Protecting our kelp forests and oceans

*This material is from the informational back matter in my picture book manuscript, **Ocean Forest**. Even if a publisher never acquires this book, I hope this information is helpful to students, parents, and teachers.*

Imagine a forest of kelp fronds in the ocean. Instead of air, this forest is surrounded by water, and sways with the motion of the waves and tides. This forest has fish swimming among the kelp fronds; a land forest has birds flying among tree branches.

The kelp in a kelp forest is a **keystone species**. A keystone species is a species which holds an ecosystem together, one on which other species in the ecosystem depend. If a keystone species disappears, it alters an ecosystem drastically. Kelp in the forest provides food and shelter for many species.

Elements of a Kelp Forest in this story:

Kelp is an algae, not a plant. It grows in every ocean except Antarctica. Kelp has **stipes**, which are like long stems, as long as 30 to 60 feet in length. Each stipe has many **blades**, which are the leaf-like structures which grow from the stipe. Blades are kept afloat and able to access sunlight by **pneumocysts**, small air bladders.

The ocean constantly bathes the kelp forest in nutrients, unlike a land forest where the plants draw nutrients from the soil. Ocean water contains microscopic **phytoplankton**, plants which are eaten by animals ranging in size from tiny zooplankton to baleen whales. Both kelp forests and land forests use sunlight for photosynthesis to produce energy. The ocean water also helps support the kelp to keep it upright in the water.

Fronds are strands of kelp—the stipes and blades. The blades lower on the stipe produce **kelp spores** which drop to the ocean floor and grow into fronds. The fronds are attached to the rocky ocean floor with **holdfasts**. **Holdfasts** look like roots clinging to outcroppings of rocks on the ocean floor, but they do not carry nutrients like the roots of land plants do. Instead, holdfasts keep the kelp in place with their branching, rootlike **haptera**.

The kelp forest has layers like a land forest does: a **canopy** which consists of the upper parts of fronds, which are closest to the surface and also create shade and a home for creatures such as **kelp crabs** and **kelp snails**; an **understory**, which has other algaes growing among the fronds, as well as juvenile fish and invertebrates; and the **forest floor**, which is the ocean floor with the holdfast and the animals which shelter there: sponges, tube worms, bristle worms, the young of shrimp and small fish, sea slugs, young sea stars, and other animals .

Sea urchins have gnawed their way through holdfasts in many kelp forests, which kills the forests. Sea urchins become a problem when they do not have predators. They are in the same phylum –echinoderm-- as sea stars, and both sea urchins and sea stars have tube feet for moving around on the ocean floor.

Sea otters are a **keystone predator** because they are a main predator of sea urchins, and keep sea urchin populations from killing the kelp. Other sea urchin predators are sea stars, particularly the sunflower sea star, and wolf eels, which have strong jaws which they use to crush the urchins.

Orcas are apex predators. This means that they are at the top of the food web, and eat other animals such as sea otters, seals, salmon, squid, smaller fish, and even some sharks. Orcas live in groups called pods. The orca in this story is rolling in the kelp, wrapping kelp fronds around its

body as it twirls. Biologists call this **kelping**. Some scientists think kelping is a way of scratching, getting tickled, or of rubbing off parasites on the orca's skin. Others think it is a form of play. It certainly looks like fun!

Storms can tear the kelp fronds free of their holdfasts. The action of wind and waves forms **kelp rafts**, floating clumps of kelp, complete with smaller animal passengers such as crabs, young shrimp, and snails. Kelp rafts which drift onto shore are called **wrack**, and feed land animals and birds. When migrating birds find a kelp raft out at sea, they have food and a place to rest when they are far from land. Kelp rafts may drift for miles before they eventually sink and give their nutrients up to the ocean bottom. Scientists found a kelp raft with fronds (and hitchhiking animals such as barnacles) which traveled 12,500 miles!

How important are kelp forests?

Kelp forests are very important ecosystems, to animals and to us. They provide many ecosystem services. **Ecosystem services** mean that an ecosystem—including the plants and animals in it-- does things which benefit us and all life. In a kelp forest, the kelp absorbs and removes carbon dioxide from the ocean, and it gives off oxygen. This is a way to help reverse climate change. How does this work? Carbon dioxide makes the ocean acidic. The oxygen which kelp gives off helps lower the acidity of the ocean water. Another ecosystem service kelp forests provide is filtering excess nitrogen from the ocean. Both of these benefit all life in the ocean. Kelp forests also stabilize the water around shorelines, providing some erosion control.

How can we help kelp forests?

Watch what you put in the water or even on the ground. All water comes from a watershed somewhere, and eventually ends up in the ocean, whether through rivers and streams, or through rain and snow. If it flows over clean soils, that is good for the ocean and for all life. If you need to get rid of something toxic like chemicals, for example, find out how to dispose of it in a way that is safe for humans and animals and the life in the ocean. Organize a litter cleanup with friends or your family.

Work to reverse global warming. Automobile exhaust creates pollution which causes the problems leading to global warming. To fight climate change, take the bus, walk, ride your bike, or share a ride with other people when you can. Why is this important? Many animals are adapted to a specific climate with seasons. When temperatures are significantly hotter or colder, this can harm them, even cause them to die from extreme heat or cold, or cause them to move to somewhere else. When one type of animal moves away, that may mean less food for other animals—it affects the whole food web.

Try to eat organic foods when you can. Pesticides harm animals and us. If you grow food crops, avoid pesticides and chemical fertilizers. Remove weeds by pulling them. Crops which are grown without chemical fertilizers or pesticides are beneficial to all life, including us and everything in the ocean.

Use fewer or no single-use plastics. Why is this important? A plastic bag or bottle in the ocean may look like a squid or other food to a larger fish or whale, and they swallow it. When their stomach fills with plastics, they cannot absorb food, and starve to death. Whales provide ecosystem services by bringing nutrients from deep in the ocean back up to the surface; they feed deep near the ocean bottom, then come to the surface to breathe and excrete what they have eaten. The nutrient-rich whale poop floats on the surface and feeds phytoplankton, which feed

many other animals in the marine food web, including those in the kelp forest. Refill a water bottle rather than buying drinking water in single-use bottles. Bring a reusable shopping bag when you shop, or ask for a paper bag instead of plastic.

Books about kelp forests:

Audrey DeLella Benedict and Joseph K. Gaydos. Explore the Salish Sea: A Nature Guide for Kids. Seattle: Sasquatch Books. 2018.

Susannah Buhrman-Deever. If You Take Away the Otter. Somerville, MA: Candlewick Press. 2020.

Patricia Fletcher. Kelp: The Underwater Forest! New York: Gareth Stevens Publishing. 2017.

Kate Messner. Over and Under the Waves. San Francisco: Chronicle Books. 2022.

Anita Sanchez. The Forest in the Sea: Seaweed Solutions to Planetary Problems. New York: Holiday House. 2023.

Louise Spilsbury and Richard Spilsbury. Marine Biomes. New York: Crabtree Publishing. 2018.

Mary Jo Rhodes and David Hall. Life in a Kelp Forest. New York: Children's Press. 2005.

Online resources:

- The Monterey Bay Aquarium website has lots of information on kelp forests. https://www.montereybayaquarium.org/animals/habitats/kelp-forest.
- National Geographic Kids has a short video on YouTube*: Kelp Forest/Nature Boom Time* https://www.youtube.com/watch?v=GDbHoF6loa8.
- The kelp camera at Birch Aquarium at Scripp's Institute operates during daylight hours, as it uses natural light: https://aquarium.ucsd.edu/kelpcam.
- Project Oceanography has an instructional unit on kelp forests: https://www.marine.usf.edu/pjocean/packets/sp02/sp02u1p4.pdf