*Olympic Coast National Marine Sanctuary*

# Management and Protection of Kelp Forest Systems

## Management Issue

Kelp habitat and the associated ecological community need to be monitored to assess long-term trends for management needs and resource protection in the Olympic Coast National Marine Sanctuary (OCNMS or Sanctuary).

## Description

*Kelp forest as fish habitat. Photo credit: Steve Fisher*

Giant kelp (*Macrocystis integrifola*) and bull kelp (*Nereocystis leutkeana*) are the dominant kelp species in the nearshore waters of the Sanctuary. Kelps can grow up to 20 meters in length, and form dense patches known as kelp forests which provide habitat for a wide variety of organisms. Kelp forests are often compared to tree forests on land since both have distinct layers: a sunny canopy at the surface, a dimly lit middle, and a dim forest bottom. This pattern of vertical zonation provides a variety of microhabitats or niches that support a large and diverse assemblage of biological species. Sea otters often forage and rest in kelp canopies, while many fish and invertebrate species find safe cover within the intricate structure of the kelp forest. The complex structure of this living habitat buffers nearshore areas from the force of waves, surges and currents, thereby creating a relatively protected environment. The kelp canopy is dynamic and has considerate inter-annual variability, yet these kelp forests are generally thought to be stable. The overall trend is increased total surface area of floating kelp along the outer coast and the Straits of Juan de Fuca.

## Questions and Information Needs

1) Will the increasing trend in kelp canopy area continue over longer time scales to include decadal oscillation cycles such as sea surface temperature or upwelling intensity?

2) How will global climate change impact the abundance and distribution of kelp, and can this be assessed *a priori* by simulation models? How will the associated kelp community change in response to climate change?

3) What is the trend for kelp canopy area at the mouth of rivers? Is there an impact from increased sediment load and increased turbidity from watershed sources? Would this lead to a localized reduction in kelp canopy?

4) What is the intra-annual or seasonal variability in kelp canopy area, and could it explain high level of inter-annual variation? Can wintertime kelp monitoring data be used to forecast abundance during the subsequent summer?

5) Is monitoring canopy cover sufficient or do we need to include methodologies for assessing kelp biomass, etc?

6) What was the original natural distribution of kelp forests within the Sanctuary as determined by historical documentation and tribal oral histories?

7) Would a subtidal monitoring program by divers or remote sensing be warranted to complement the current kelp monitoring program by including subsurface macroalgal, fish and invertebrate species? Would this be a better indicator for nearshore ecosystem performance?

8) Is the increase in kelp canopy area primarily due to biotic factors such as the growing population of sea otters and their predation on grazing sea urchins, or is it more influenced by physical factors such as changes in oceanographic conditions?

## Scientific Approach and Actions

- Annual aerial photographic surveys of the floating kelp canopy area have been conducted by the Washington State Department of Natural Resources since 1989 and in collaboration with the Sanctuary since 1995.
- Surveys are conducted from the Columbia River north along the Olympic Coast to Cape Flattery and east along the Straits of Juan de Fuca to Port Townsend, WA.
- Post processing of data distinguishes between bull kelp and giant kelp.

## Key Partners and Information Sources

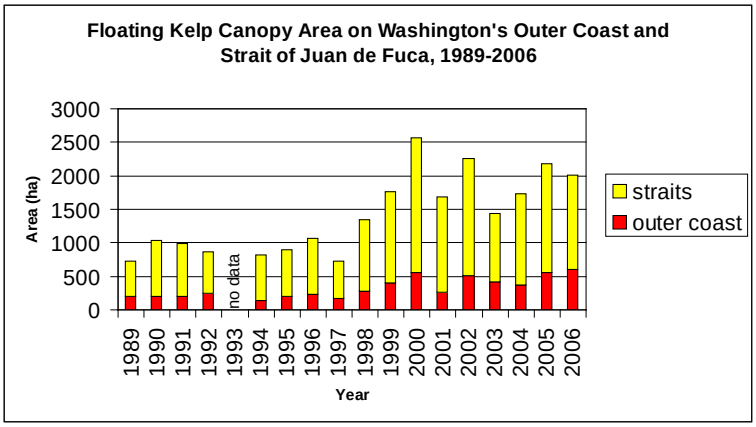
The kelp canopy is monitored in collaboration with the Washington State Department of Natural Resources and contracted through Ecoscan Resource Data, Inc. Annual aerial surveys have been flown since 1989. Data is also used in conjunction with sea otter and seabird surveys with Washington State Department of Fish and Wildlife as associated habitat.

## Management Support Products

- High resolution maps depict late summer kelp habitats from 1989 to present.
- Kelp maps can be used as GIS layers and overlap with other natural resources such as sea otters, invertebrates or fishes.
- Sea otter surveys provide population size of Olympic Coast sea otters categorized by location and age class.
- Use maps for education and outreach.

## Planned Use of Products and Actions

- Use kelp canopy maps and natural resource overlays as baseline data to mitigate impacts such as oil spills.
- Use kelp canopy data to assess impacts of global climate change on coastal communities.
- Develop recommendations assessing permits such alternative energy projects.
- Develop habitat suitability models.




*Summary results of aerial surveys for kelp canopy surface area.*
*Source: Washington Department of Natural Resources*

## Program References

OCNMS Management Plan

- 1994 OCNMS Management Plan: Research (III) 1- monitoring
- 2008 OCNMS Management Plan Review: Priority Topics C & E
- http://olympiccoast.noaa.gov/protection/mpr/mpr_prioritytopics.html

OCNMS Condition Report

- Question 6

ONMS Performance Measures

- By 2015, 100% of the sanctuary system is adequately characterized.
- Number of sites in which select living marine resources, based on long term monitoring data, are being maintained or improved.

Other Documents

- OCNMS Science Framework, 2003 (http://olympiccoast.noaa.gov/research/interested/welcome.html)