



Summary of Key Findings

ShoreZone Inventory

Consistent information about shoreline habitats is needed to characterize the abundance and distribution of different habitats and their general health. To fill this need, scientists with the Nearshore Habitat Program at the Department of Natural Resources completed a statewide inventory of saltwater shorelines using the ShoreZone Mapping System.



The Washington State ShoreZone Inventory characterizes approximately 3,000 miles of saltwater shorelines statewide. Intertidal areas were surveyed between 1994 and 2000 using helicopter-based aerial videography. These recordings were then used to create geographic data that summarizes the physical and biological characteristics of the shoreline. More than 50 parameters are included that describe shoreline geomorphology, vegetation, and anthropogenic development. Inventory results show spatial patterns in features that are commonly considered to be indicators of habitat function and ecosystem condition. The data are useful for characterizing nearshore habitat characteristics at multiple scales, including the county scale for local management, and other geographic areas such as oceanographic basins. In addition to the data discussed below, the ShoreZone Inventory includes data on shoreline modification reported in Chapter 2 on page 18.

Nearshore Vegetation

Aquatic vegetation is recognized to be important fish and wildlife habitat by ecologists and in regulatory policy. For this reason, information on the abundance and distribution of aquatic vegetation is needed to support research and planning activities. Table 1. Summarizes ShoreZone Inventory data to show the relative abundance of four types of shoreline vegetation that affect habitat condition.

County Name	Total Miles	Percent of Shoreline with Aquatic Vegetation			
		Eelgrass	Floating Kelp	Non-floating kelp	Sargassum
Clallum	254	20%	40%	80%	1%
Grays Harbor	187	5%	> 1%	6%	> 1%
Island	214	63%	10%	18%	8%
Jefferson	254	58%	7%	33%	18%
King	123	62%	13%	27%	25%
Kitsap	254	48%	> 1%	21%	21%
Mason	232	28%	> 1%	24%	33%
Pacific	276	22%	> 1%	1%	> 1%
Pierce	239	26%	7%	44%	19%
San Juan	408	41%	31%	63%	47%
Skagit	229	51%	12%	26%	15%
Snohomish	133	22%	1%	1%	3%
Thurston	118	4%	> 1%	24%	4%
Whatcom	147	55%	7%	18%	34%
Total	3067	37%	11%	31%	18%

Table 1. Percentage of Aquatic Vegetation Along Coastal Shorelines in Washington State (By county). Source: Department of Natural Resources.

Eelgrass beds (*Zostera marina* and *Zostera japonica*) occur along 37% of shorelines. Island, King, Whatcom, Kitsap and Skagit Counties have the highest percentage of eelgrass. Eelgrass is not common in South Puget Sound and it does not occur in the extreme reaches, including Budd Inlet, Eld Inlet and Totten Inlet. While this data provides a useful snapshot of eelgrass distribution, it cannot address temporal trends in eelgrass distribution and abundance. A separate monitoring project within the Nearshore Habitat Program monitors temporal trends in eelgrass beds (see Monitoring Eelgrass Abundance in Puget Sound on page 88).

Kelp beds are important nearshore habitats that support commercial and sport fish, invertebrates, marine mammals and marine birds. The ShoreZone Inventory shows very different patterns in the distribution of floating kelp (*Macrocystis integrifolia* and *Nereocystis leutkana*) and other non-floating kelp species (*Laminaria spp.*, *Egregia menziesii* and other species). Statewide, shorelines with floating kelp are less common (11%) than non-floating kelp (31%). Floating kelp is most common in rocky, high-energy environments, corresponding to high percentages of this habitat in Clallum and San Juan Counties. In Jefferson County, floating kelp is common along the rocky outer coast headlands and around Port Townsend, but it is rare in Hood Canal. Floating kelp decreases gradually as energy decreases and rocky habitat becomes less common, leading to intermediate percentages in Whatcom County, Skagit County, Island County and King County. Floating kelp is rare in lower energy areas with predominantly sand and mud shallow subtidal substrates, including counties that border Southern Puget Sound, Willapa Bay, and Grays Harbor. Like floating kelp, non-floating kelp is most common in counties with relatively high-energy rocky shorelines, such as San Juan and Clallum Counties. However, non-floating kelp occurs in all counties. In protected, lower energy areas, the principle species is *Laminaria saccharina*. The lowest percentages are found in counties with extensive low angle embayments, such as Grays Harbor, Pacific, and Snohomish Counties.

Sargassum muticum is a non-indigenous brown alga from Asia. It has been known to be established in Washington for decades. However, little is known about its distribution or its interaction with local species. ShoreZone Inventory data shows that *Sargassum* is present along 18% of the state's shorelines, and its distribution is not even (Figure 1). *Sargassum* is found more often along shorelines in the Hood Canal, the San Juan Archipelago and the Strait of Georgia, leading to correspondingly high percentages in San Juan, Mason, and Whatcom counties. It is least common along the outer coast, in Clallum, Grays Harbor and Pacific counties.

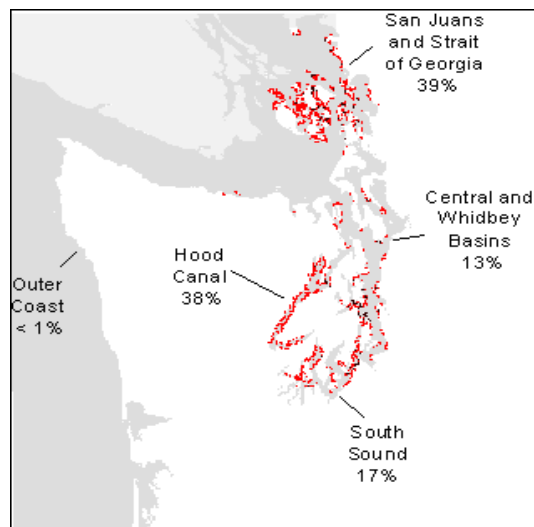


Figure 1. Sargassum distribution. Source: Natural Resources. Source: Department of Natural Resources. Puget Sound's Shoreline

Shoreline Modification

Shorelines in Washington State have been extensively modified by humans. Scientists with the Nearshore Habitat Program at the Department of Natural Resources completed a statewide inventory of saltwater shorelines, including extent of human modification, using the ShoreZone Mapping System. The shoreline modification data is discussed here. Other data from the ShoreZone Mapping System is discussed in Chapter 6 on page 86.

The Washington State ShoreZone Inventory characterizes approximately 3,000 miles of saltwater shorelines statewide. Approximately one-third of all shorelines have some of kind shoreline modification structure, such as a bulkhead (Table 2). Shoreline modification is not evenly distributed geographically (Figure 2). The outer coast has relatively little modification, while Puget Sound is more extensively modified. The large river deltas in Puget Sound are the most extensively modified habitats, such as the Commencement Bay / Puyallup River areas, and the Elliott Bay / Duwamish River areas. At the county level, Snohomish County and King County have the most highly modified shorelines. These areas have relatively high population densities and a high proportion of unconsolidated shorelines. Much of the shoreline has been modified (historically and recently) for agricultural, industrial, and residential uses. San Juan County has the lowest modification overall. This county is less heavily developed, and many of the shorelines are rocky, which do not tend to erode. In addition to structures such as bulkheads, many other types of human shoreline modification are summarized in the ShoreZone Inventory. For example, the state has approximately 1,200 boat ramps, 3,600 piers and docks, and 30,000 recreational boat slips.

County	Total Miles	Miles Modified	Percent Modified
Snohomish	133	99	75%
King	123	84	68%
Pierce	239	129	54%
Thurston	118	54	46%
Kitsap	254	110	43%
Mason	231	92	40%
Skagit	229	81	35%
Whatcom	147	49	34%
Gray's Harbor	187	45	24%
Island	214	49	23%
Pacific	276	57	21%
Clallum	254	27	11%
Jefferson	254	22	9%
San Juan	408	19	5%
TOTAL	3067	917	30%

Table 2: Shoreline modification by county. Source: Department of Natural Resources.

Shoreline Modification Associated with Single Family Residences

Shoreline modification, such as bulkheading, is known to degrade shoreline habitats by interrupting natural shoreline processes. For this reason, a variety of state and federal statutes regulate shoreline modification projects. Some of state statutes exempt projects associated with single-family residences or subject them to less stringent criteria. It has been suggested that existing policies should be altered in order to address the cumulative impacts of shoreline modification due to single-family residences. However, the relative proportion of shoreline modification associated with single-family residences was not known.

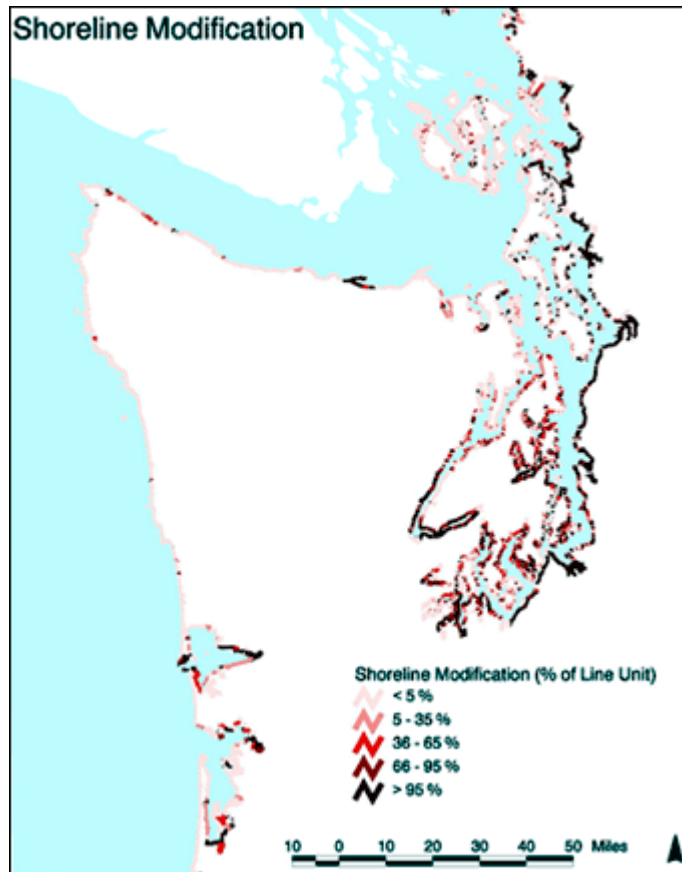


Figure 2. Shoreline Modification. Source: Department of Natural Resources.

In order to determine the relative significance of single-family residences in overall shoreline modification, scientists in the Nearshore Habitat Program at the Department of Natural Resources collected data on the proportion of shoreline modification along state saltwater shorelines associated with single-family residences. They found that approximately half of all shoreline modification in Washington State is associated with single-family residences (55% ±9%). This finding suggests that shoreline modification associated with single-family residences is a major component of total shoreline modification. Regulatory policies relating to shoreline management could be improved to more fully consider this potential source of environmental degradation.