Monterey Bay Kelp Forests: Full of Diversity!

Adam Curtis December 23, 2009

Intriguing Stories of Life, Death, and Deception

Did you know that there is more to kelp forests than just kelp? Kelp forests provide food, shelter, and substrate for many marine species. We will take a more in depth look at the many adaptations of some common invertebrate species found in local kelp forests. Kelp can grow up to depths of 150 feet, but is limited by light availability because it's a photosynthetic alga, which is not a true plant, but plays a similar role to trees in a forest.

Bryozoan (*Membranipora tuberculata*) on a single leaf (blade) of kelp

Have you ever seen those hard white crusts on kelp fronds? They are actually little animals called bryozoans. Since kelp blades only live for an average of three months, the sessile animals that colonize them must conform to an exacting timetable of rapid growth, reproduction, and a short lifespan.

The Sanctuary

The Monterey Bay National Marine Sanctuary is a federal Marine Protected Area (MPA) off the coast of central California, stretching from Cambria to just north of San Francisco (***figure 1***). Within this area, multiple marine agencies carefully monitor sanctuary resources. For example, the Sanctuary Integrated Monitoring Network (SIMoN), uses a variety of resources to provide an overall picture of the sanctuary and its inhabitants, and any changes that take place in physical, chemical, or biological resources over time. Kelp forests are an important natural resource, and hug the coastline (green on map), since kelp is limited to depths ≤ 150 ft. Unlike the east coast, the continental shelf is very narrow in California, and great depths occur very close to shore.

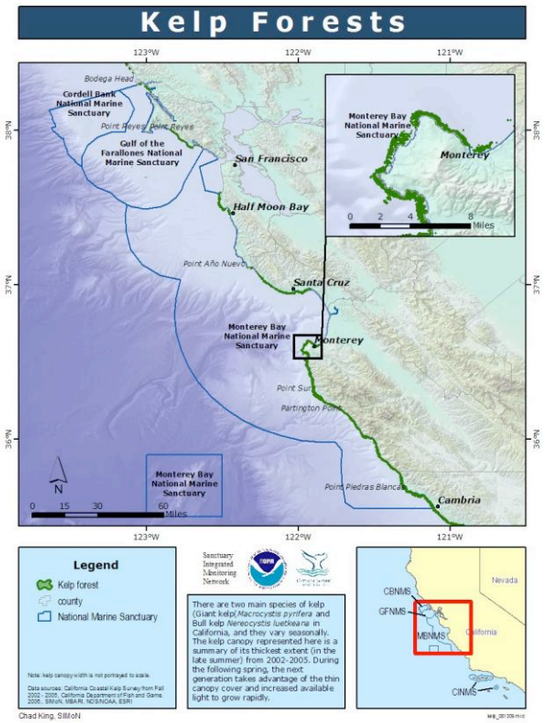
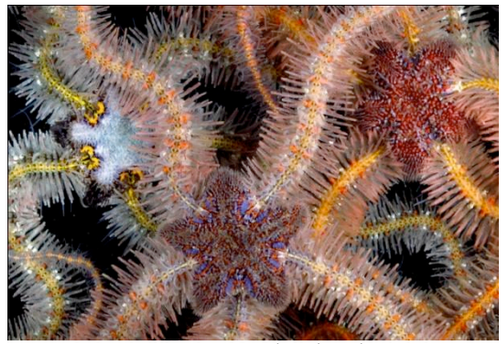


Figure 1: **Monterey Bay National Marine Sanctuary Areas in green show kelp forest distribution**
http://sanctuarysimon.org/regional_sections/kelpForests/kf_overview_map.php

Staying Alive:

Lose a Leg, Not a Life



Spiny brittle star (*Ophiothrix spiculata*)

Sea stars can shed their legs (autotomy) to escape the grasp of a predator. Crabs, such as the hermit crab and the decorator crab, also have a similar anti-predator defensive technique: they can shed their legs and then later regenerate them.

Masters of Deception

Decorator crab (*Loxorhynchus crispatus*)

Most animals would suffer by having other creatures attached to them, but the decorator crab intentionally decorates its shell with pieces of kelp, and even other animals such as sponges and anemones, which provide both camouflage and protection.

Walking the Line

Giant green anemone (*Anthopleura xanthogrammica*)

Some hermit crabs such as the blue-banded hermit can actually walk up and down the mouth and stinging tentacles of the giant green anemone without being eaten. Giant green anemones help provide the hermit crab a home by eating turban snails and then spitting out their shells. Turban snail shells are the preferred shell used as shelter by the blue-banded hermit crab.

Blue-banded hermit crab (*Pagurus samuelis*)

Run for Their Lives

Sunflower star (*Pycnopodia helianthoides*)

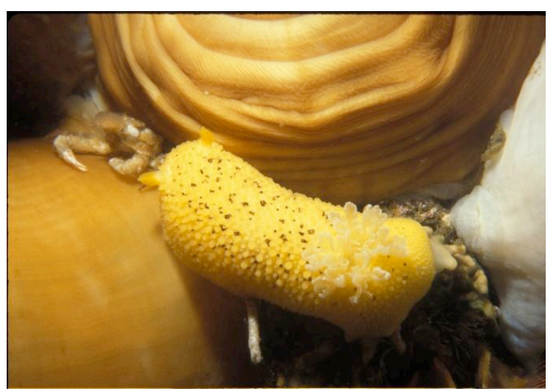
Animals pick up on certain cues from predators such as scents. When invertebrates such as the bat star, picks up the smell from a predatory sea star, such as the voracious sunflower star, it quickly tries to escape with its life. This is called a chemosensory response.

Sea Cucumbers: Spill Their Guts

The sea cucumber (*Parastichopus parvimensis*) shoots out its guts to repel predators called "evisceration"

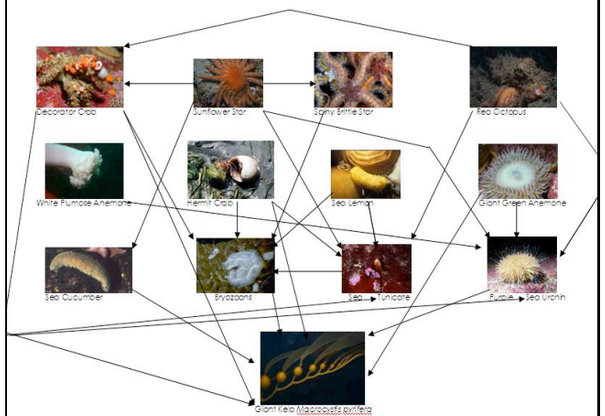
Sea cucumbers have the ability to shed their guts, in an attempt to deter predators, as this material is largely inedible and sticky. This defense response is called evisceration. The sea cucumber will later regenerate its guts, but the process does take a bit of time and energy to go through, so never try to trigger this defense mechanism in an animal intentionally.

Caution Don't Eat Me!

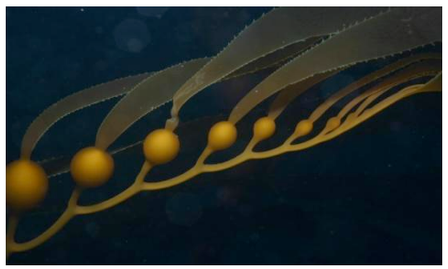


The Noble Sea lemon (*Peltodoris nobilis*) is a slug that lives in the ocean. Sea slugs like the Noble Sea lemon warn predators that they are distasteful using bright colors. The animal uses a chemical defense, producing toxic compounds with an aromatic lemony scent that it stores in specialized skin glands. Predators that bite these slugs quickly stop and learn that the bright colors serve as a warning: eat me at your own risk.

Food Webs: Webs of Life



Each species of animal in a food web provides a vital link to others within the web. A food web basically shows who is eating whom. This simple food web shows 12 invertebrate species commonly found in Monterey Bay kelp forests. Even this simplified web shows that kelp forests are complex ecosystems.



Giant Kelp (*Macrocystis pyrifera*)

Note that nearly all animals in this food web rely on kelp. This is because kelp is a primary producer, meaning it uses sunlight and nutrients to grow, and provides a foundation for the larger food web to build upon.

A Prickly Predicament

Purple sea urchin (*Strongylocentrotus purpuratus*)

Sea urchins eat kelp, and then get eaten by other animals. When kelp is scarce, urchins eat the holdfast, which anchors the kelp to the sea floor, thereby detaching it, killing the entire plant. Sea otters and other animals, such as some sea stars, and fishes, all eat sea urchins, so they keep urchin populations in check, in turn protecting kelp beds.

Connected to Humans

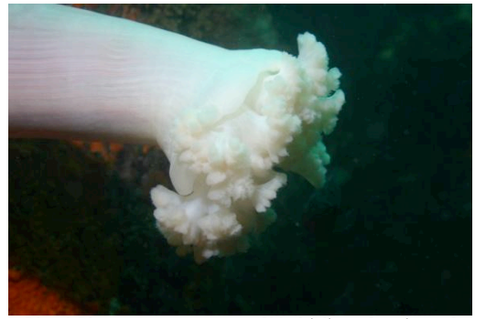
Kelp forests and marine creatures support fisheries and many recreational activities. Many marine invertebrates, such as anemones, sea slugs, and tunicates, are used for medical research, and could lead to innovations in medical science.

How Do Humans Affect Kelp Forests?

Humans impact kelp forest ecosystems in a variety of ways. Used motor oil poured down the drain or on the ground winds up in rivers that drain into the ocean. No matter what the source, oil harms ocean animals. Each year, Americans illegally dispose of 220 million gallons of oil, twenty times the Exxon Valdez spill. Anything that finds its way into the ocean, whether it is tossed away as trash, washes off a beach or falls off a boat, may eventually make its way to the homes of animals. It's important to realize that the ocean is not so far away that it is beyond the reach of human activities. Even living creatures in the deep are affected by what we do at the surface.

Tunicate (*Styela montereyensis*)

Indicator species, such as tunicates and sea anemones, are highly sensitive to polluted waters, and cannot tolerate high levels of pollution.



Giant Plumose anemone (*Metridium farcimen*)

What can you do to Help Protect Kelp Forests?

Enjoy marine resources with care. Beachcombers, divers, and tide-poolers should remember not to collect or disturb any creatures that they encounter. The removal of animals from an ecosystem may disrupt ecological processes, and decrease the diversity in areas that are frequently visited. Keeping our cars tuned to limit dripping oil, and not littering, can help to prevent further pollution of our oceans, and further loss of marine species.

References

Carlton J.T. 2007. Light and Smith Manual 4th Edition. Intertidal Invertebrates from Central California to Oregon. University of California Press.

Langstroth, Lovell and Libby 2000. A Living Bay: The Underwater World of Monterey Bay. Monterey Bay Aquarium, and University of California Press.

Monterey Bay National Marine Sanctuary Map
http://sanctuarysimon.org/regional_sections/kelpForests/kf_overview_map.php

Photos from the SIMoN Photo Library by Dr. Steve Lonhart
http://www.sanctuarysimon.org/photos/index.php

http://www.montereybayaquarium.org/animals/

http://www.wallawalla.edu/academics/departments/biology/rosario/inverts

For more information see:
http://www.sanctuarysimon.org/species/

http://sep.csumb.edu/class/ESSP303/

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