APPENDIX - MARINE HABITAT CLASSIFICATION

CMECS FRAMEWORK

In 2012 the Coastal and Marine Ecological Classification Standard (CMECS) was adopted in the United States (Federal Geographic Data Committee 2012) to provide a common framework for describing habitat, using a simple, standardized classification scheme and common terminology (Figure 1). The goal of using CMECS is to both enhance scientific understanding and to advance ecosystem-based and place-based resource management through better communication. As the name implies, CMECS is increasingly being incorporated into scientific descriptions and being used in management documents. Components of the CMECS classification framework have been incorporated into the SWAP – in particular, the CMECS approach to evaluating and describing habitats.

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

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

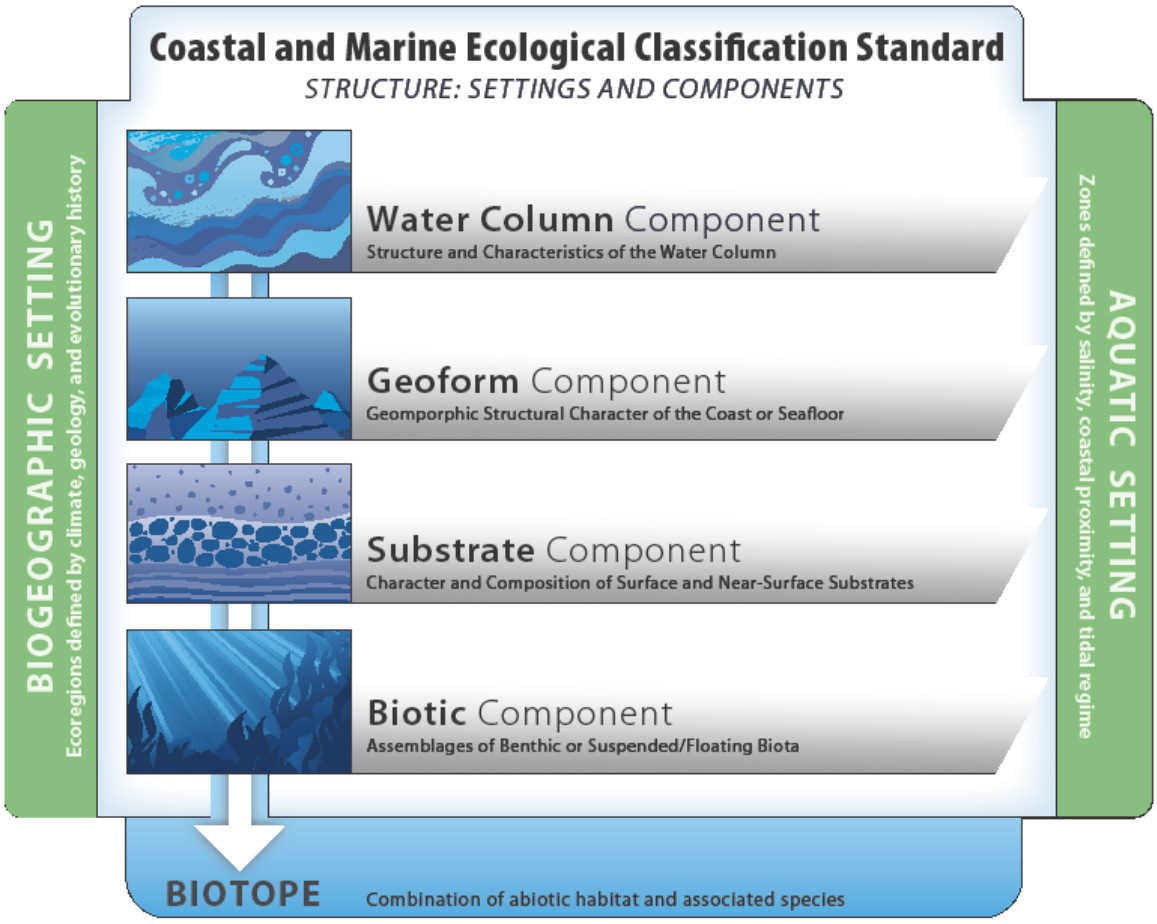


Figure 1. Overview of the Coastal and Marine Ecological Classification Standard framework (Source FGDC 2012).

The Biogeographic Settings have a hierarchical structure composed of Realm, Province, and Ecoregion. The hierarchical structure of Aquatic Settings are composed of System, Subsystem and Tidal Range. Tables 1 and 2 provide the reader with an overview of the Biogeographic and Aquatic Settings for the species and their habitats in Oregon's coastal and marine waters encompassed in the SWAP.

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

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

Hierarchical Level	Definition[1]	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	Oregon, Washington, Vancouver Coast and Shelf

[1] The definitions in CMECS were drawn from Spalding et al. 2007.

	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.	

49

50 **Table 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[2]
Marine[3] Defined by salinity which is typically ~ 35 parts per thousand, but may vary considerably especially in areas near river mouths. Includes all non-estuarine	Offshore Extends from the 30 meter depth contour to the continental shelf break, which generally occurs between 100 - 200 meters depth.	Subtidal The substrate is continuously submerged in this zone and includes those areas below MLLW.	Neritic Rocky Subtidal Soft Bottom

[2] The habitats identified here are described and classified by additional Water Column, Geoform and/or Substrate Components.
[3] 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 subsytems, which fall outside the focus of the Oregon SWAP which focuses on species and habitats that occur within the Oregon Territorial Sea.

System	Subsystem	Tidal Range	Oregon's Coastal and Marine Habitats[2]
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.	Nearshore Extends from the landward limit of the Marine System to the 30 meter depth contour.	Subtidal The substrate is generally continuously submerged in this zone and includes those areas below Mean Lower Low Water (MLLW).	Neritic Rocky subtidal Soft Bottom
		Intertidal The substrate is regularly and periodically exposed and flooded by tidal action. This zone extends from MLLW to Mean Higher High Water (MHHW).	Rocky Shores Sandy Beaches
		Supratidal 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.	Rocky Shores Sandy Beaches

System	Subsystem	Tidal Range	Oregon's Coastal and Marine Habitats[2]
Estuarine[4] 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	Estuarine Open water 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.	Estuarine Open Water Subtidal The substrate is generally continuously submerged in this zone and includes those areas below MLLW.	Estuaries
	Estuarine Coastal The Estuarine Coastal Subsystem extends from the supratidal zone at the	Estuarine Coastal Subtidal The substrate is generally continuously submerged in this zone and includes those areas below MLLW.	Estuaries

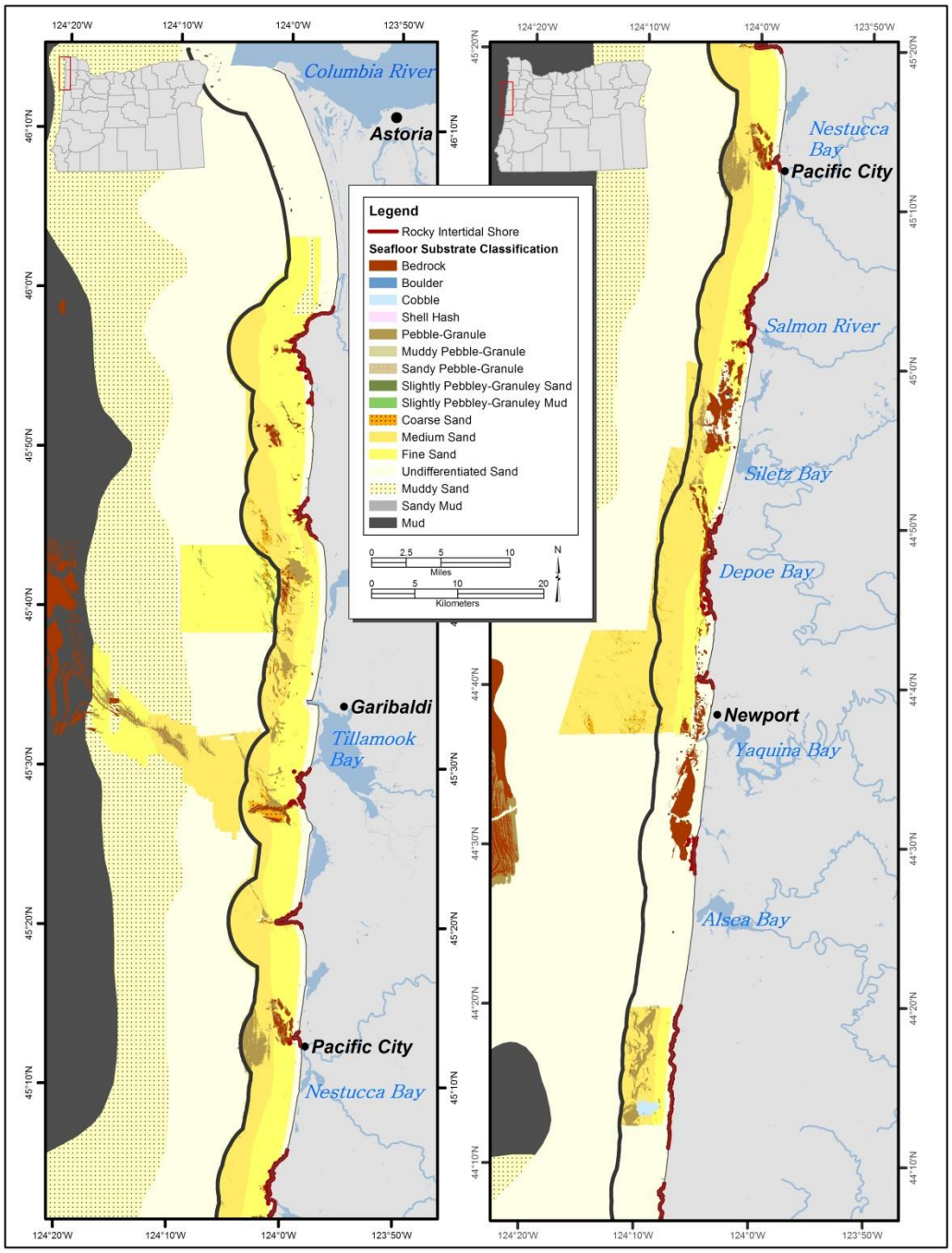
[4] The Riverine Open Water and Riverine Coastal subsystems are parts of the Estuarine Key Habitat not addressed in this document. Although these subsystems are critically important to the ecology of estuaries, they are not the primary habitat for the species covered here. Riverine portions of estuaries are addressed in Estuary Key Habitat section of the SWAP.

System	Subsystem	Tidal Range	Oregon's Coastal and Marine Habitats[2]
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.	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).	<u>Estuarine Coastal Intertidal</u> 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.	Estuaries
		<u>Estuarine Coastal Supratidal</u> 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.	Estuaries

NEARSHORE HABITAT MAPPING

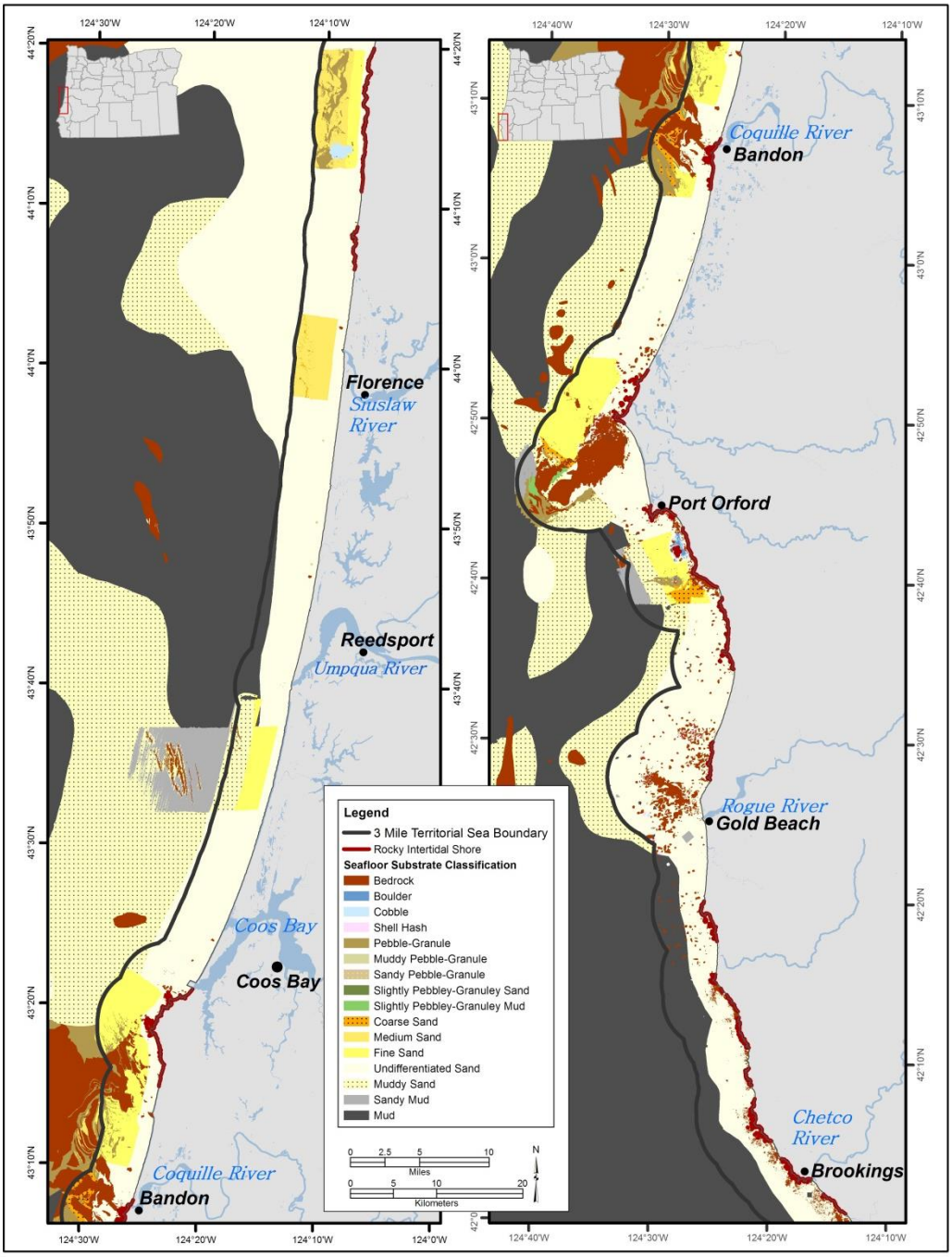
Seafloor mapping data, collected using modern high-resolution sonar technologies, now cover approximately 53% of Oregon's Territorial Sea. This is a major improvement from approximately 6% of the Territorial Sea that had been mapped with these advanced technologies, when the original Oregon Nearshore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

The difference in detail in the new habitat maps, compared with those available for the 2006 version, is striking. Use of the CMECS substrate component system also provides far more detail. A good example is the area off Cape Arago (Figure 3) where at a larger scale the differences are very apparent. Additional mapping products are anticipated as more high-resolution data for rocky reefs is acquired and processed.



68

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



71

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

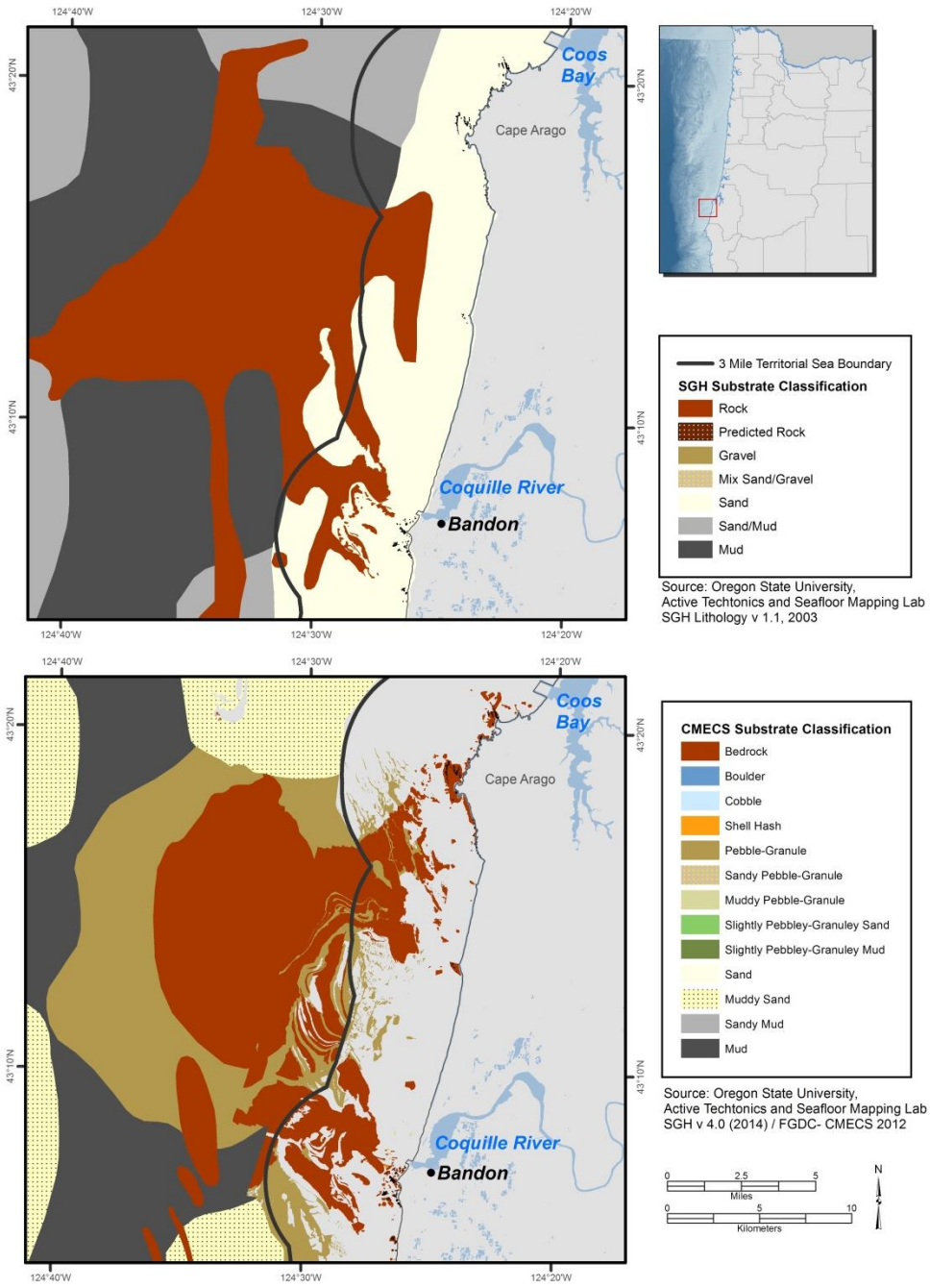


Figure 3. Detail map of the area off Cape Arago, Oregon included in original version of the Oregon Nearshore Strategy in 2006 (a) and map of the same area that incorporates data from surveys with modern sonar technologies and the CMECS classification of substrate components (b).

SPECIES-HABITAT ASSOCIATIONS

Habitat associations for Nearshore SGCN, Watch List Species, and commonly associated species are identified to provide insight into the biological communities affiliated with

specific habitats. This combination of abiotic habitat information and their associated species will help define the CMECS biotopes (areas of uniform environmental conditions, habitat, and assemblages of animals and plants) for Oregon's coastal and marine environment.

Habitat association matrices for specific life history stages of SGCN provide information about the distribution of these species in Table 3. SGCN that have any part of their life history commonly occur in a specific habitat are included in the species-habitat association. Readers should assume that information provided on species-habitat associations is based on published literature for the west coast of the U. S. and may or may not specifically be known for Oregon. However, there is Oregon-specific information available for many species such as cabezon (Figure 4). General habitat association matrices for Watch List Species and commonly associated species can be found in **Appendix - Nearshore Species**.

Figure 4. Cabezon in subtidal rocky reef habitat. Photo NOAA.

97 **Table 3**. Species of Greatest Conservation Need habitat usage, by life history phase: Adult (A), Spawning/Mating (S/M), Eggs/Parturition
98 (E/P), Larvae (L), Juveniles (J).

SGCN	Rocky Shore	Sandy Beach	Rocky Subtidal	Soft Bottom Subtidal	Neritic	Estuarine	Habitat Unknown	Comments
Birds								
Black brant *Branta bernicla nigricans*						A		Estuaries used by wintering and staging adults; feeds on marine and estuarine vegetation.
Black oystercatcher *Haematopus bachmani*	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.
California brown pelican *Pelecanus occidentalis californicus*					A			Breeds and nests near coast but not in nearshore area. Feeds primarily on small marine fish.
Cassin's auklet *Ptychoramphus aleuticus*	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.
Caspian tern *Hydroprogne caspia*		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
Fork-tailed storm petrel *Oceanodroma furcata*	S/M, J				A			Breeds and nests in rocky cliffs or sandy burrows primarily on offshore islands. Forages at ocean surface.
Leach's storm petrel *Oceanodroma leucorhoa*	S/M, J				A			Breeds and nests on offshore islands. Forages by hovering or skimming over water; feeds primarily on small crustaceans.
Marbled murrelet *Brachyramphus marmoratus*					A			Nests inland in old growth forests. Forages by diving; feeds on small fishes.
Rhinoceros auklet *Cerorhinca monocerata*	S/M, J				A			Nests in long burrows on offshore islands. Adults forage near nests during breeding season and return at sunset to feed chicks. Eat small fish and zooplankton.
Rock sandpiper *Calidris ptilocnemis*	A, J					A, J		Forages in nearshore waters during winter.
Tufted puffin *Fratercula cirrhata*	S/M, J				A			Winters at sea, spends spring and summer months in the nearshore; nests on coastal headlands and offshore islands.

SGCN	Rocky Shore	Sandy Beach	Rocky Subtidal	Soft Bottom Subtidal	Neritic	Estuarine	Habitat Unknown	Comments
Western snowy plover *Charadrius alexandrinus nivosus*		A, S/M, J						Resident or short-ranged migrant.
Fishes								
Big skate *Raja binoculata*				A, S/M, E/P, J				Soft seafloor spawning habitat. May be affected by wave energy development.
Brown rockfish *Sebastes auriculatus*			A, S/M, E/P, J			A, S/M, E/P, L, J		
Cabezon *Scorpaenichthys marmoratus*	J		A, S/M, E/P, J		L, J	A, S/M, E/P, L, J		
Chinook salmon *Oncorhynchus tshawytscha*			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.
Chum salmon *Oncorhynchus keta*					A, J	A, J	A, J	Anadromous; substantial data gaps regarding habitat usage in nearshore.
Coastal cutthroat trout *Oncorhynchus clarkii clarkii*					A, J	A, J	A, J	Anadromous; substantial data gaps regarding habitat usage in nearshore waters.

SGCN	Rocky Shore	Sandy Beach	Rocky Subtidal	Soft Bottom Subtidal	Neritic	Estuarine	Habitat Unknown	Comments
Coho salmon *Oncorhynchus kisutch*					A, J	A, J	A, J	Anadromous; substantial data gaps regarding habitat usage in nearshore waters.
Green sturgeon *Acipenser medirostris*	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.
Eulachon *Thaleichthys pacificus*					A, L, J	A, S/M, E/P, L, J		Anadromous; spawn in fresh water. Also school offshore.
Longfin smelt *Spirinchus haleichthys*					A, J	A, S/M, E/P, L, J		Anadromous; spawn in fresh water. Also school offshore.
Northern anchovy *Engraulis mordax*					A, S/M, E/P, L, J			Pelagic forage fish; commonly found in nearshore kelp beds and bays.
Pacific lamprey *Entosphenus tridentatus*							A	Anadromous. Requires fine gravel beds in freshwater for spawning. Gaps in knowledge of habitats used in marine life history phase.

SGCN	Rocky Shore	Sandy Beach	Rocky Subtidal	Soft Bottom Subtidal	Neritic	Estuarine	Habitat Unknown	Comments
Pacific sand lance *Ammodytes personatus*				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.
Pacific sardine *Galeorhinus galeus*					A, S/M, E/P, L, J			Pelagic forage fish ecologically important. Known for boom and bust population cycles.
Surf smelt *Hypomesus pretiosus*		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.
Soupfin shark *Sardinops sajax*					A		J	Soupfin 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
Western river lamprey *Lampetra aryesii*							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.
White sturgeon *Acipenser transmontanus*				A		A, L, J		Anadromous. Movements in marine habitats poorly understood.
Yelloweye rockfish *Sebastes ruberrimus*			A, E/P, J				S/M, L	Will inhabit artificial reefs. Juvenile usage of nearshore.
Invertebrates								
Blue mud shrimp *Upogebia pugettensis*						A, S/M, J		Marine water dependent estuarine species.
California mussel *Mytilus californianus*	A, S/M, J		A, S/M, J		E/P, L			Rocky intertidal, pilings.
Dungeness crab *Cancer magister*		A, E/P, J		A, S/M, E/P, J	L	A, S/M, J		Oceanic conditions linked to larval survival. Will inhabit pilings.
Flat abalone *Haliotis walallensis*			A, E/P, J		S/M, E/P, L			Rocky subtidal, gaps in life history knowledge.

SGCN	Rocky Shore	Sandy Beach	Rocky Subtidal	Soft Bottom Subtidal	Neritic	Estuarine	Habitat Unknown	Comments
Native littleneck clam *Leukoma staminea*	A, J	A, J		A,J	S/M, E/P, L	A		Marine water dependent estuarine species. Distinct from introduced Manila littleneck clam (*Venerupis philippinarum*).
Morning sun star *Solaster dawsonii*			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.
Ochre sea star *Pisaster ochraceus*	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.
Pinto abalone *Haliotis kamtschatkana*	A, E/P, J		A, E/P, J		S/M, E/P, L			Rocky intertidal and subtidal habitat near kelp.
Razor clam *Siliqua patula*		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.
Red abalone *Haliotis rufescens*	A, E/P, J		A, E/P, J		S/M, E/P, L			Do not mate at northern end of range (Cape Argo, OR).

SGCN	Rocky Shore	Sandy Beach	Rocky Subtidal	Soft Bottom Subtidal	Neritic	Estuarine	Habitat Unknown	Comments
Red sea urchin *Mesocentrotus franciscanus*	A, J		A, J		S/M, E/P, L			Adjacent to kelp forest habitat.
Rock scallop *Crassadoma giganteus*	A, S/M, J		A, S/M, J		S/M, L, J		E/P	Will inhabit pilings and jetties.
Striped morning star *Solaster stimpsoni*	A		A		S/M, E/P, J			Usually live on rocky surfaces once settled from water column, but occasionally found in low intertidal zone.
Sunflower star *Pycnopodia helianthoides*			A	A	S/M, E/P, J			Wide ranging habitats primarily subtidal once settled out from the water column. Keystone predator.
Algae and Plants								
Bull kelp *Nereocystis luetkeana*			A, S/M, E/P, J		S/M, E/P			Shallow subtidal. Reproduce by spores, with alternating generations.
Native eelgrass *Zostera marina*				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.
Sea palm *Postelsia palmaeformis*	A, S/M, E/P, J				S/M, E/P			Mid to low intertidal. Reproduce by spores, with alternating generations.

SGCN	Rocky Shore	Sandy Beach	Rocky Subtidal	Soft Bottom Subtidal	Neritic	Estuarine	Habitat Unknown	Comments
Surf grass *Phyllospadix spp.*	A, S/M, E/P, J				S/M, E/P			Low intertidal and shallow subtidal. Areas exposed to high wave action. Angiosperm.
Marine Mammals								
Gray whale *Eschrichtius robustus*			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.
Harbor porpoise *Phocoena phocoena*				A	A, S/M, E/P, J		A, S/M, E/P, J	
Humpback whale *Megaptera novaeangliae*					A, J			Make extensive migrations, with mating an birthing occurring outside OR waters.
Killer whale *Orcinus orca*					A, S/M, E/P, J	A, J	A, S/M, E/P, J	Southern resident DPS have been tracked in OR waters.
Northern elephant seal *Mirounga angustirostris*		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.

SGCN	Rocky Shore	Sandy Beach	Rocky Subtidal	Soft Bottom Subtidal	Neritic	Estuarine	Habitat Unknown	Comments
Pacific harbor seal *Phoca vituline*	A, J	A, S/M, E/P, J	A, J		A, S/M, J	A, S/M, E/P, J		
Sea otter *Enhydra lutus*			A	A	A	A		Not currently a resident reproductive population in OR waters, but sightings of individuals have occurred in these habitats.
Marine Reptiles								
Leatherback sea turtle *Dermochelys coniiacea*					A			Makes extensive migrations, with Oregon Nearshore waters designated as critical habitat for foraging adults.