BULL KELP (*Nereocystis luetkeana*)

OVERVIEW

- **Oregon Conservation Strategy Species**
- **Size:** Up to about 115 feet long
- **Lifespan:** Usually 1 year, but some may live longer
- **Key Strategy Habitats:** Nearshore, Estuaries
- **Similar Species:** Giant kelp (*Macrosystis pyrifera*) also forms kelp beds, but it has many small air bladders. The single large air bladder of Bull kelp makes it easy to tell these species apart. The two species may grow together in some locations forming kelp beds that are a mix of both species. Bull kelp is far more common than giant kelp in Oregon waters.

RANGE AND DISTRIBUTION

In Oregon: Bull kelp can be found statewide in Nearshore waters with rocky bottoms in depths less than about 66 feet, but it is most common in waters along the south coast.

Everywhere Else: Bull kelp can be found from Point Conception, California in the south to Unimak Island, Alaska in the north in waters with rocky bottoms out to depths of about 66 feet.

Bull kelp is a brown alga that can grow to about 115 feet long. A tough root-like structure called a holdfast anchors it to the rocky bottom. The long, hollow stem-like stipe grows from the bottom up towards the surface buoyed by a single large air bladder bulb from which the leaf-like blades grow. The blades spread out at the surface. Bull kelp absorbs dissolved nutrients and water directly from seawater through its blades, unlike vascular plants that absorb water and nutrients from the soil through their roots. Bull kelp grows in relatively shallow waters that have a rocky bottom and is often found in dense patches know as kelp forests or kelp beds. Bull kelp blades in these kelp forests form a canopy at the water's surface.

FUN FACTS

Food: Bull kelp creates its own food through photosynthesis.

- Bull kelp has alternating generations in its annual life cycle: one generation is massive (sporophyte), the other is microscopic (gametophyte).
- Bull kelp typically form large beds known as kelp forests that are home to a wide variety of fish and invertebrates.
- Bull kelp beds disappear from coastal waters in the winter months when large waves rip them from the bottom, but the microscopic spores and gametophytes, the sexual stage of the bull kelp life cycle, are still present.
- Bull kelp grows from the bottom to the surface, buoyed up by a single "air bladder" or pneumatocyst that contains oxygen, nitrogen, and carbon monoxide gas. Bull kelp blades spread out at the surface absorbing sunlight, carbon dioxide, water, and nutrients for photosynthesis to make food.

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LIFE HISTORY AND ECOLOGY

Bull kelp is a brown alga that like all kelp species alternates generations. The large sporophyte generation, that has two sets of chromosomes, is what we see as kelp beds along the Oregon coast. This generation grows quickly, up to 2.5 inches (6 cm) per day, from a fertilized egg in the spring. A single stemlike stipe grows from a holdfast that anchors it to the rocky bottom. The stipe is buoyed up to the surface by a single large air bladder, or pneumatocyst. Between 30-60 blades grow from the top of the air bladder and stretch out along the surface where they absorb sunlight, water, carbon dioxide, and nutrients to generate food through photosynthesis. The blades are narrow and flat when bull kelp grows in waters with currents and waves but are wide and wavy when bull kelp grows in protected waters. This difference seems to be a tradeoff between photosynthesis and being dislodged because the narrow blades have less drag and are less prone to dislodging bull kelp from the bottom in water exposed to waves and currents. Maximum photosynthesis occurs in summer and early fall and it has been estimated that bull kelp can grow 10 inches (25 cm) a day this time of year. Bull kelp is flexible and the upper third of the stipe is hollow allowing it to stretch up to 38% with the pull of the waves and currents. Bull kelp form spores with a single set of chromosomes on patches of their blades called sori. These sori form near the base of the blades and become more mature as they grow further away from the base. The sori fall away from the blade as they release spores. An enormous number of spores are produced, and they are released quickly when they are ready with an estimated of an average of 1.5 million per square inch of sori per minute (230,000/cm^2/min), The spores have two whiplike tails called flagella that allow them to move. Spores may settle close to the large kelp soon after being released, helping ensure kelp beds appear in the same places the following year, or they may drift with currents and settle elsewhere to establish new kelp beds. Spores that are successful germinate into the microscopic gametophyte generation of bull kelp, with one set of chromosomes, that produces sperm and eggs. Very little is known about the microscopic gametophytes that grow from the spores and how long they can live, but the seasonality of bull kelp indicates that most produce gametes, eggs and sperm, within 2-3 months. Bull kelp eggs are immobile and release a chemical cue called a pheromone that attracts the mobile sperm, but only at very close range, so the density of settled spores that produce the gametophyte generation must be high, about 645-6,450 spores/in^2 (1-10/mm^2), for the next generation of the large sporophytes to succeed and kelp beds to form. Bull kelp is generally an annual, with the large sporophyte generation growing quickly up toward the surface in spring, becoming most visible at the surface in Oregon starting in July, dropping spores in late summer and fall, and the microscopic gametophyte generation present during the winter months after the large bull kelp generation has been torn from the bottom by fall and winter storms. So, while the kelp beds made up of large bull kelp are absent from Oregon nearshore waters in the winter months, bull kelp is still present in its microscopic form as a natural part of its complex life cycle. It is worth noting that variation in the life cycle and its timing has been documented. In some more protected waters in southern parts of its range some large bull kelp last through the winter, but further north it is strictly an annual with earlier spore production than further south.

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Bull kelp is important ecologically in Oregon's Nearshore. It is the primary canopy forming kelp off our coast. It provides food and/or habitat for a wide variety of marine animals. Red and purple sea urchins, and a variety of snails such as abalone eat bull kelp and other algae. A myriad of invertebrates and fish live in kelp beds. Bull kelp is the primary canopy forming kelp in Oregon waters, but it is also found mixed with giant kelp both in Oregon and other locations mostly further to the south.

FOOD GENERATION

Bull kelp like all algae generates its own food from sunlight, carbon dioxide, water, and nutrients through photosynthesis making it one of the primary producers of food in our nearshore ocean. Bull kelp absorbs carbon dioxide, water, and nutrients directly from the seawater it is surrounded by. Virtually all nutrient, water, carbon dioxide, and sunlight uptake for photosynthesis takes place in the blades that make up the kelp canopy of large bull kelp. The food generated in the blades is transported down along the stipe to the holdfast.

HABITAT CHARACTERISTICS

Bull kelp grows in waters from about 9 to 66 feet deep with rocky bottoms. It is found along the coast of North America in the temperate waters of the Pacific Ocean from Unimak Island, Alaska to Point Conception, California. It needs adequate nutrients and waterflow and is found both in waters exposed to waves and strong currents as well as in more protected waters such as bays and outer estuaries.

CONSERVATION AND MANAGEMENT

Threats: Oil spills, pollution, increased turbidity from coastal runoff, warming ocean and climate change that affects coastal upwelling. Additionally, the loss of predators that help keep grazers in check can be a threat.

Conservation and management: Bull kelp forests in Oregon waters are known to vary by more than ten-fold from year to year, but the reasons for these changes are poorly understood. Recent ocean warming associated with marine heat waves combined with a decline in the Sunflower Star (*Pycnopodia helianthoides*), a known predator of herbivores that eat bull kelp are thought to have contributed to a recent decline in bull kelp abundance. Limited amounts of living bull kelp and most other seaweed species may be taken seasonally in Oregon for non-commercial purposes.

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