



Long-term canopy-forming kelp monitoring on the coast and strait

Kelp beds are highly productive nearshore habitats that support salmon, Orca killer whales, forage fish, invertebrates, and marine birds. Many factors, both natural and anthropogenic, affect the extent and composition of kelp beds. DNR has monitored floating surface canopies along the outer coast and the Strait of Juan de Fuca since 1989 using aerial photography. Two species make up these beds, bull kelp (*Nereocystis luetkeana*) and giant kelp (*Macrocystis integrifolia*). Some kelp beds persist over decades, while others fluctuate greatly year-to-year. Overall, floating kelp canopies in this area have been stable over the last 3 decades of monitoring. They also appear stable when compared to historical surveys from 1911, with some possible exceptions within Puget Sound. DNR will continue to monitor this important kelp resource. Climate warming is a major concern, as are human impacts. Kelp along the coast and strait is likely to be less vulnerable than the beds in Puget Sound, which are subject to greater human impacts and naturally higher water temperatures.



The floating canopy of bull kelp (*Nereocystis luetkeana*).



Washington's stunning coastal landscape includes diverse and critical kelp forest ecosystems.

Why does this matter to DNR?

DNR manages over 2.6 million acres of state-owned aquatic lands. Sustainable management of kelp is one of DNR's important stewardship responsibilities. Like coral reefs and rain forests, kelp is a foundation species that supports a unique and diverse community of animals. Many of these animals, like Chinook salmon and Orca killer whales, are both iconic and critical to the ecosystem. Through monitoring, DNR can understand the state and the kelp resource and target management actions to optimally protect kelp. Recently, kelp losses have been reported at sites world-wide, which constitutes a call for monitoring and management in our region.

For more information

<https://www.dnr.wa.gov/programs-and-services/aquatics/aquatic-science/kelp-monitoring>

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Project Outcomes

DNR's 3-decade long record of annual kelp canopy extent provides an important research for understanding the dynamics in kelp habitat, changes over time and relationships to the animals that rely on kelp habitat.

Key findings include:

The long-term data set allowed the researchers to detect climate signals in the dynamics of kelp forests.

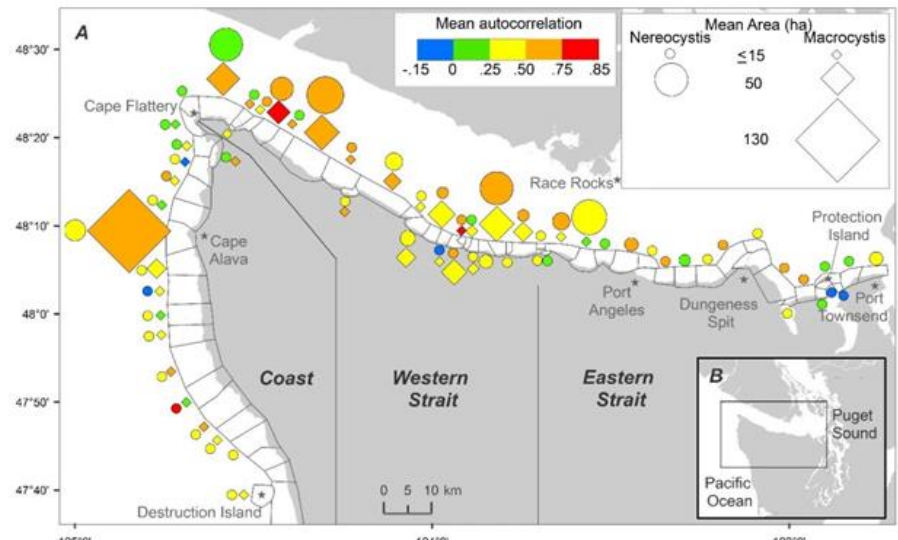
Throughout state waters, kelp cover has been strongly related to large scale climate indices. Increased kelp cover has occurred when the Pacific Decadal Oscillation and the Oceanic Niño Index were negative and the North Pacific Gyre Oscillation was positive. Under these conditions, seawater is colder and more nitrogen rich.

Kelp forests have been most abundant and persistent along the western Strait of Juan de Fuca and the outer coast, remaining stable when compared to historical kelp surveys done in 1911-1912. Meanwhile, kelp forests declined in the eastern Strait over that same time. The proximity of kelp forests to human population centers and their distance from the influence of cooler oceanic waters may explain this century-scale decline.

Project Outputs

Recent publications and data:

- [Kelp monitoring page \(DNR's Nearshore Habitat Program\)](#)
- [Scientific study of kelp dynamics \(Journal of Ecology\)](#)
- [Storymap with maps showing historical and current canopy-forming kelp distribution](#)
- [Kelp forest dynamics following decades of sea otter expansion](#)
- [Download GIS Data](#)



Abundance and persistence of giant kelp (*Macrocystis*) and bull kelp (*Nereocystis*) canopies between 1989 and 2015. The symbol shape depicts species. The size depicts abundance. The color indicates how consistent in abundance each population has been over the last 26 year – more red colors are more consistent through time. (Journal of Ecology)

Future Opportunities

DNR will continue to monitor this important resource. Climate warming is a major concern because kelp is a cold water species, and warming could exceed thresholds for damage. There is also a pressing need to extend long-term monitoring of kelp canopies throughout Puget Sound. Kelp along the coast and strait is likely to be less vulnerable than the beds in Puget Sound, which are subject to greater human impacts and higher water temperatures.

In addition to the two species of canopy-forming kelp, Washington State is home to 20 species of understory kelp. Understory species are much more abundant, and are also critical habitat. However, they are difficult to monitor because they can't be seen from the water's surface. New research and monitoring efforts are needed to track this important resource.