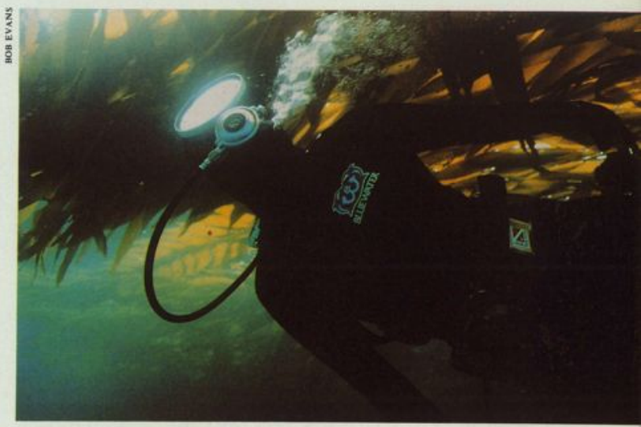
KELP

Star of Santa Barbara's Sea Gardens

By Hillary Hauser • Photographs by Henry Genthe



BOB EVANS

Opposite: Just off the coast of Santa Barbara "cathedral beams of light" illuminate a magnificent habitat where millions of sea animals make their homes and go about their daily business. The great sea forests capture the sun's energy in vast stretches of floating kelp canopies–energy that fuels one of the most phenomenal growth rates in all creation: up to two feet a day. Above left: The thick vegetative overhang buoys to the surface through an ingenious system of air-filled bulbs. Above right: The author takes in a new perspective of kelp off Santa Cruz Island.

THE YEAR was 1955 and I was ten years old. My faithful teacher David Shiffman led me by the hand through the surf at Miramar Beach. In my free hand I held tightly onto a pair of black fins he had given me to wear — magic rubber things which he promised would propel me faster through the water to a point offshore.

Ten minutes later we were a quarter of a mile out, suspended in deep water and looking down at an enormous kelp plant that reached up toward us from the bottom. The golden yellow-brown of long wavy leaves glowed in the afternoon sun and the water was so clear we could see almost to the bottom.

"Isn't that beautiful?" said David. He finned away from me to get another view of the seaweed tree.

In a hurry I dog-paddled to get next to him again. I was scared to death. Wasn't kelp something that grabbed people? If you got tangled in kelp, you would be pulled slowly but surely into the briny deep. What was so beautiful about that? Kelp was just like quicksand: if you struggled in it you'd get more and more in trouble until finally you'd be finished off in a big snarl. All your friends would find you washed ashore days later, wrapped forever in the brown spaghetti monster.

I wasn't allowed to keep that particular set of ideas for long because David continued to take me on his open ocean swims and he never did put up with any nonsense from me. Even so, it wasn't until 1966 that I finally got the true, panoramic perspective of seaweed. That was because I, at the age of 21, was introduced to scuba diving — a new window to look through. On the surface of the ocean we all have strange notions about the unseen squigglies and wigglies down there, but when you put on a scuba tank and come eye to eye with the kelp forest, there is nothing creepy about any of it.

To many people the word *kelp* is a rather unexalted appellation somewhere between *help* and *gulp*, but in its original seventeenth century usage it referred to the ashes of seaweeds burned for their soda and potassium salts. Today the term is generally applied to a number of living seaweeds, particularly *Macrocystis pyrifera*, the giant brown kelp. This towering marine plant with the little bulbs fringes much of the California coast, and in the waters around all of the Channel Islands big pastures of it provide homes and habitats for millions upon millions of sea animals. Off Santa Barbara is one of the largest kelp beds in the world, harvested regularly by great, lumbering barges that swallow up mountains of *Macrocystis* on

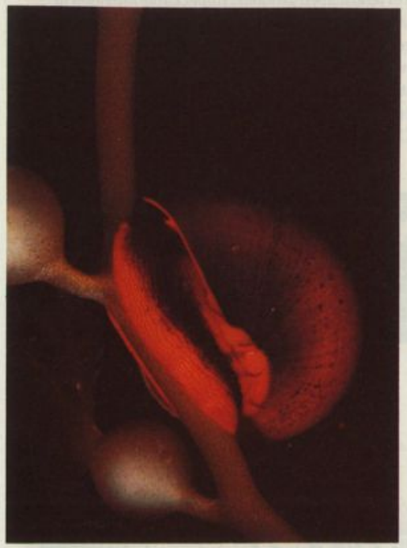
each of their trips. The list of human uses for kelp is so long as to stagger the imagination (and as to contradict Emerson's statement that a weed is a plant whose virtues have not yet been discovered). This weed of the sea is not only a very significant crop to be harvested, it is also vital to the overall health of the sea itself.

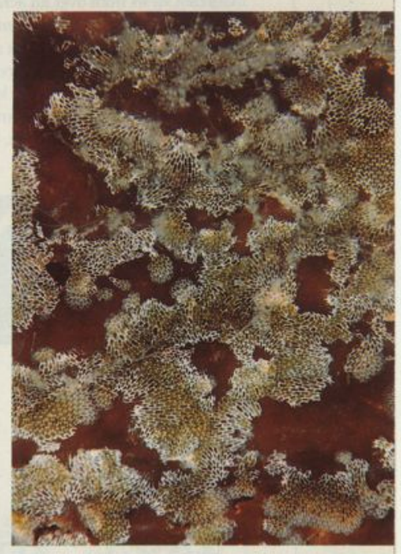
California divers have an inherent understanding of kelp's biological importance because they know that where it grows there is the most to see. Kelp creates its own reef community, and the millions of resident animals and plants that thrive in such a leafy neighborhood are the very reasons divers dive. Non-kelp areas in the sea — unless they are vertical reefs and drop-offs — often have flat, sandy bottoms with not much more than a few burying worms, straggling sea urchins, and wayward fishes to keep each other company. This last statement is a generality, full of holes, but when most divers I know are looking for a place to dive, they look for the biggest patch of seaweed they can find.

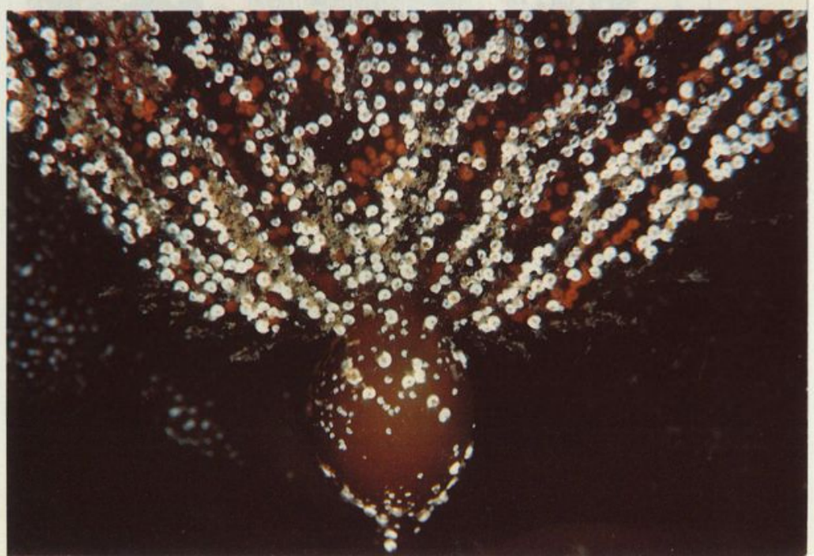
In speaking of kelp there is a particular lingo: the roots are called holdfasts, the leaves are called blades, and the stems are called stipes. Solemn phycologists — those people who study seaweeds — shudder when they hear normal plant talk applied to kelp, such as "roots," "leaves," "trees," and so on. Therefore, we won't tell them how glorious it is to soar through a sunlit forest of kelp trees and watch the fascinating creatures that live in the roots and leaves.

No matter what you call it, the kelp forest is the star of Santa Barbara's sea garden, and is one of the great wonders of the entire Pacific coast. Divers from California seem to talk about kelp a lot when they're in places like Hawaii, the Carib-

*Opposite: A brilliant purple fan nudibranch (*Flabellina iodinea*) wends his way across the floor of the Santa Barbara sea forest. Top right: Another colorful character, the giant kelpfish, switches pattern and coloring to blend into a varigated hideaway. Center left: The "Sisyphus snail" (*Norrisia norrisi*) grazes to the top of a chosen piece of kelp before falling to the seafloor to start his endless journey all over again. Center right: Colonies of moss-like animals called bryozoans spread quickly in a thin layer over a kelp leaf. Bottom right: The life cycle of kelp is so rapid that most encrusting animals, such as these polychaete worms, cannot become firmly established before the blade has outlived its purpose.*







bean, or the South Pacific. In those tropical climes a diver has great visibility, but he doesn't have the trees, oops, plants, and so the scenery seems strangely open and bare. In the vast library of literature about the ocean there have been countless scuba-diving kelp enthusiasts who, in their descriptions, invariably sketch the undersea forest as having "cathedral beams of light filtering through the surface canopy." Whatever the prose, what the fanatics say is all true. Such is the kelp forest primeval.

A diver swimming through a towering seaweed grove can simply enjoy the pure sensation of soaring as he glides through these underwater trees, or he can give his curiosity a ride by taking the time to carefully look around. At the bottom of the kelp plant is the big holdfast, a round ball of rubbery threads called "haptera." The holdfast attaches the plant to something solid and does not give life as roots do in terrestrial plants. It functions only as an anchor, and it's not a bad anchor at that. The kelp plant has to endure the repeated thrashings of ocean storms that would have the entire thing torn out in a minute. Often such storms are too much for the kelp, and the complete plant with the big tangled ball at the end will wash ashore. Curious beachcombers have cut open these holdfasts to investigate what's inside and they've been amazed to find a miniature zoo. In their natural settings, these snarled spaghetti balls are nurseries for baby fishes, infant urchins, worms, brittle stars, and octopi. Over 178 different types of animals spend their youth in the holdfasts of kelp, leaving the protective tangle only when they're big enough to withstand the rigors of predatory ocean life.

The rest of the kelp plant — the blades, stipes, and fronds — are home for some 114 species of animals, most of which move around in an undersea game of musical real estate. Many species of *Sebastes* rockfish take cover in the kelp forest to get out of harm's way (harm's way being big, open-ocean fish that feed on little rockfishes). The *Sebastes* are there too because they are plankton feeders, and the plankton is most prolific in the kelp community. That's because the resident animals are constantly sending off their reproductive seed, the seed that results in the larvae that make up plankton. Since the ready food supply is in the kelp, you often see rockfishes, as well as the perches and damsel-like blacksmiths, hanging around in the midst of seaweed trees, facing the current with their mouths open. They are, as they say, taking it all in.

There are also the blenny-type fishes that live in kelp — the fish that don't swim too much nor hang suspended in mid-water. These bottom dwellers don't have the air bladders which regulate buoyancy to make swimming easy, so they lounge around in the kelp blades and camouflage themselves by becoming kelp colored, even kelp textured. They change every time they move to a new location, too. The giant kelpfish (*Heterosticus rostratus*) can be brown in the seaweed, then instantly green if it moves over to a bed of sea grasses. The *Gibbonsia* species of kelpfish can do the same thing, its disguise so clever that a diver wouldn't see the fish unless he were aware of its chameleon ways.

Another curious creature of the seaweed world is the kelp snail (*Norrisia norrisi*), a turban-shelled animal that I like to call the Sisyphus snail. Like the mythical son of Aeolus who is condemned to roll a huge stone up a hill only to have it roll down again each time, the kelp snail begins at the bottom of the seaweed plant, climbs slowly up the frond to graze on the layer of surface cells, and when it reaches the end of a blade it falls to the seafloor and begins all over again.

Then there is the nudibranch. This colorific creature of the kelp forest is actually a mollusk that has no shell. The word *nudibranch* (pronounced "noodibrank") means "naked lung," which refers to the exposed patch of gills that decorate the animal's back. Since the nudibranch has no shell to protect it from predators it relies on a biological means of self-defense. The bright, multicolored *Hermissenda* nudibranch grazes on beds of hydroids, transfers the stinging nematocysts of the hydroids through its body to the feathery gills on its back, and thereby turns itself into something unfit to eat. The lemon nudibranch, *Anisodoris*, is not only the color of a lemon but smells like one, and this works out well because fishes and other potential predators don't like the taste of lemons. The nudibranchs' brilliant color schemes are part of their defense, since predators remember those bright colors, know they mean trouble, and pass right on by.

Bryozoans are among the tiniest organisms in the sea and therefore one might think they'd be the most inconspicuous animal of the kelp colony. However, it is the bryozoan that most of us know best in relation to kelp. It appears as a white encrustation spread over

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the blades of the kelp plant and looks to be the deterioration or rotting of the plant rather than an animal simply making itself at home. The plant can support the thinly spread bryozoans because they grow quickly and don't weigh much. The heavier barnacles and mussels would readily have the kelp plant as their building site, but before they can get established the kelp blade is gone. Kelp grows fast but it also dies fast; on the average, a blade of seaweed will last only one or two months.

The rapid life cycle of kelp is part of the overall survival plan of the species. When old kelp disintegrates, new plants appear right away. Kelp is exceptionally fertile. The "fruiting" blades near the bottom of the healthy plant are continually sending off millions of twin-tailed spores which travel a few hundred feet from the parent plant, drop to the bottom, and develop into tiny male and female plants. The infant kelp begins to grow at a rate that is among the fastest in the plant kingdom — ten to fifteen feet within the first six months of life and thereafter at the rate of one to two feet per day. *Macrocystis* is known to reach the gigantic length of 200 feet, with great excesses of growth spreading across the surface of the sea to form the proverbial canopy that writers write about. This vegetative overhang can be so thick as to block out 90 percent of sunlight.

How a 200-foot plant rises from the bottom to the surface is one of those perfectly organized wonders of creation, because anyone who has tried to lift a clump of beached seaweed knows that the stuff is heavy. It is the little pear-shaped bulbs of giant kelp that keep the plant afloat and aimed upward. These miniature air bladders are filled with a mix of oxygen, nitrogen, carbon dioxide, and even some carbon monoxide, each one serving as an effective buoy. Without the bulbs, the kelp plant would probably lie across the sea bottom and never see the light of day.

The phenomenally fast growth rate of *Macrocystis* is the chief reason that the commercial kelp business is as successful as it is, and one has to remember that all present harvesting is done in natural beds. In one year almost 200,000 tons of seaweed can be collected, and the plants regenerate themselves quickly enough for harvest after harvest of this size. A common sight off Santa Barbara are the big Kelco kelp barges which cut swaths twenty feet wide and four feet deep through the offshore beds, returning just weeks later to do it all over again.

Opposite: Our South Coast storms sometimes prove too much for the kelp plant, and it's torn out of the forest and washed ashore. Above: This brown spaghetti monster is actually the plant's anchor or holdfast. In its natural setting the rubbery mass is home to over 178 species of animals. Below: A kelp cutter harvests mountains of Macrocystis *near Ellwood Pier. Humans use kelp in an enormous number of products, including medicines, ice cream, beer, toothpaste, and the glossy paper sizing of this magazine page.*

The carrot for this horse of an enterprise is algin, which does about everything short of driving the family car. Alginates are used to keep cosmetic creams from separating, to keep ice cream smooth, to glaze doughnuts, even to toughen up beer bubbles. It also is used to coat paper, to retard burning in fabrics, and to improve glue, rubber, and auto polishes. Alginate is used as a suspending, stabilizing, emulsifying, gel-producing, and film-forming additive in fruit drinks, eggnog, candy, toothpaste, hand lotion, paper sizing, milk shake mixes, toppings, canned foods, bakery fillings, salad dressings, and meringues. In the building business, algin is used in plaster and cement, paint, patching plasters, and crack fillers.

There are other prizes in kelp beside algin. There is iodine, which has a long history of medical applications, and also there are vitamins and minerals, including potassium. A recent biomedical science symposium heard the news that kelp has now been commercially developed to treat mumps, inflammation, and herpes — both types. Symposium-goers also heard how dried pieces of giant kelp had been used successfully in Europe as contraceptives and that a certain kelp product mixed with whiskey made an excellent cough medicine.

Come to think of it, kelp just might drive the family car, too. It has been

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proven that seaweed is excellent for conversion to methane, and methane will gradually replace, or at least augment, the natural gas supply of this country which is presently being gobbled up at the rate of 20 trillion cubic feet per year. Kelp-to-methane technology has been given a big boost by an important research effort in California wherein kelp is being grown offshore on inverted, umbrella-shaped growing racks. The program, under the management of General Electric and fueled by the Gas Research Institute and the U.S. Department of Energy, has established test farms for the development of rapid growing techniques for *Macrocystis*. Dr. Wheeler J. North of Cal Tech, a long-time seaweed expert, is working on futuristic kelp farming concepts, and Dr. Michael Neushul, director of Neushul Mariculture in Santa Barbara, is making rapid progress toward the development of even faster-growing hybrids of *Macrocystis*. Methane may not actually drive the family car in the near future, but it will certainly become an important element in every household in the country.

Energy, birth control, and ice cream — what more could one want from this thing called kelp?

Perhaps just a little swim through a forest of it, where there is the Sisyphus snail trying another trip upward, a fish that's trying to look like seaweed, a nudibranch that smells like a lemon, and those cathedral beams of light filtering through the surface canopy. I, myself, might get one perspective of kelp as I eat my salad and plaster my ceiling, but the world of seaweed is probably most real to me when I go for my daily swim. Today, 26 years after my first ocean excursion with David Shiffman, I'm no longer scared when I accidentally bump into a big clump of kelp off Miramar Beach. I back off, just as he did then, take a look at that giant plant which is busily growing in its isolated spot just offshore, and I think to myself how beautiful that old seaweed tree really is.

Hillary Hauser's books and articles generally center on the ocean and underwater activities. In one of her books, The Living World of the Reef, *she collaborated with Santa Barbara photographer Bob Evans, who also specializes in undersea subjects. Henry Genthe, a local journalist and photographer, lives part of the year on the island of Roatan off the coast of Honduras, where he conducts diving and natural history tours.*