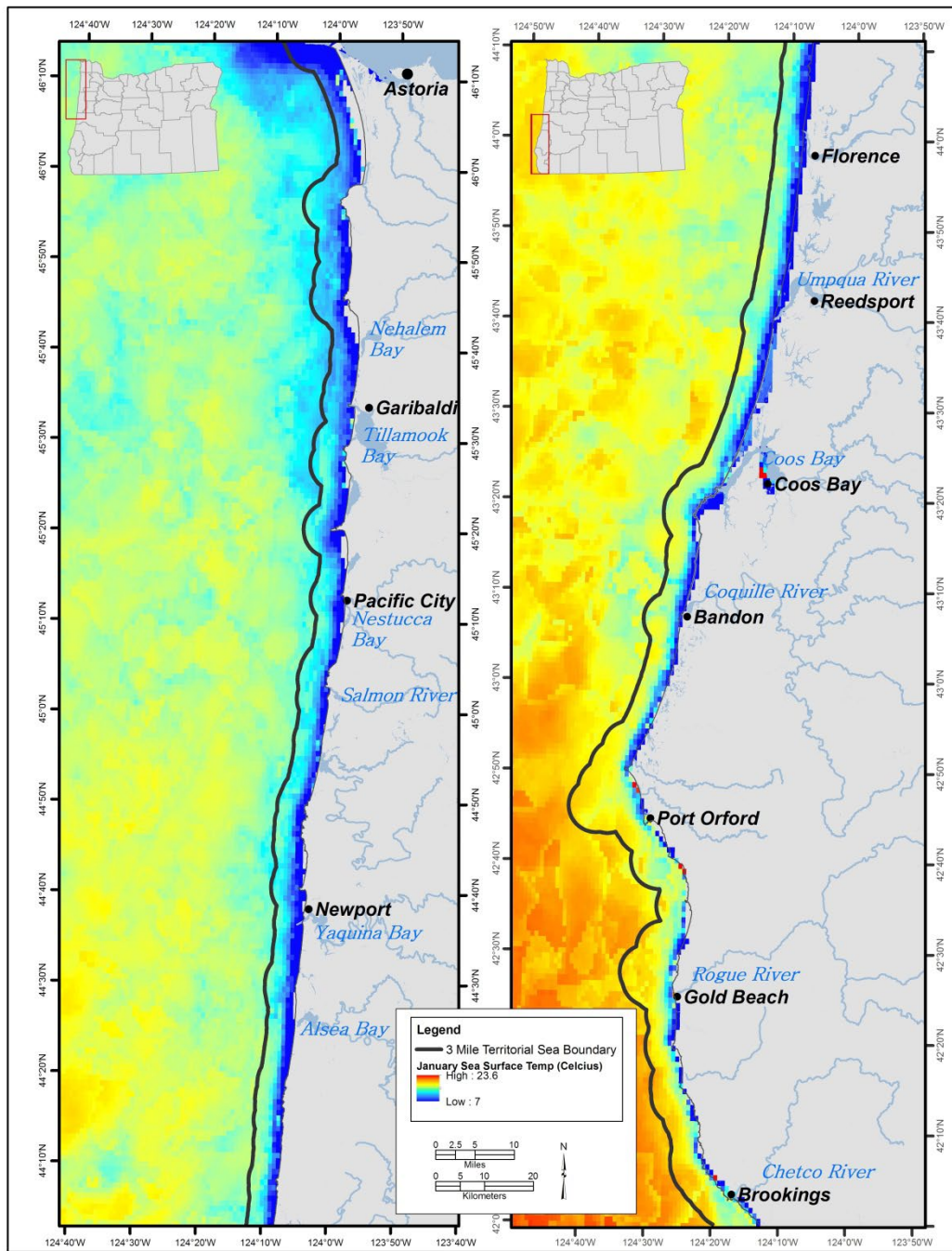
21  
22 Coastal upwelling is perhaps the most defining feature of Oregon's neritic habitat with its alternating  
23 upwelling-relaxation events. Upwelling is a water column hydroform, described by CMECS as an  
24 upwardly-directed current caused by divergence of water masses. In spring and summer months, strong  
25 northerly winds push surface and upper water layers westward towards the deep ocean. This movement  
26 causes deep, cold, oxygen-poor but nutrient-rich waters to rise to the surface near the coast replacing  
27 the water that was driven offshore. These nutrients, brought to the upper layers of the water column,  
28 help propagate and sustain the rich biota of Oregon's coastal waters. The relaxation events, when the  
29 northerly winds briefly cease or reverse, allow the upper water layer to move back towards shore  
30 bringing its rich biotic content with supplies of food, larvae, and juvenile organisms. In fall and winter  
31 months when winds blow predominantly from the south, the surface and upper water layers move  
32 shoreward and downward in a process called downwelling. Downwelling is an important part of the  
33 annual seasonal cycle that forces oxygen rich waters from the upper layers downward in the water  
34 column. Surface water temperatures provide a good indication of these seasonal wind forcing  
35 differences that bring the cold, nutrient-rich waters to the surface in the summer (Figure 6.6a) and the  
36 warmer waters from offshore to the coast in the winter (Figure 6.6b).

37  
38 Large-scale changes in water masses, temperatures and currents result in changes in plankton species  
39 composition and abundance, which impact the survival and distribution of organisms within coastal and  
40 oceanic ecosystems. These large-scale oceanic events, such as El Niño/La Niña and the Pacific Decadal  
41 Oscillation, occur at multi-year or decadal time scales. Recently, scientists have made strides in  
42 understanding how El Niño/La Niña events and the warm and cool regimes of the Pacific Decadal  
43 Oscillation influence Oregon's coastal and marine water ecosystem.

44  
45



1  
 2 **Figure 6.6a. Average sea surface temperature for July (1997 - 2003). Note colder water nearshore.**  
 3 **(Source: Juan-Jorda Masters Thesis/College of Oceanic and Atmospheric Sciences/ Oregon State**  
 4 **University/2006.**



1  
 2 **Figure 6.6b. Average sea surface temperature for January (1997 - 2003). Note warmer water**  
 3 **nearshore. Source: Juan-Jorda Masters Thesis/College of Oceanic and Atmospheric Sciences/ Oregon**  
 4 **State University/2006.**

1 Another water column component that affects Oregon’s neritic habitats is river plumes. CMECS does not  
2 characterize the marine waters affected by these plumes as estuarine because they are not meaningfully  
3 enclosed by landforms. Riverine waters entering the ocean often carry high concentrations of nutrients,  
4 create gradients in salinity, cause physical mixing, and create areas of high turbidity. Large river plumes,  
5 such as that from the Columbia River, may serve as a microhabitat within neritic habitats and can  
6 potentially act as biogeographic barriers between marine areas to the north and south. The Columbia  
7 River plume stretches hundreds of miles offshore and shifts predictably over the course of each year. In  
8 the summer the plume spreads south and offshore from the river’s mouth, while during the winter the  
9 plume is found to the north of the river mouth and is usually directly adjacent to the coast. This plume  
10 has important ecological effects, not only to neritic habitats, but to nearshore and offshore habitats as  
11 well. The oceanographic fronts created by the Columbia River plume in the marine systems generate  
12 productive conditions that attract many species of invertebrates, fish, seabirds, and marine mammals.  
13

#### 14 Biological Characteristics

15 Neritic habitats support two basic types of marine organisms: plankton and nekton. Planktonic  
16 organisms live in the water column and are incapable of swimming against currents, instead drifting  
17 with them. Plankton are often categorized as either phytoplankton or zooplankton. Phytoplankton are  
18 microscopic photosynthesizing organisms (e.g., diatoms), and are the primary producers that form the  
19 base of the marine food web. Huge surges in phytoplankton populations, known as “blooms,” are  
20 commonly associated with upwelling events. Zooplankton are heterotrophic organisms that range in size  
21 from microscopic single-celled organisms to enormous jellyfish a meter or more in diameter. Some  
22 plankton, called holoplankton, like many diatoms, copepods, krill and jellyfish spend their entire lives as  
23 drifters in the water column. Many species like sea urchins, mussels, crabs, some snails and many fishes  
24 have planktonic stages as eggs or larva, called meroplankton, before either settling to the bottom or  
25 growing large enough to be nekton. The CMECS biotic component uses these planktonic classes and  
26 subclasses to describe the open water neritic zone. They can be further refined by taxonomic groups  
27 and communities that are dominant in any given area of interest. Dramatic changes in plankton  
28 communities occur in Oregon waters with water masses changes. For example, warm water species are  
29 brought in to nearshore water with El Niño events.  
30

31 In contrast, nektonic marine organisms are capable of swimming against currents and include animals  
32 such as adult crustaceans, mollusks, and vertebrates. Highly migratory and schooling species are typical  
33 of nekton in neritic habitats. Many species of invertebrates, fish, birds, and marine mammals travel and  
34 forage exclusively or occasionally within this habitat.  
35

36 Many nearshore SGCN, Watch List and commonly associated species utilize the open water neritic  
37 habitat during their life history (Table 6.3 Appendix E and F). Many forage fishes such as northern  
38 anchovy, Pacific herring, topsmelt, Pacific sardine, surf smelt, Pacific sand lance and longfin smelt feed in  
39 this open water neritic habitat. Juvenile rockfish are found in the water column. Breeding birds such as  
40 tufted puffin and common murre are central place foragers that feed on the forage fish and other  
41 species while nesting. The majority of nearshore SGCN depend on this habitat for some phase of life.  
42 This is also the habitat that supports primary production by phytoplankton and secondary production by  
43 zooplankton, which is at the base of the food web for the nearshore ecosystem. Ocean currents  
44 transport and disperse larvae and juveniles of many invertebrate and fish species throughout the region.  
45

#### 46 Human Use

47 Human uses of the neritic habitat include commercial and recreational fishing, nonconsumptive  
48 recreational pursuits such as boating or whale watching, scientific research, commercial maritime

1 transportation, and military operations. Development of renewable energy sources from both wind and  
2 waves is an emerging use of the neritic habitat.

### 3 4 ***Soft Bottom Subtidal***

5 Soft bottom subtidal habitat includes all of the unconsolidated substrate areas (e.g., mud, sand, granule  
6 pebbles and various mixes thereof) on the ocean bottom. Soft bottom subtidal habitats are  
7 characterized by CMECS as being within the subtidal zones of the nearshore and offshore marine  
8 subsystems. Subtidal soft bottom habitats are diverse based on distinct organism assemblages that are  
9 influenced by differences in substrate type (sand vs. mud), organic content and bottom depth. The  
10 distribution and relative abundance and mixes of these substrates are not yet well described for much of  
11 Oregon's nearshore ocean waters.

#### 12 13 Physical Environment

14 The primary substrate types in Oregon's soft bottom subtidal areas range from sand to pebble. CMECS  
15 defines unconsolidated mineral substrates based on particle diameter. Here we consider soft bottom  
16 habitats to be composed of the various mixes defined by CMECS of particles <64 mm in diameter.  
17 Because the Oregon coast is primarily an exposed, high energy environment, most soft bottom subtidal  
18 areas are sandy. However, mud can be the more prevalent substrate type in areas receiving less energy  
19 from water movement, including isolated and sheltered areas, and deeper areas. The distribution of  
20 these unconsolidated sediment types in Oregon waters is influenced by currents in both the nearshore  
21 and offshore subsystems. Areas close to outfalls and discharge pipes would be expected to show  
22 localized differences based on the displacement of substrate and the increased availability of organic  
23 and small particulate material. The smaller the particle size, the smaller the pores (or spaces between  
24 the particles) are. Pore size dictates the amount of water and the water chemistry of the substrate,  
25 which can define what types of organisms can live in that sediment.

#### 26 27 Biological Characteristics

28 Most soft bottom subtidal communities are dominated by infaunal (burrowing) invertebrates such as  
29 polychaetae worms. However, other organisms such as crustaceans, echinoderms and mollusks may be  
30 locally abundant. Common epifauna (found on the sediment surface) can include species of shrimp,  
31 crabs, snails, bivalves, sea cucumbers, and sand dollars. Dungeness crab are an important component of  
32 soft bottom subtidal communities and are found both on the surface as well as buried in the substrate.  
33 Sea pens (*Ptilosarcus* sp.), colonial relations to sea anemones, are common on more muddy bottoms. In  
34 some areas of the coast, shallow sandy habitats support extensive beds of dense sand dollars that may  
35 extend miles in length. Common fish in this area include several species of flatfish (e.g., sanddab, English  
36 sole, and sand sole), and important burrowing forage species such as Pacific sand lance and sandfish.

37  
38 Species associated with soft bottom subtidal habitats provide a spectrum of ecosystem services. Most  
39 widespread but least apparent of these services are the nutrient cyclers: deposit feeders and microbes  
40 living within the sediments. Emergent species such as sea pens are only found in this habitat. There are  
41 a vast array of worms and other invertebrates that live in the soft subtidal bottom. Soft bottom habitats  
42 are important to many SGCN, SGIN, Watch List and other commonly associated species at various life  
43 stages (Table 6.3, Appendix E and F). For example, big skate, starry flounder, sand sole, Pacific sand  
44 lance burrow or cover themselves to hide in these sediments. Gray whales feed by sifting buried  
45 amphipods from the sediments and scooping clouds of mysid shrimp from above the sediment surface  
46 sometimes at the edges of rocky reefs. Many invertebrates like razor and native littleneck clams live in  
47 the subtidal soft bottom habitat. Both juvenile and adult Dungeness crab forage here and sometimes

1 hide in these soft sediments. The young of commercially valuable fish species can often be found here  
2 and utilize these areas as nursery habitat. The young of many species use the nearshore area for  
3 foraging, and are themselves prey for larger fishes and birds. Sand lance is a particularly valuable forage  
4 species for birds, other fishes, and marine mammals. Diving birds such as the common murre forage for  
5 food for their young in soft bottom areas taking juvenile flat fish back to their chicks while they are  
6 nesting.

#### 7 8 Human Use

9 Commercial and recreational harvest of Dungeness crab, surf perch, and species of nearshore flatfish are  
10 the principal human uses of the soft bottom subtidal habitat. Sand and mud from dredging projects are  
11 sometimes deposited over soft bottom habitats. Soft bottom subtidal habitats could also soon be  
12 utilized for siting renewable energy projects and their associated infrastructure. Finally, the soft bottom  
13 subtidal offers many opportunities for scientific research

#### 14 15 ***Rocky Subtidal***

16 Rocky subtidal habitat includes all hard substrate areas of the ocean bottom. The geologic origin  
17 substrate components include cobble and boulder in the CMECS unconsolidated mineral substrate class  
18 and bedrock and megaclasts in the rock substrate class. Anthropogenic origin hard substrates are also  
19 here. Anthropogenic reefs include any areas where hard, persistent material has been placed either  
20 purposely or accidentally by humans. Examples include rock jetties at the entrance to many bays,  
21 shipwrecks, anchoring systems for renewable energy projects, and unburied portions of underwater  
22 cables or pipelines. Rocky subtidal areas are often referred to as reefs, rocky reefs, rocky banks,  
23 pinnacles, or “hard bottom.” Rocky subtidal habitats, including both the natural and anthropogenic  
24 components, are characterized by CMECS as being within the subtidal zones of the nearshore and  
25 offshore marine subsystems. Although most areas are never exposed to air, the CMECS subtidal  
26 definition does include areas that are exposed intermittently each month when tide levels fall below the  
27 Mean Lower Low Water (MLLW) level. Rocky subtidal habitats are found in both the nearshore  
28 subsystem and offshore subsystem and some of the differences are discussed below.

29  
30 Some rocky subtidal areas are extensions of shoreline rocky features such as headlands, cliffs, or rocky  
31 intertidal habitat, while others exist as isolated regions of rock surrounded by habitat with soft bottom  
32 substrate. Rocky reefs have varied topography; some may barely come above the surrounding seafloor,  
33 while others may rise from the seafloor many meters, or extend above the surface to form islands in the  
34 Territorial Sea. There are more than 1,800 islands off the coast of Oregon, the bases of which form rocky  
35 subtidal habitat.

#### 36 37 Physical Environment

38 The physical characteristics of rocky subtidal habitats reflect proximity to shore, depth of the water,  
39 local seafloor geology, erosional forces, and biological influences. The geology of many rocky subtidal  
40 areas mimics the geology of adjacent landforms, often consisting of erosion-resistant basalts or  
41 metamorphic rock common in Oregon’s rocky headlands. Over geologic time, the underwater rock  
42 features have been uplifted, bent, deformed, and alternately exposed to ocean and terrestrial erosional  
43 forces as successive ice ages and geologic forces caused massive sea level changes. These forces have  
44 shaped a variety of physical habitat features within reefs, including flat rocky benches, stacks, jagged  
45 ridges, broken boulder fields, and a vast number of cracks and crevices that provide shelter and  
46 substrate to abundant life.

1 Oceanographic processes and features strongly influence the rocky subtidal environment. Subtidal reefs  
2 are exposed to pounding wave action, underwater currents, and the physical and chemical properties of  
3 the water. These factors in turn influence the biological communities on the reefs. Generally, nearshore  
4 reefs are more exposed to wave action than offshore reefs, and the wave action is much stronger in  
5 winter than during summer. Wave action is a key factor in determining the types of organisms that can  
6 live on the very shallow reefs. Ocean currents vary widely by location, time of year, and over tidal cycles.  
7 Currents influence reefs in a variety of ways including direct erosion, sand scour or burial of reef areas,  
8 and movement of organisms to and from reefs, including plankton and larva. Large-scale or long-term  
9 variation in the ocean environment such as upwelling, seasonal current directional shifts, shifts in ocean  
10 circulation, water temperature variation, local and global weather patterns, ocean acidification, and  
11 biological processes combine to determine the ambient chemical and physical composition of the water  
12 in rocky subtidal habitats. The CMECS water column components can be used to describe important  
13 features of the waters surrounding and overlying rocky reefs that are important in shaping the biological  
14 communities which live there.

15  
16 The 30 m depth contour is defined by CMECS as the boundary for the nearshore subsystem and the  
17 offshore subsystem. Nearshore rocky reefs differ from offshore reefs in some key physical  
18 characteristics. Light penetration is adequate to support algal life on nearshore reefs, while offshore  
19 reefs support far less algal growth. For example, kelp is only found in nearshore subsystem rocky areas.  
20 Wave action, currents, and storms produce a higher energy environment on nearshore reefs than their  
21 deeper counterparts. Organisms adapted to higher energy environments are more prevalent in the  
22 nearshore area. On some reefs, strong currents can scour and seasonally bury or expose the rocks with  
23 sand, considerably influencing the types of organisms that can utilize those rocky subtidal environments.

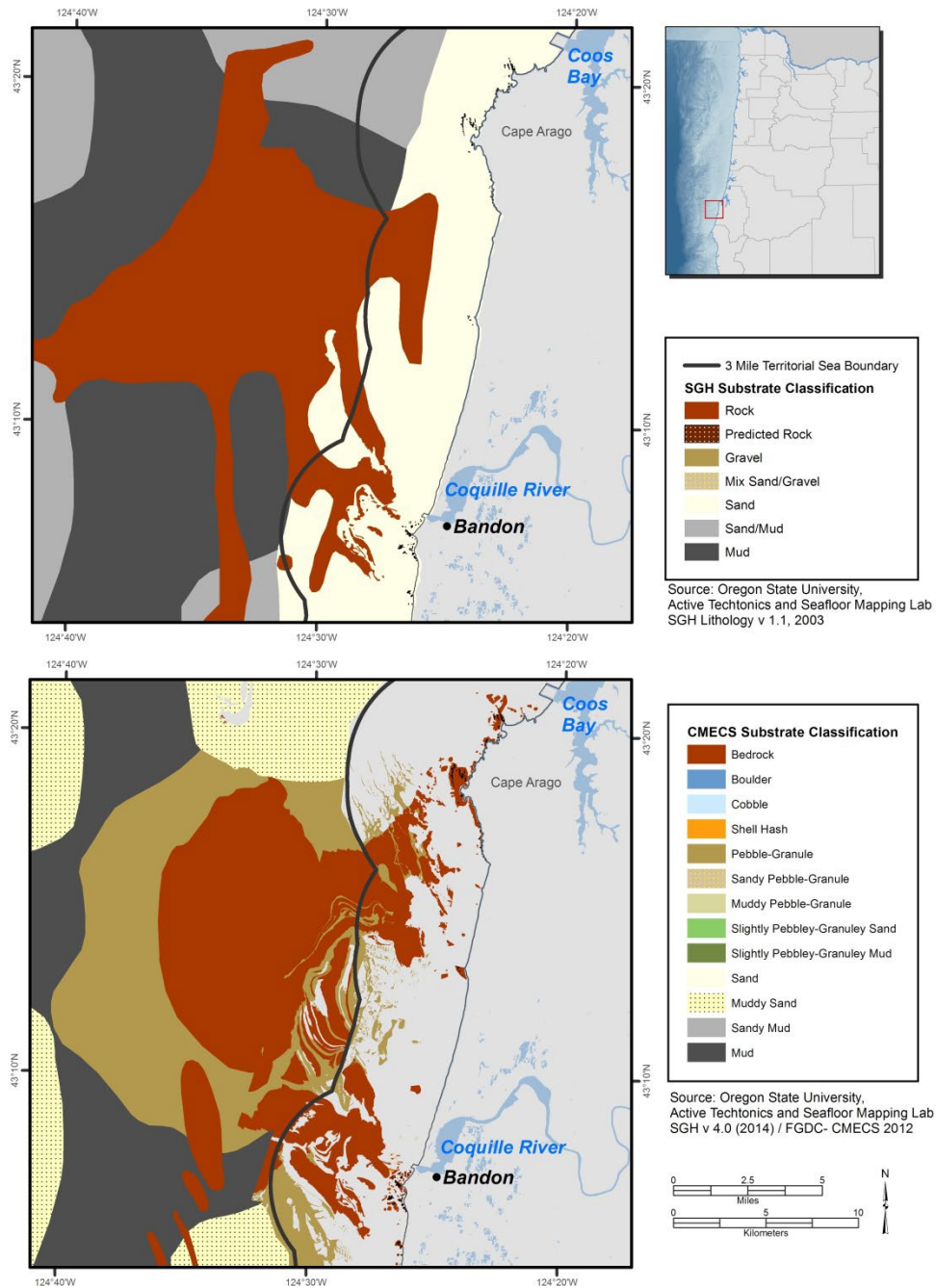
24  
25 The difference in detail in the new habitat maps, compared with those available for the 2006 version of  
26 the Nearshore Strategy is striking. Use of the CMECS substrate component system also provides far  
27 more detail. A good example is the area off Cape Arago (Figure 6.7) where at a larger scale the  
28 differences are very apparent. Additional mapping products are anticipated as more high-resolution  
29 data for rocky reefs is acquired and processed.

### 30 31 Biological Characteristics

32 Subtidal rocky reefs are known for their abundant and diverse biological communities. The variety in  
33 topography, substrate characteristics, and depths within and among rocky reefs produces a plethora of  
34 microhabitats, often within relatively small geographic areas. This in turn provides for a diversity of  
35 species adapted to life in these different microhabitats. Habitat-forming organisms, such as kelp or  
36 attached invertebrates, provide additional microhabitats used by reef species.

37  
38 Most nearshore rocky reefs have rich algal, invertebrate, fish, bird, and marine mammal communities.  
39 Depending on water depth, light penetration, wave energy, and other physical and biological processes,  
40 algae and macroalgae can provide extensive or sporadic cover and food for other species in the  
41 nearshore subsystem. Algae and macroalgae include encrusting forms that grow close to the rock  
42 surface, turf forms that can create a dense layer up to a foot thick or more, subcanopy forms that  
43 provide added subsurface habitat structure, and canopy forms that create kelp “forests” which may  
44 break the surface of the water. Offshore rocky reefs in deeper water do not have kelp forests. Free-  
45 swimming (nektonic), drifting (planktonic), and attached invertebrates are common in both the  
46 nearshore and offshore rocky subtidal habitats.

47



1  
 2 **Figure 6.7. Detail map of the area off Cape Arago, Oregon included in original version of the Oregon**  
 3 **Nearshore Strategy (a) and map of the same area that incorporates data from surveys with modern**  
 4 **sonar technologies and the CMECS classification of substrate components (b).**

1 Many Nearshore SGCN, SGIN, Watch List, and other commonly associate species inhabit rocky subtidal  
2 habitats (Table 6.3., Appendix E and F). These include many fish as well as a wide variety of filter or  
3 suspension feeding invertebrates attach to hard substrates such as sponges, anemones, barnacles,  
4 bryozoans, hydrozoans, tunicates, and coldwater corals. Mobile invertebrates abound here as well. Red  
5 and purple urchins, red and flat abalone eat algae attached to the rocks. Ochre, sunflower and other sea  
6 stars forage in subtidal rocky habitats as do crabs, shrimps, brittle stars, nudibranchs, chitons, and  
7 worms.

8  
9 The diversity of producers and consumers found in the rocky subtidal creates complex food webs and  
10 interdependence among organisms. Reefs are linked to surrounding environments by ocean currents  
11 and organism movements. Reef topographic structure often slows currents, enhancing the local  
12 community's ability to capture drifting organisms, an effect enhanced by the occasional presence of  
13 large kelp beds. Many organisms move on and off reefs, some in large-scale migrations and others in  
14 short feeding forays to other areas. While most nearshore reef fishes occupy both nearshore and  
15 offshore reefs, there are differences in depth preferences of some species and life history stages.

16  
17 Several fish species depend on nearshore rocky reefs during early life history stages before moving off to  
18 deeper reefs, the continental shelf, or other areas as they grow. Conversely, some fish depend on  
19 estuaries or rocky intertidal habitat for early life history stages before moving to rocky subtidal areas as  
20 adults. For example kelp greenling, cabezon, and grass rockfish tend to be more prevalent on the  
21 nearshore reefs. Canary and yelloweye rockfish move from nearshore to offshore reefs as they grow.  
22 Many fish species are entirely dependent on reefs for parts of their life cycle, while others are visitors.  
23 Common visitors include herring, smelt, sharks, ratfish, and salmon.

24  
25 Ecological linkages within and between rocky subtidal habitats help to shape their biological  
26 communities and the diversity of species found in this habitat type. Currents bring in planktonic  
27 organisms and transport drifting larvae to and from disparate rocky subtidal habitats. The location of  
28 reefs with respect to other "upstream" or "downstream" reefs has a dramatic effect on the types,  
29 abundance, and recruitment rates of the reef's communities and organisms. This complexity of organism  
30 interrelationships makes the outcome of natural or human disturbance to reefs difficult to measure or  
31 predict.

### 32 33 Additional Biological Component: Kelp Beds

34 Kelp beds form a small but important subset of Oregon's rocky subtidal habitat. CMECS classifies kelp  
35 beds as a biotic component of Oregon's rocky subtidal habitat, and more specifically as canopy-forming  
36 algal beds. . Kelp canopies in Oregon consist almost exclusively of bull kelp (*Nereocystis luetkeana*), a  
37 brown macroalgae that grows from the seafloor to the ocean surface and forms a floating canopy,  
38 though a few locations have historically featured small amounts of giant kelp (*Macrocystis pyrifera*). The  
39 strip of coast from Cape Arago south has historically contained approximately 92 percent of the state's  
40 kelp beds (Figures 6.8a and 6.8b). Kelp canopies are relatively scarce habitats in Oregon's waters,  
41 covering less than one percent of the nearshore area. This distribution is driven historically by the  
42 locations of subtidal rocky seafloor shallow enough for sufficient light penetration to support kelp  
43 growth. More recently, the even more limited distribution reflects reductions in the total abundance of  
44 kelp in response to changes in oceanographic stressors such as warming ocean temperatures, marine  
45 heat waves, changes in ocean chemistry associated with climate change (kelps need cool, nutrient-rich  
46 waters to thrive) and recent increases in populations of grazing sea urchins.

1 The presence and attributes of kelp beds depend on a number of physical and biological variables. The  
2 primary variables determining where kelp might exist include water depth and substrate availability. In  
3 Oregon’s waters, kelp beds only form on rocky substrate and are limited to the nearshore subsystem.  
4 Beyond that depth, low light levels on the seafloor limit the growth of kelp. However, light and substrate  
5 are not the only limiting factors; many rocky reefs in the appropriate depth range rarely or never  
6 support kelp beds. Factors that may limit kelp on these reefs include seasonal sand burial of the reef,  
7 sand scour of the rocks, overexposure to wave and storm energy, locally high turbidity, lack of nutrients,  
8 distance of the reef to “seeding” sources of kelp, abundance of organisms that consume kelp (e.g., sea  
9 urchins), and competition with invertebrates and other algae for rock substrate available for  
10 attachment.

11  
12 Kelp beds in Oregon display pronounced seasonal and annual variation in extent and density. Bull kelp  
13 beds grow rapidly in spring and summer, followed by a winter period when storms dislodge much of the  
14 algae, leaving little or no surface canopy. The biomass of kelp beds can also vary ten-fold or more from  
15 year to year due to interannual variation in the combinations of physical and biological variables that  
16 affect their growth.

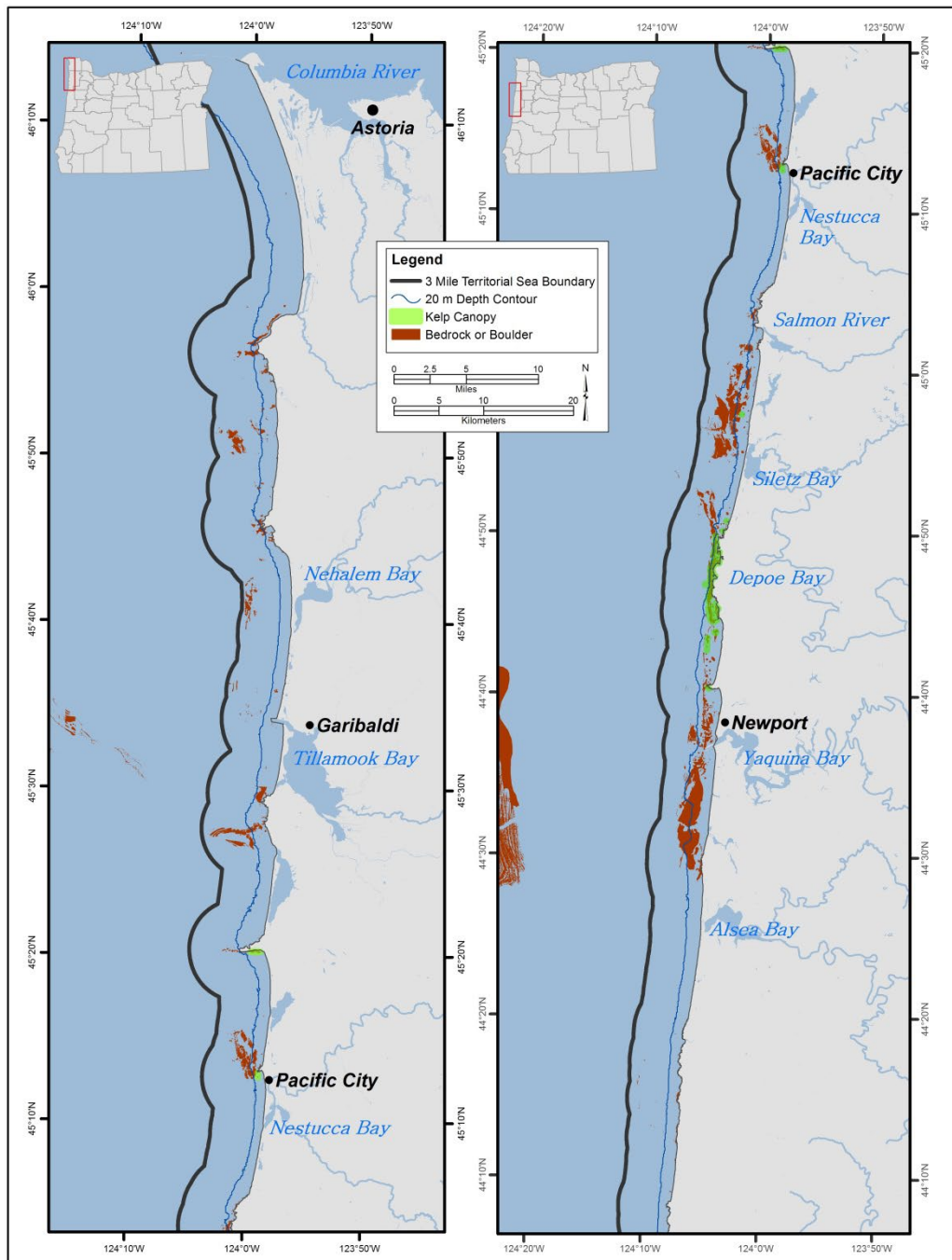
17  
18 Kelp beds are biologically rich habitats due to both the primary productivity of the kelp and the effect  
19 kelp beds have on the surrounding environment. Bull kelp is one of the fastest growing organisms in the  
20 world, annually providing a large biomass available for consumption directly or as detritus after the kelp  
21 dies. Kelp furnishes a vertical habitat structure that otherwise would not exist on the reef. Kelp beds  
22 also slow water currents and reduce waves and wind chop, helping to trap drifting larva and nutrients  
23 and providing shelter.

24  
25 Kelp beds and their canopies can also support a rich understory of algal and attached invertebrate cover.  
26 On Oregon reefs, dense understory algae coverage gives way to dominant invertebrate cover at about 5  
27 to 10 m water depth. Thick kelp cover reduces light penetration and can limit the density of understory  
28 algae. The kelp bed and underlying reef support a diverse array of fish and invertebrate species and  
29 provide cover and foraging areas for diving seabirds and marine mammals. In Oregon, the mix of fish  
30 species on kelp bed and non-kelp bed reefs is similar, reflecting a lack of kelp-specialist fish species that  
31 is perhaps unsurprising given the relatively low proportion of Oregon’s rocky seafloor that is covered in  
32 kelp canopy.

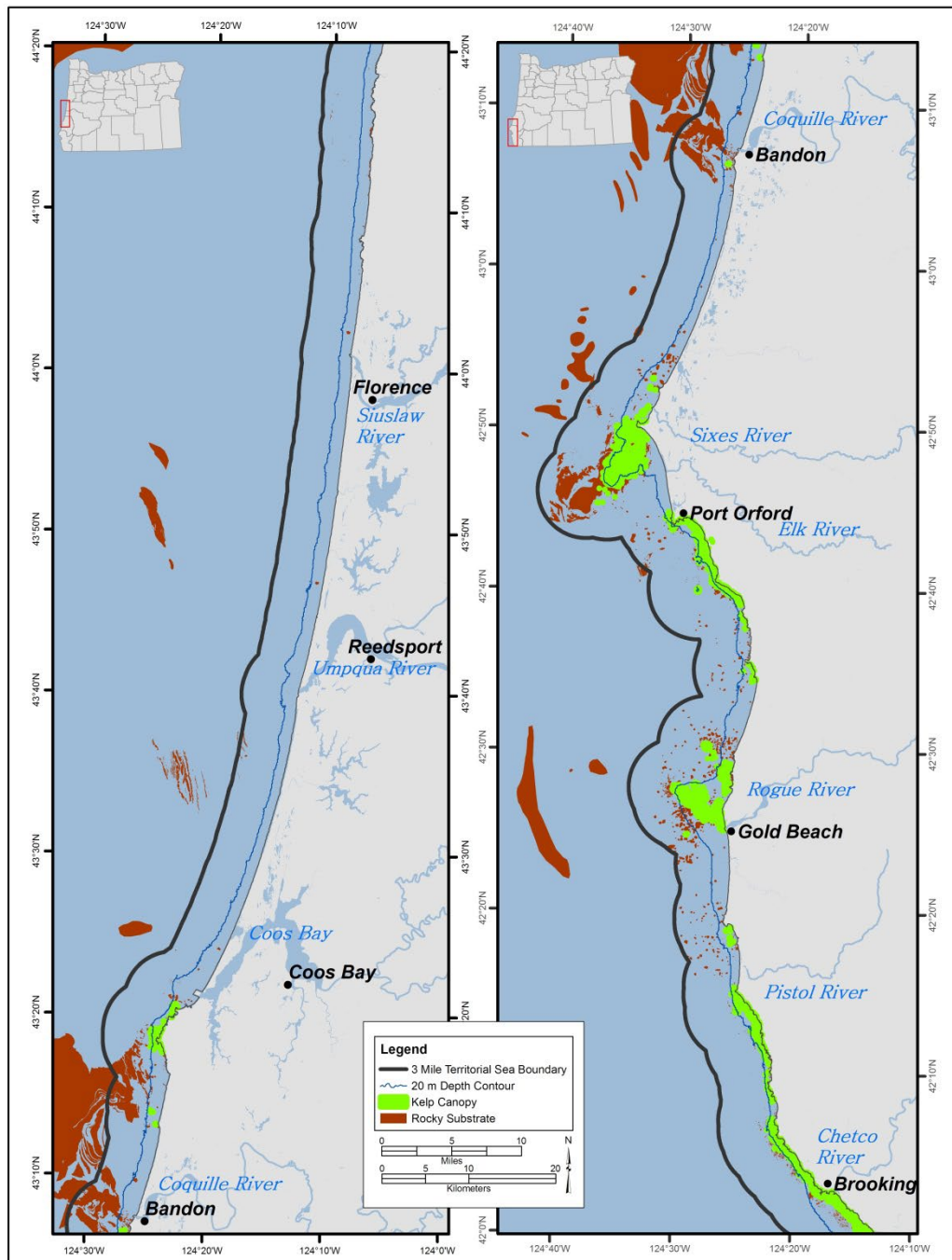
### 33 34 Human Use

35 Human uses of nearshore rocky reefs include fishing, scientific research, sightseeing, and a number of  
36 other recreational and industrial pursuits. Commercial and recreational fishing for many types of  
37 rockfish species, lingcod, cabezon, and kelp greenling are the primary human uses of this habitat to  
38 date. SCUBA diving and underwater photography are among the other less prevalent uses. Much of the  
39 commercial live fish fishery takes place on shallow nearshore reefs. Recreational anglers also favor  
40 shallow nearshore reefs, if they are available. Commercial fishing effort targeting nearshore species  
41 tends to be higher on the south coast and recreational effort more prevalent on the north coast. Many  
42 reefs are used recreationally by SCUBA divers, sea kayakers, boaters, and surfers. Reefs with extensive  
43 kelp beds and islands provide sightseeing and bird watching opportunities for coastal residents and  
44 visitors. However, many reefs have no features extending to the ocean surface, and thus many people  
45 are unaware of the teeming life existing just below the water’s surface.

46



1  
2 Figure 6.8a. Maximum historical extent of kelp beds along the north Oregon coast.  
3



1  
2 Figure 6.8b. Maximum historical extent of kelp beds along the south Oregon coast.

1 **Rocky Shore**

2 Oregon's rocky shores, often referred to as rocky intertidal or tidepool areas, form parts of the  
3 shoreward boundary of the nearshore planning area and can extend from the extreme low tide to the  
4 extreme high tide. They are characterized by CMECS as marine nearshore areas in the Intertidal and  
5 Supratidal zones, which include all hard substrate areas along the shoreline that are alternately exposed  
6 and covered by tides or are affected by wave splash and overwash, but not areas affected only by wind-  
7 driven spray. Everything beyond the reach of ocean waves is considered terrestrial habitat. The  
8 substrates making up Oregon's rocky shores include both volcanic and sedimentary bedrock as well as  
9 megaclasts, boulder, cobble and human-made (anthropogenic) structures. Some rocky shore areas are  
10 extensions of other shoreline rocky features such as headlands or cliffs, others exist as isolated regions  
11 of rock surrounded by sandy beach habitat, and some are anthropogenic in origin, having been  
12 deposited intentionally or unintentionally by humans. Oregon's coastline has approximately 152 linear  
13 miles of rocky shore habitat, and some 20 miles of jetties.

14  
15 An example of a naturally-occurring geoform component found in Oregon's rocky shores would be a  
16 tidepool. Some of the anthropogenic geoforms found in Oregon's rocky shores include breakwaters,  
17 jetties, and rip rap deposits. All rocky shore habitats in Oregon are contained entirely within the SWAP's  
18 planning area.

19  
20 Physical Environment

21 The physical characteristics of rocky shores reflect local shoreline geology, exposure to ocean waves and  
22 currents, and biological influences. The Pacific Ocean exerts tremendous energy on Oregon's rocky  
23 shoreline, eroding coves, widening crevices, and reducing bedrock to rubble. On the north and central  
24 coast volcanic basalt dominates the hard shoreline, but sedimentary sandstone and mudstone rock can  
25 found at several locations. Between Coos Bay and the Coquille River the geology is characterized by  
26 sedimentary rock. South of the Coquille River, headlands and rocks are primarily remnants of ancient  
27 metamorphic rocks over 200 million years old. Because of the variety of geologic origins and processes,  
28 Oregon's rocky shores consist of an assortment of cliff faces, wave-cut platforms, boulder fields,  
29 outcrops, and rubble. Each geoform presents a unique mixture of habitats that provide shelter and  
30 substrate to support a wide variety of life.

31  
32 Ocean forces and weather strongly influence rocky intertidal environments. Tides are the primary  
33 influence on organisms and communities. The physical environment of intertidal areas changes  
34 dramatically as the tide rises and falls, alternately covering everything with salt water or exposing it to  
35 air, fresh water from rain and runoff, and the sun. Wave exposure also has a primary influence on this  
36 environment. Intertidal areas protected from waves due to shoreline orientation or geology provide  
37 dramatically different habitat than areas directly exposed to wave action. Local alongshore currents and  
38 ocean circulation processes introduce additional variables in the habitat, including sand scour of rocks,  
39 seasonal sand burial of rocky areas, and transport of nutrients, larvae, and adult organisms to and from  
40 intertidal sites.

41  
42 Biological Characteristics

43 Rocky shore habitats are known for and crucial to their abundant and diverse biological communities.  
44 The variety in tidal elevations, wave exposure, and geologic structure within and among intertidal  
45 habitats produces a variety of microhabitats, often within relatively small geographic areas. This, in turn,  
46 provides for a diversity of species adapted to life in these different microhabitats. Organisms contribute  
47 to the variety of habitats as well. For instance, mussels and algae attach to the rocks, sometimes in huge

1 numbers, providing additional structure and biogenic habitat used by intertidal species. Anthropogenic  
2 geoforms like jetties often take on similar biological characteristics of natural rocky shore geoforms,  
3 with similar biological communities using them.  
4

5 Biological communities associated with rocky intertidal habitat include algae, marine plants, attached  
6 and mobile invertebrates, fish, marine mammals and birds. SGCN, SGIN, Watch List, and other  
7 commonly associated species that utilize rocky shore habitat can be found in Table 6.3 and Appendix A  
8 and B. Algae cover many intertidal areas with dense growth, often layered with several different species.  
9 Surfgrass, a marine vascular plant, often forms thick beds in lower intertidal areas, providing additional  
10 habitat structure for invertebrates and fish. Most rocky shore areas are extensively covered with  
11 attached invertebrates. Common types of attached organisms include sponges, anemones, barnacles,  
12 bryozoans, tunicates, and mussels. The rocks, algae, and attached invertebrates provide homes for a  
13 variety of mobile invertebrates such as crabs, snails, limpets, sea stars, urchins, brittle stars,  
14 nudibranchs, chitons, and worms. Free-swimming invertebrates, such as shrimps and drifting  
15 (planktonic) invertebrates also occur in tidepools or drift in with the tides. The algal and invertebrate  
16 communities in rocky intertidal areas often form distinct horizontal bands or zones of life according to  
17 the amount of time exposed to the air or covered by the tides.  
18

19 The upper reaches of the supratidal and intertidal zones experience the greatest variation in moisture,  
20 exposure, and salinity, and are often highly dependent on strong wave action to bring in nutrients and  
21 life. Compared to other rocky shore areas, fewer species are found in the high intertidal and supratidal.  
22 These zones are typically characterized by vegetated rocks and boulders, along with isolated crevices  
23 and tidepools that hold water even during low tides. Greater abundance and diversity of life is  
24 associated with the lower intertidal areas. The distribution of organisms living in the mid-intertidal is  
25 generally limited at upper elevations by environmental stressors (such as high temperatures and  
26 desiccation) and at lower elevations by biological interactions (such as predation and competition).  
27 Organisms in the lowest parts of the rocky shore area experience almost continual tidal inundation and  
28 must be able to withstand the mechanical and biological stresses associated with this high-energy  
29 environment.  
30

31 The low intertidal serves as an important connection in the marine food web. Wave activity helps  
32 convert kelp and other organic debris into small fragments that are consumed by grazers and filter  
33 feeders and provide some nutrients to algal communities. Invertebrates and small fish provide a source  
34 of food for numerous bird species that forage along rocky shores.  
35

36 Fishes using the rocky shore include species adapted to live in tidepools and subtidal species that move  
37 in and out of the intertidal area with the tides. Tidepool fishes include a variety of sculpins, gunnels, and  
38 pricklebacks, among others. Rockfish species, greenlings, and surfperch often move into the intertidal  
39 area during high tide to feed and take refuge from subtidal predators. The rocky shore area is especially  
40 important to juvenile life stages of these fishes. The rocks and islands associated with Oregon's rocky  
41 shores and the subtidal rocky reefs provide important seal and sea lion haulout and pupping areas, and  
42 support some of the largest seabird nesting colonies on the contiguous U.S. West Coast. Islands and  
43 rocky intertidal areas are also utilized for nesting by birds that do not nest in colonies like black  
44 oystercatchers. Islands are another example of geoforms in the CMECS framework. Several seabird  
45 species that do not nest in colonies in Oregon do feed and take refuge here, including black turnstones  
46 and surfbirds.  
47

1 Rocky shores are linked to surrounding habitats by ocean currents and organism movements. Currents  
2 bring in planktonic organisms that help feed intertidal animals, and transport drifting larvae to and from  
3 intertidal environments. Currents also bring nutrients that feed the lush algal growth. Many organisms  
4 move in and out of intertidal habitats to feed or take refuge. Fish move in during high tides and  
5 terrestrial animals move in during low tides. Rocky intertidal areas are also linked to each other,  
6 primarily through transport of larvae by ocean currents. The proximity of intertidal habitat to other  
7 “upstream” or “downstream” habitats has dramatic effects on the types, abundance, and recruitment  
8 rates of communities and organisms.

9  
10 Ecological linkages within and between rocky shore areas help to shape biological communities and  
11 contribute toward the biological abundance of this habitat type. The diversity of producers and  
12 consumers in the intertidal create complex food webs and interdependencies among organisms. This  
13 complexity of organism interrelationships makes the outcome of natural or human disturbance to rocky  
14 shore habitats difficult to predict or measure. For instance, while human foot traffic can result in  
15 inadvertent trampling of organisms, anthropogenic structures such as jetties provide a unique and  
16 valuable rocky shore habitat at the transition between estuaries and the marine environment.

### 17 18 Human Use

19 Human uses of rocky intertidal areas include fishing, invertebrate and algae harvest and collection,  
20 education, scientific research, sightseeing, and other recreational, economic, and social pursuits. Due to  
21 their accessibility and the fascinating array of marine life, rocky intertidal areas receive more public use  
22 than many other marine habitats. Visitation by school groups and others curious about marine life  
23 comprises the majority of public use. For many visitors, their first and sometimes only interaction with  
24 the wonders of marine life comes from tidepool visits. Visitation of rocky shore areas has generally been  
25 increasing over the past five decades.

26  
27 Rocky shores are used extensively by researchers as a natural laboratory to increase understanding  
28 about general marine ecological principles. Currently, there are fifteen intertidal and subtidal sites along  
29 the Oregon coast that have special regulations limiting harvest or collection of organisms in order to  
30 enhance scientific research, as well as education and enjoyment benefits.

31  
32 Detailed descriptions of types and amount of human use at individual rocky shore sites along Oregon’s  
33 coast can be found in the *Oregon Rocky Shores Natural Resources Inventory* (ODFW 1994).

### 34 35 **Sandy Beaches**

36 Sandy beaches are a widespread feature of the entire Oregon coast and make up approximately two-  
37 thirds of the coastline. Their distribution is interrupted by rocky shores, rocky headlands, river mouths,  
38 estuaries, and human constructions. Oregon’s sandy beaches are characterized by CMECS as marine  
39 nearshore areas in the intertidal and supratidal zones that are composed of very fine to very coarse sand  
40 substrate; they extend in a continuum from the Mean Lower-Low Waterline to the areas above the  
41 Mean Higher-High Waterline that are affected by wave splash and overwash at extreme high tides, but  
42 not areas affected only by wind-driven spray. Sandy beaches stretch inland until they are stopped by a  
43 continuous line of vegetation, debris, rocks, or other barrier. Everything beyond the reach of the waves  
44 and splash zone is considered terrestrial habitat.

1 Physical Environment

2 Oregon’s sandy beaches are high-energy environments that experience significant wave and wind  
3 energy. Several million cubic meters of sand are transported to the nearshore area annually by river  
4 systems. Seasonal variation in wind and wave energy and currents move substantial amounts of sand  
5 onto or off beaches, which results in significant changes in beach character as underlying rock structures  
6 (bedrock and/or cobble) are exposed. In some areas, patches of ancient forest where the land dropped  
7 during past subduction zone earthquakes may become exposed. Currents and wave energy are other  
8 significant factors in moving sands onto or off of beaches at elevations that are frequently immersed;  
9 the lateral width of the beach will govern the area over which current and wave energy is dispersed, and  
10 hence determines the slope of the beach as sands are deposited or swept away. At higher elevations  
11 that are dry and experience infrequent immersion by tides, wind is the predominant factor in  
12 distributing sand, and can create windrows and mobile dunes from a few centimeters to several meters  
13 tall, while dunes further inland may be several stories high.

14  
15 The lateral (north-south) extent of sandy beaches is punctuated by rivers or rocky headlands where the  
16 transition from sand to volcanic rock can be quite abrupt. Rivers can frequently become “bar-bound”  
17 during the summer and early fall months when river flows diminish due to reduced precipitation, and  
18 the energy of flowing water is insufficient to maintain an open, flowing channel to the sea. In such cases,  
19 the river or stream will flow *through* the sand in its final stages. Bar-bound rivers are generally freed by  
20 fall rains on the Oregon coast that increase river flows and wash sand out of the river mouths to re-  
21 establish a channel of flow. Fall rains and the breaking of blocking bars are important in restoring access  
22 to fresh-water streams for anadromous fishes.

23  
24 The supratidal zone and upper range of the intertidal zone are subject to the greatest variation in  
25 temperature and moisture and the least physical energy from the ocean. The intertidal zone, particularly  
26 its lower reaches, receives much greater physical energy from waves and currents, and also experiences  
27 the least variation in temperature.

28  
29 Biological Characteristics

30 The movement of sand by water and wind energy makes sandy beaches largely unsuitable for rooted  
31 and attached organisms. However, between the grains of sand in the intertidal zone is a vast multitude  
32 of life too small to see with the naked eye, including diatoms, harpacticoid copepods, amphipods, and  
33 algae, among others. Larger invertebrates can be found here as well, including crustaceans, mollusks,  
34 and diverse worm taxa. Many of the resident invertebrates burrow in the sand during periods of  
35 exposure for protection from desiccation and/or predation, and emerge to forage as tides permit.

36  
37 Biological communities of the upper intertidal and supratidal zones of sandy beaches are often based on  
38 the resources provided by the incoming tides and deposited at the high tide line. Once in the intertidal  
39 zone, the detritus is broken down by the mechanical force of waves pounding against the shore and the  
40 industry of the many organisms that live and forage there. Organisms of the mid and lower intertidal,  
41 particularly the small invertebrates, provide food resources for numerous larger invertebrate, fish, and  
42 bird species. Some marine mammals intentionally use this zone to rest, hauling themselves out of the  
43 ocean to lay on the sand.

44  
45 SGCN, Watch List, and commonly associated species that are associated with general sandy beach  
46 habitats, or specific to distinct sandy beach types, are listed in Table 6.3 and Appendix A and B,  
47 respectively. Surf smelt use particular beaches to lay their eggs in the intertidal zone. Native littleneck  
48 and razor clams burrow below the sand and feed on plankton when the ocean water covers them.

1 Western snowy plover nest either in the supratidal zone or above and feed in the intertidal sandy areas.  
2 Sanderlings gather in loose flocks in the winter months to feed on the rich array of invertebrates under  
3 the sand as the waves recede. Harbor seals rest on sandy beaches and northern elephant seals come  
4 ashore to molt, usually in the supratidal zone.

5

#### 6 Human Use

7 Sandy beaches attract substantial human use at all levels of the intertidal and supratidal. Their easy  
8 access and wide variety of organisms and ecological processes attract scientific interest. Thanks to their  
9 uniform, comfortable surface, sandy beaches are valued for a wide variety of recreational activities  
10 including sightseeing, picnicking, walking, running, agate-hunting, and kite flying. Lower portions of  
11 beaches are also launch and recovery areas for surfers, windsurfers, kite boarders, sea kayakers, and  
12 some sailboats, power boats, and personal watercraft. Wildlife found at sandy beaches is highly valued  
13 by humans for everything from bait or dinner to instructional or aesthetic uses. Driving is permitted on  
14 some Oregon beaches, but not all. All beaches in Oregon are free for the public to access.

15

#### 16 ***Estuaries***

17 Estuaries are characterized by tidally-influenced waters that have a surface connection to the sea. The  
18 connection may be permanently open, restricted, or intermittently closed. Oregon's estuaries are part  
19 of the Coast Range ecoregion and are a critical interface between the terrestrial environment of coastal  
20 watersheds and the nearshore marine environment. Estuaries are designated as a Strategy Habitat in  
21 the Oregon Conservation Strategy and the riverine portions are discussed there. The Nearshore Strategy  
22 focuses on species and habitats where saline marine waters influence the ecological communities.

23

24 The estuarine system extends from the mouth of the estuary, defined by an imaginary line connecting  
25 the two most seaward portions of land, upstream to the head of tide where the average difference in  
26 water level caused by tides is 0.2 feet (0.06 m). Estuarine tidal basins are generally narrow and  
27 elongated throughout their upper riverine regions, and may be broad and shallow in the middle and  
28 lower regions before making the connection to the sea. These basins are typically drained and filled by a  
29 primary tidal channel that is connected to numerous secondary and tertiary channels, inlets, sloughs,  
30 and tidal creeks.

31

#### 32 Physical Environment

33 Within the CMECS framework, the Oregon estuarine aquatic system is defined by geomorphology of the  
34 tidal basins and by the salinity regime of the brackish waters. The estuarine system is composed of  
35 several subsystems, including: (1) tidal riverine coastal; (2) tidal riverine coastal –diked (3) tidal riverine  
36 open water; (4) coastal; (5) coastal – diked; and (6) open water. Although the riverine subsystems  
37 greatly influence the lower portions of the estuaries, the species and habitats in the nearshore  
38 ecoregion all occur in the coastal and open water subsystems where the average salinity during the  
39 summer dry season / low freshwater flow period is greater than 0.5 practical salinity units.

40

41 Oregon's estuaries exhibit a wide variety of CMECS geofrom components such as bays, beaches, berms,  
42 boulder fields, channels, coves, deltas, islands, lagoons, levees, marsh platforms, mega-ripples, rubble  
43 fields, shoals, shoreline, sloughs, spits, stacks, tidal creeks, tidal flats, and tidepools. The estuaries also  
44 contain a diverse variety of geofoms with biogenic origin such as burrows, bioturbation areas, and shell  
45 beds. Anthropogenic origin geofoms are widely represented in the Oregon estuaries and include  
46 aquaculture structures, boat launches, breakwaters and jetties, bridges, bulkheads and seawalls, dikes

1 and levees, docks and piers, dredged channels, dredge deposit and fill areas, harbors and marinas,  
2 intakes and outfalls, pilings, rip-rap, and wharves.

3  
4 Mapping efforts of Oregon's estuaries utilizing CMECS components is underway and an online tool for  
5 viewing estuary maps is available at: <http://www.coastalatlantlas.net/estuarymaps/>. This is a work in  
6 progress and data for various CMECS components is not yet complete. It is designed to help with  
7 planning efforts and is administered by the Oregon Coastal Management Program. An example of a  
8 geofom components map of Yaquina Bay shows a number of its geofoms for which data are available  
9 (Figure 6.9).

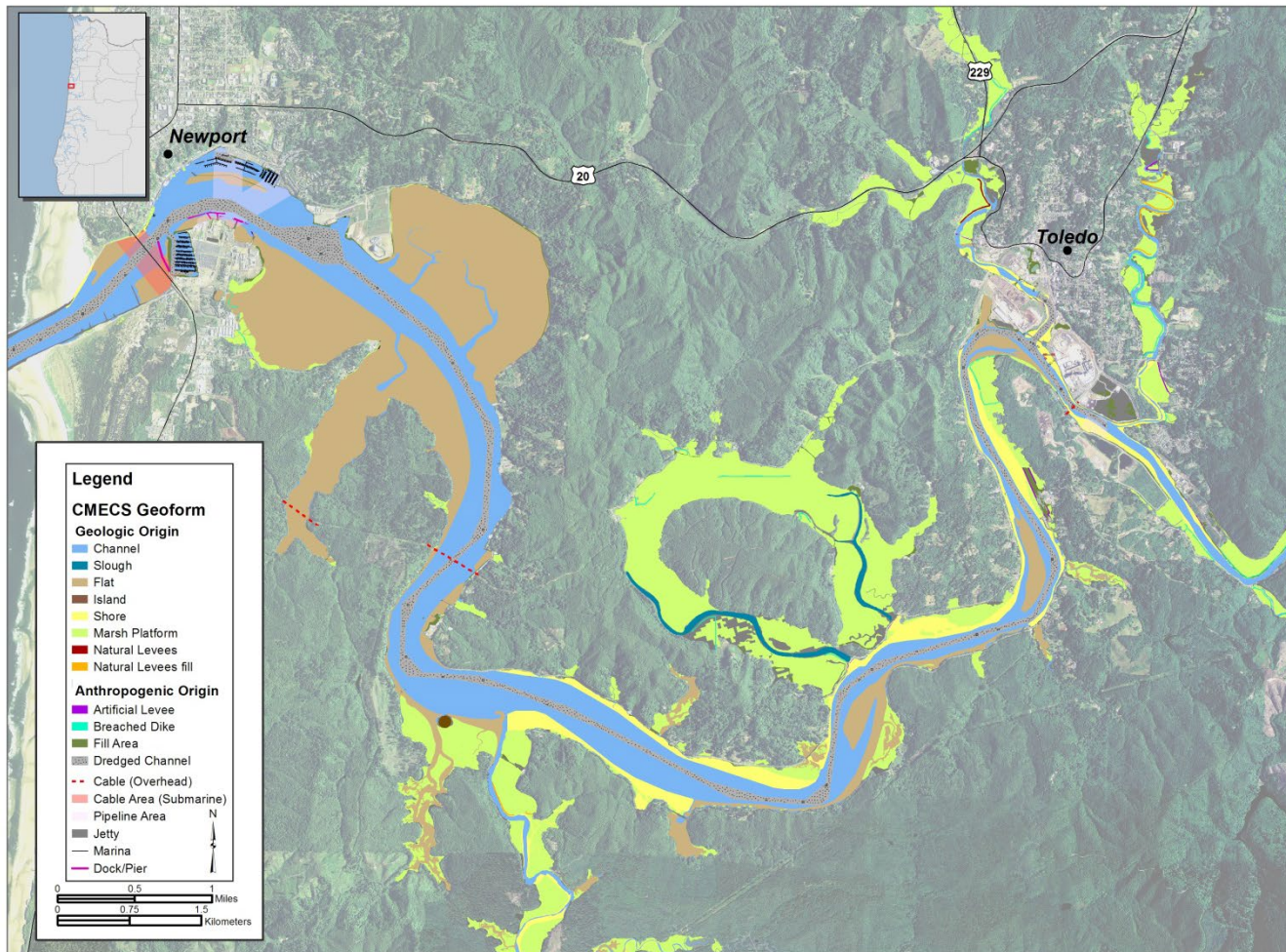
### 10 11 Biological Characteristics

12 Oregon's estuaries are dynamic and productive components of the nearshore coastal ecosystem. They  
13 harbor a rich diversity of species, habitats and ecological communities. This highly complex, productive  
14 habitat is critical for many fish and wildlife species, including salmon, crabs and other shellfish, juvenile  
15 marine fish, marine mammals and birds. Primary production in estuary habitats is among the highest of  
16 any on earth, meaning that both the visible and microscopic plants produce a tremendous amount of  
17 carbon material (from photosynthesis) that supports the base of the food web. Tidal marshes are  
18 particularly productive and produce plant material that, when it dies seasonally, is broken down by  
19 microscopic bacteria to serve as food for many organisms which in turn are eaten by larger ones as  
20 material is distributed throughout the estuary with the tides. Estuaries and eelgrass beds are habitat  
21 types that have been designated as a Habitat Area of Particular Concern under NOAA Fisheries' Essential  
22 Fish Habitat regulations for salmon and groundfish species. Efforts to maintain and restore estuaries will  
23 benefit many wildlife and commercially important species.

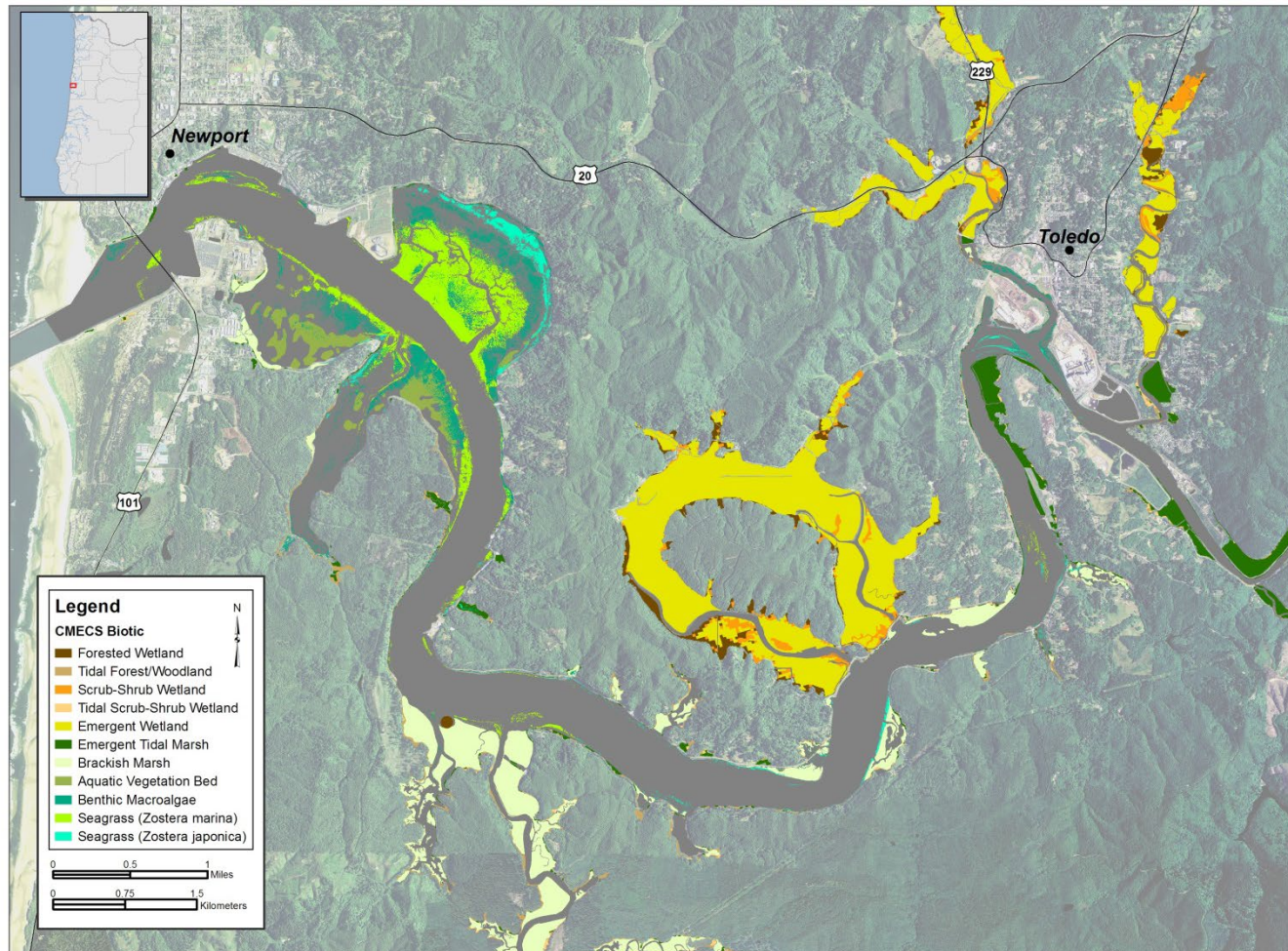
24 Many SGCN, Watch List, and other commonly associated species utilize Oregon's estuaries during parts  
25 of their life history (Table 6.3, Appendix A and B). For some, such the blue mud shrimp and Olympia  
26 oyster, the adult and reproductive stage is entirely in estuaries. Longfin smelt also spawn in estuaries.  
27 Native eelgrass is an important habitat forming species in estuaries. Native eelgrass and the habitat it  
28 provides is utilized by several Nearshore SGCN, for example: Black brant, Dungeness crab, black rockfish,  
29 copper rockfish and kelp greenling. Eelgrass is also an important spawning substrate for Pacific herring,  
30 an important forage fish species. Complex ecological communities occur in the different regions of  
31 Oregon bays and estuaries. Many invertebrates such as gaper clams, butter clams, native littleneck  
32 clams, softshell clams, and cockles live in the soft sediments along with polychaete worms, amphipods  
33 and burrowing shrimp. Other species, like barnacles, mussels, oysters, tunicates, and hydroids live  
34 attached to hard surfaces. More mobile species such as fishes, sea stars, birds and marine mammals  
35 utilize a wider variety of habitats. Starry flounder, English sole, sand sole, staghorn sculpins, and  
36 sturgeon are benthic feeders that utilize subtidal habitat to locate their prey. Salmonid species that  
37 utilize and move through estuaries include Chinook, Coho salmon, and chum salmon, steelhead and  
38 coastal cutthroat trout. Pelagic fishes like eulachon, topsmelt, Pacific herring, longfin smelt, surf smelt,  
39 northern anchovy, and Pacific sand lance also utilize Oregon estuaries. Estuaries provide important  
40 wintering habitat for waterfowl and migration feeding area stopovers for or a wide variety of shorebirds.  
41 The tidal channels, sand flats, and mudflats are also used regularly by raccoons and river otters.

42 The CMECS biotic components are determined by the dominant biota, defined as those with the  
43 greatest percent coverage. Although planktonic maps and maps of fauna associated with bottom  
44 substrate are possible, most mapping work in Oregon estuaries has focused on vegetation cover. An  
45 example of a biotic component map for Yaquina Bay (Figure 6.10) shows available CMECS biotic  
46 information along with more specific work that focused on eelgrasses. Gathering data to improve

- 1 mapping the biotic components of Oregon's estuaries is a work in progress that is anticipated to be
- 2 valuable for planning, management, research and monitoring purposes.



1  
 2 **Figure 6.9. Map of Yaquina Bay depicting CMECS Geoform Components of geologic and anthropogenic origin.**

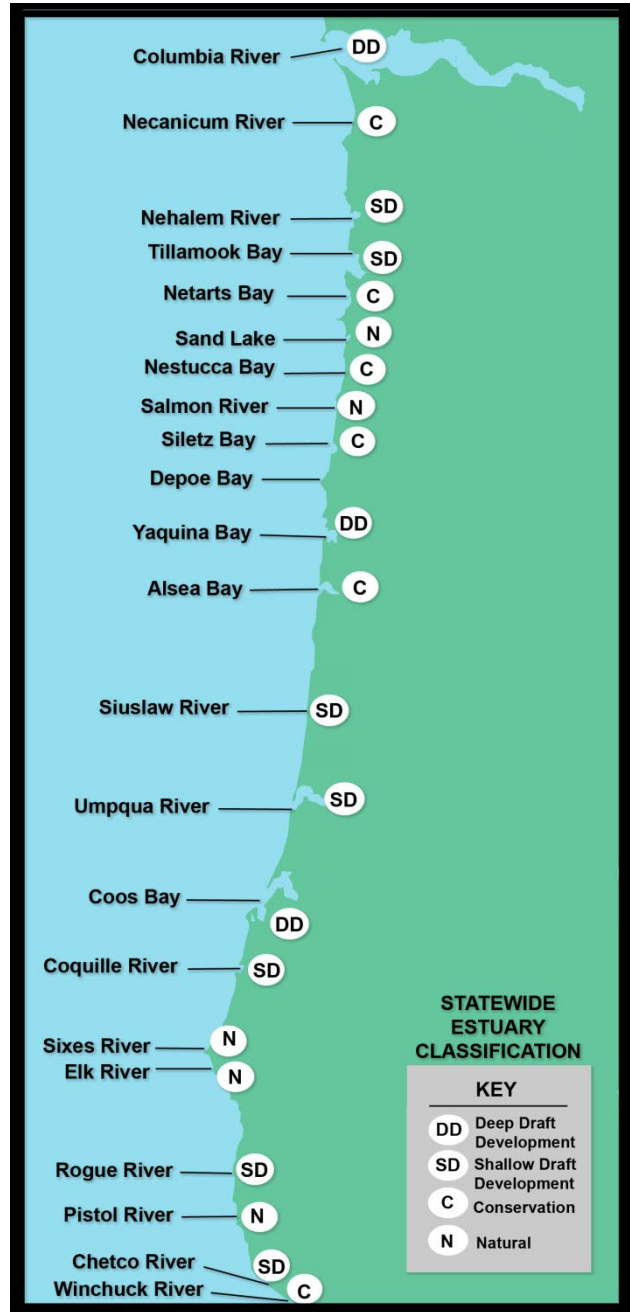


1

2 **Figure 6.10. Map of Yaquina Bay with CMECS Biotic Components.**

1 Human Uses

2 Oregon has 22 major estuaries (Figure 6.11) and many other smaller estuaries along its coast. Many  
3 coastal cities developed around estuaries. People use estuaries for recreational and commercial harvest  
4 of fish and shellfish, navigation and shipping, ports for recreational and commercial vessels, shellfish  
5 aquaculture, hunting, sightseeing, bird watching,  
6 sailing, and other recreational and commercial  
7 activities. Portions of most of the larger estuaries  
8 have been altered through dredging, filling or  
9 diking. Many of the smaller estuaries remain in a  
10 more natural state. Twenty-two cities, seven  
11 counties, and thirteen port districts have planning  
12 or management responsibilities for Oregon's major  
13 estuaries and work with the Oregon Coastal  
14 Management Program and other state and federal  
15 agencies. Oregon utilizes a four level estuary  
16 classification system that defines the level of  
17 development permitted: natural; conservation;  
18 shallow draft development; and deep draft  
19 development. Natural estuaries are usually little  
20 developed for residential, commercial or industrial  
21 uses and include Sand Lake, Salmon River, Elk River  
22 and Pistol River. These estuaries do not have  
23 maintained jetties or channels. Conservation  
24 estuaries are within or adjacent to urban areas  
25 which have altered shorelines. These include the  
26 Necanicum River, Netarts Bay, Nestucca River, Siletz  
27 Bay, Alsea Bay and Winchuck River. Like natural  
28 estuaries, maintained jetties and channels are  
29 absent. Shallow draft estuaries include Nehalem  
30 Bay, Tillamook Bay, Depoe Bay, Siuslaw River,  
31 Umpqua River, Coquille River, Rouge River, and  
32 Chetco River. These estuaries have maintained  
33 jetties and a main channel maintained by dredging  
34 to 22 feet (6.7 m) or less. Oregon's three deep draft  
35 estuaries, the Columbia River, Yaquina Bay and  
36 Coos Bay, are maintained by dredging to depths of  
37 22 feet or deeper and have maintained jetties. This  
38 management classification system is designed to  
39 preserve the inherent diversity among Oregon's  
40 estuaries, and to guide the process of residential  
41 and industrial development in estuaries that have  
42 been altered and which can support further  
43 urbanization.



44 **Figure 6.11. Oregon's 22 major estuaries are**  
45 **classified into four levels for development and**  
46 **planning purposes.**

1 **CONSERVATION OVERVIEW**

2 There are many issues for the conservation of Nearshore habitats and the species that live  
3 there. The KCIs affecting the Nearshore include Climate Change, Disruption and Disturbance  
4 Regimes, Land Use Changes (often referred to as marine spatial planning when applied to the  
5 marine environment), Invasive Species, Pollution, and Water Quality (quantity of seawater per  
6 se is not an issue in the marine environment). There are series of recommendations (link to  
7 Nearshore Recommendations), intended to facilitate voluntary, collaborative actions to improve  
8 understanding and stewardship of Oregon’s nearshore resources. These recommendations  
9 reflect the input received from ODFW staff, outside experts who served as technical advisors  
10 and reviewers, and members of the public. Twelve recommendations are outlined below,  
11 categorized into three main themes: Education and Outreach, Research and Monitoring, and  
12 Management and Policy. These are all important and not listed in a prioritized manner. Each  
13 recommendation was chosen because it addresses priority nearshore issues in need of  
14 immediate or timely attention, is feasible, has received public support, and is beyond the  
15 capability of any single institution to achieve. The recommendations rely on partners to differing  
16 degrees and are intended to help guide collaboration rather than act as an action plan for  
17 ODFW alone. Below is a summary of some of the limiting factors and recommended approaches  
18 in these three broad categories to address the KCIs affecting Oregon’s nearshore waters.

19 **LIMITING FACTORS AND RECOMMENDED APPROACHES**

20 **Limiting Factor: Public Awareness of Nearshore Ecosystem Habitats and Species**

21 Oregon’s nearshore waters are part of the California Current Ecosystem. What occurs in the  
22 ocean waters of the Pacific such as El Nino and La Nina, and Pacific Decadal Oscillation, the  
23 timing of spring and fall transition can greatly influence not only the nearshore habitats and  
24 species, but also such things as rainfall, snowpack and drought conditions throughout the state.  
25 A well-informed public helps drive policy and management decisions as well as individual  
26 actions that support a healthy ecosystem and the many benefits it offers.

27 **Recommended Approach**

28 There are a series of recommended approaches in the Nearshore Recommendations (link to  
29 Nearshore Recommendations page) under the category of education and outreach that include:  
30 1) developing creative ways to engage with the general public, constituent, and advisory groups  
31 and exploring technologies that support alternative methods of communication and  
32 participation in addition to traditional paths such as issue-specific advisory groups; 2)  
33 broadening outreach materials and information available electronically to deepen public  
34 appreciation of Oregon’s nearshore environment including increasing the quantity, quality, and

1 timeliness of information on ODFW’s website; and 3) developing new and expanding existing  
2 partnerships for communication, education, and outreach on nearshore topics and issues.

3 This approach depends on having the necessary research and monitoring to provide the public  
4 with information about the KCIs listed above and how those KCIs translate into the direct  
5 threats (link to direct threats here) to fish, wildlife and their habitats in the Nearshore  
6 ecosystem.

### 7 **Limiting Factor: Climate Change, Disruption and Disturbance Regimes**

8 Oregon’s ocean is already experiencing effects of climate change and increased carbon dioxide,  
9 including ocean acidification, hypoxia, other changes in water chemistry, warming ocean  
10 temperature, and changes in upwelling and other characteristics of the nearshore ocean and  
11 estuaries. These changes will continue to grow and intensify in the future. Oregon’s upwelling  
12 ecosystem is experiencing many of these changes sooner and in greater magnitude than other  
13 parts of the nation, increasing the urgency for collecting the needed information and  
14 formulating the necessary management response. This is a global problem that requires  
15 rigorous scientific information to solve, and partnership between scientists inside and outside of  
16 agencies to both understand the phenomena and try to mitigate its effects. Desired outcomes  
17 are to increase ecosystem and community resilience and sustainability of Oregon’s nearshore  
18 resources.

### 19 **Recommended Approach**

20 Several of the Nearshore Recommendations in the Research and Monitoring category as well as  
21 in the Policy and Management category are recommended to help address these limiting  
22 factors. Expanding research and monitoring activities are required to generate the data and  
23 information needs. This is especially true in true in the nearshore area where human activities  
24 are intense and information on species and their habitats is sparse. Develop and implement  
25 research and monitoring efforts to understand, track, and work toward predicting effects of  
26 climate change and increased carbon dioxide on Oregon’s nearshore species and ecosystems.  
27 Focus research on species and ecosystems most at risk, and foster collaboration between  
28 scientists and managers to optimize research outcomes for use in management and  
29 conservation. Continue and expand research and monitoring efforts on nearshore species and  
30 habitats. Gather scientific information on the abundance and distribution of species and  
31 habitats, the interactions among species and between species and their physical environment,  
32 and changes in those resources and interactions over time. Priorities for research and  
33 monitoring needs include oceanographic data, ecosystem data, habitat data, human dimensions  
34 and the impacts of human development that are listed in detail the Nearshore Research and  
35 Monitoring section (link to Nearshore Research and Monitoring needs here). Promote use of

1 climate change information in management decision-making and policy development in  
2 statewide, regional and global arenas. Build climate resilience and climate change adaptation  
3 into decision-making to maximize the long-term benefits of today’s public investment in natural  
4 resource management.

5 **Limiting Factor: Land Use Changes (Marine Spatial Planning)**

6 The Land Use Changes KCI ([link to Land Use Changes KCI here](#)) provides an overview of the  
7 issues associated with land use throughout the state and information about [Oregon’s 19](#)  
8 [Statewide Land Use Planning Goals](#). Goals 16-19 are particularly relevant to the Nearshore  
9 environment and ecosystem, especially Goals 16 and 19 on estuarine and ocean resources,  
10 respectively. In the wider marine realm “land use” is often referred to as “marine spatial  
11 planning”. Oregon utilizes its [Territorial Sea Plan](#) to guide state agency actions. Changes to land  
12 use in coastal areas directly and indirectly affect nearshore species and habitats in a variety of  
13 ways, that include such things as shoreline armoring, leasing mariculture plots, siting renewable  
14 energy developments such wave or wind energy facilities, as well as designating marine  
15 reserves, marine gardens, and research areas. In addition to state agencies, federal agencies  
16 also have various roles in marine spatial planning such as USWF, USCG, and BOEM. There is  
17 growing demand for ocean and coastal resources and competing use of space has increased the  
18 need to move beyond single-sector management and plan for ocean uses more holistically.  
19 Marine planning processes require comprehensive spatial information on location, abundance  
20 and distribution of marine resources and their uses.

21 **Recommended Approach**

22 Among the 12 Nearshore Recommendations ([link to Nearshore Recommendations here](#)) is one  
23 specific to marine planning. The approach is to participate in marine planning processes to  
24 ensure Oregon’s interests in marine natural resource conservation and use are fully represented  
25 in marine policy. Develop marine natural resource spatial information and incorporate it into  
26 marine planning processes to ensure they use the best available science to formulate plans  
27 concerning Oregon’s marine resources and uses. This will require partnerships with State and  
28 federal natural resource agencies, sport and commercial fishing interests, local, state,  
29 regional, and federal governments, community groups, non-governmental organizations,  
30 tribes, and the general public.

31 **Limiting Factor: Pollution, Water Quality**

32 Pollution in all its various forms ([link to Pollution KCI here](#)) can directly impact nearshore species  
33 and their habitats. Water quality is affected not only by pollution of the nearshore environment,  
34 but also by climate change effects that cause ocean warming, ocean acidification and hypoxia,  
35 all of which impact nearshore species and habitats.

1 **Recommended Approach**

2 Again, the recommended approaches to addressing pollution and water quality issues in the  
3 nearshore environment are tied to the Nearshore Recommendations (link to Nearshore  
4 Recommendations here) in all three categories as well as the goals and actions listed for these  
5 KCIs (link to Pollution and Water Quality KCIs here). Determining the vulnerability of species and  
6 habitats to various types of pollution requires research and monitoring in the nearshore.  
7 Similarly, the goals of monitoring water quality also depend on research and monitoring efforts  
8 in the nearshore. Expanding existing research and monitoring efforts on these topics will  
9 enhance our understanding of their effects, help inform the public, and drive management and  
10 policy choices to help achieve these goals.

11 **Limiting Factor: Non-native and Invasive Species**

12 Many non-native and invasive species have made their way to Oregon’s nearshore waters or to  
13 those of our neighboring state (link to Nearshore Appendix F Non-native species here). These  
14 have been introduced through a variety of mechanisms that include hitch-hiking in ballast  
15 water or in ocean currents. These species can affect food sources, alter habitats, expose  
16 native communities to diseases or toxins, or act as parasites of juvenile and adult  
17 members of coastal species. For many introduced species, the severity of the potential  
18 ecological threat is not yet known. Many of these species could be deemed invasive in the  
19 future, but further efforts to assess impacts are needed.

20 **Recommended Approach**

21 A framework to meet the challenges non-native and invasive species pose and the goals and  
22 actions needed to meet these goals are provided in the invasive species KCI (link to Invasive  
23 Species KCI here). Achieving the goals and taking these actions will be a collaborative effort.  
24 Again, this work need will include all three categories of the Nearshore Recommendations  
25 including education and outreach, research and monitoring, and policy and management to be  
26 successful.