OF SEA BAMBOO, SPLIT-FAN KELP AND BLADDER KELP

Three common kelp species of the Cape Peninsula and west coast.

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The third part in our series on the common intertidal seaweeds of the Cape Peninsula looks at the kelps, the giant brown seaweeds that occur in the subtidal and intertidal gullies of the Cape Peninsula and the west coast. Like trees in an ancient forest, kelp dominate the canopy of the subtidal zone in the cool, nutrient-rich waters of the South African west coast. Kelp is the largest and fastest growing of the seaweeds, growing as much as 13 mm in a day. Some of these seaweeds such as the giant kelp (*Macrocystis pyrifera*) of central and southern California are known to grow to over 30 m in length.

Unlike most seaweeds that are relatively simple in structure, kelp has reached a level of specialization closer to that of the higher green plants. Because they are so large, these brown seaweeds have developed specialized tissues and organs. Specialized tissues include conductive tissue for transporting the products of photosynthesis internally; and reproductive, photosynthetic, and strengthening tissue. Specialized organs include an elaborate root-like holdfast purely for attachment, a stem-like stipe that bears the photosynthetic and reproductive blades, and many possess floats that keep the seaweed and its blades erect in the water. All these features have improved the kelps' photosynthetic ability, allowing them to form extensive beds that dominate the subtidal zone.

The kelp species common to the Cape Peninsula and the west coast of South Africa include *Ecklonia maxima*, *Laminaria pallida*, and *Macrocystis angustifolia*. Like all brown seaweeds, they also possess the pigment fucoxanthin which is primarily responsible for their colour.

A productive ecosystem

Ecologically, the kelp canopy provides an important complex, three-dimensional habitat for thousands of species of fish, invertebrates and other seaweeds. The limpet, *Cymbula compressa* for example, occurs only on *Ecklonia maxima*. Kelp beds are among the most productive ecosystems on earth, supporting high primary production levels. This high productivity forms the base of many coastal food webs in cool water environments worldwide. So, both directly and indirectly, they are an important food source for a large variety of invertebrates, fish, mammals and seabirds. Furthermore, kelp is tough and resilient, and stretching into the sea, often for many kilometers, it helps to break the force of the waves offering protection to the nearshore ecosystem.

In South Africa, the seaweed industry is based on *Ecklonia* and *Laminaria* as well as some other brown and red seaweeds. Kelp is widely used as a fertilizer and is harvested extensively as feed for commercially farmed abalone. *Ecklonia maxima* is used as a nutritional supplement for farm animals. It is also harvested for the production of a very successful plant growth stimulant and has been shown to be a great source of micronutrients.

Internationally, a huge market exists for the harvesting of kelp for alginate production and in South Africa, *Ecklonia* and *Laminaria* are very important to this industry. Alginate is of considerable economic importance as it is used as a gelling and emulsifying agent in a number of industries. In the food industry (frozen foods, salad dressing, gravies, beer, etc.) it makes water-based products thicker, creamier, and more stable over extreme differences in temperature, pH, and time. Similarly, in the cosmetics, pharmaceutical, paint, textile and

SEA BAMBOO

***Ecklonia maxima*, commonly called sea bamboo, occurs abundantly on the south-west and west coasts. It is the largest of the local kelps, dominating the inshore regions of the southern west coast. This seaweed possesses a massive holdfast that extends into a long, hollow, gas-filled stipe up to 15 m in length that ends in a bulb (float) at its apex. The bulb further extends into a flat, solid primary blade from which secondary blades emerge. These secondary blades can quite easily reach 3 m in length. Because of its hollow stipe and bulb, this species is buoyed up in the water column, its blades frequently breaking the surface of the ocean. So, when you see kelp at the ocean's surface, this is usually *E. maxima*. This also means that *E. maxima* constitutes the canopy of the kelp forest and it is here that three species of red seaweed and the limpet, *Cymbula compressa*, occur epiphytically on *E. maxima*.**

Photo: G. Maneveldt. Graphic art by R. Frans adapted from the artwork by Margo Branch for the book *The Living shores of southern Africa* by George and Margo Branch.

welding industries, alginate aids in the suspension and stabilizing of agents over ranges of temperature and pH. In the paper industry, for example, alginate enables sizing and polishing of the finished paper product. Did you know that alginate from kelp is even used to make fibres for audio speakers?

Kelp is especially important to the medical industry. Its alginate is used to encapsulate many things such as tablets in powder form, in fracture castings and moulds, and even in organs for transplant. Kelp contains an astonishing amount of vitamins and minerals, the most important of these is probably iodine. Iodine has a normalizing effect on the thyroid gland (this gland controls the body's growth and development). In Namibia, scientists are looking to use *Ecklonia* and *Laminaria* as a treatment of goitre and prevention of (or reduction in the occurrence of) cretinism in southern Africa. Similarly, because iodine feeds the thyroid, kelp is used in weight loss formulas. Japanese studies have even shown a direct relationship between algin contained in kelp and the prevention of breast cancer.

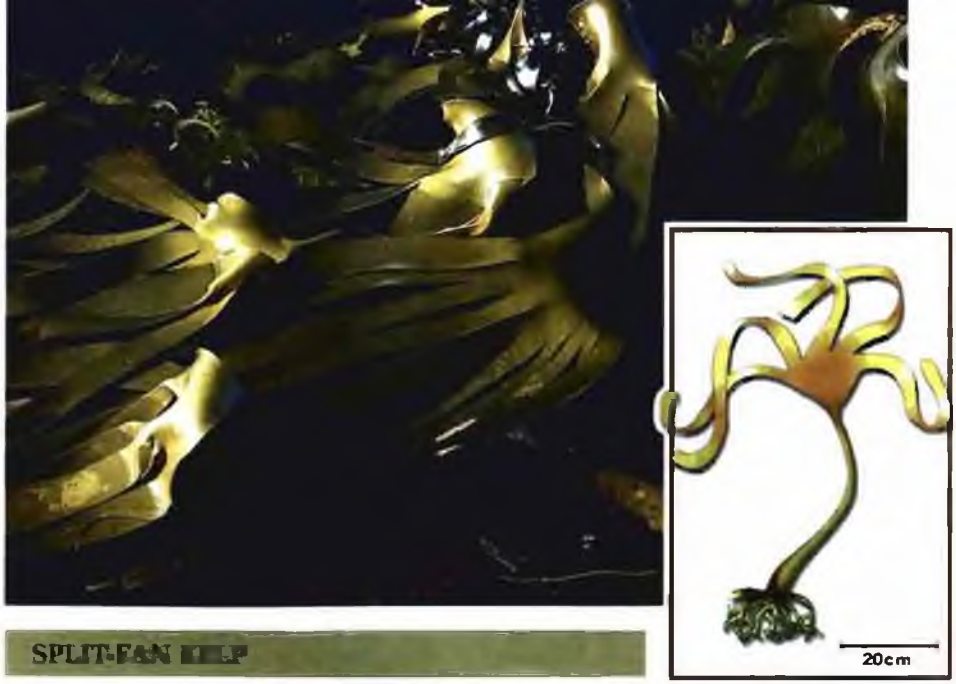
Macrocystis angustifolia is not used in the alginate industry, although it has been reported to have a higher alginate quality than either *E. maxima* or *L. pallida*; the natural populations of this species are too small to warrant commercial harvesting. There are, however, a number of scientific studies underway on the feasibility of cultivating species of kelp for alginate extraction. Marine cultivation, or mariculture, could be the answer to a sustainable high-grade alginate quality.

While the seaweed industry in the Western world is based mainly on seaweed extracts, in the East seaweeds are cultivated in huge volumes for human consumption. Much of this industry though, is based on red seaweed, which is the subject of our next article in this series.

A beautiful calendar for 2001 on the common seaweeds of the Cape Peninsula is available from the EERU at UWC, tel (021) 959 2498.

WHAT DOES THAT MEAN?

Epiphytic living on or attached to plants.
Blade synonymous with leaves in green plants.
Holdfast the root-like organ of attachment in kelp.
Rhizomatous a creeping stem-like structure.
Stipe: the flexible 'stem' in seaweeds.
Upwelling cold nutrient-rich sub-surface water moves to the surface to replace offshore moving surface water, especially prevalent on our west coast.



SPLIT-FAN KELP

While the sea bamboo, *Ecklonia maxima*, is the dominant kelp in inshore waters of the southern west coast, it becomes progressively replaced by another kelp species - the split fan kelp, *Laminaria pallida* - in deeper waters and also further north up the west coast. *Laminaria pallida* lacks the buoyant structures found in *E. maxima* (although the stipes of occasional plants have been shown to be hollow), so it rarely breaks the surface in deeper water. It grows to about 10 m in length and possesses a single broad, fan-shaped blade that becomes irregularly split, giving the kelp its name, the split-fan kelp. Unlike the sea bamboo which is more common in relatively shallow water, *L. pallida* occurs to depths of 30 m. Adult plants of *L. pallida* also differ from those of *E. maxima* in that they have warty stipes as opposed to the smooth stipes of *E. maxima*. Split-fan kelp, like sea bamboo, is common on wave-exposed shores.

Photo: G. Maneveldt. Graphic art by R. Frans adapted from the artwork by Margo Branch for the book *The Living shores of southern Africa* by George and Margo Branch.

BLADDER KELP

Generally found in shallow, somewhat sheltered water inshore of *E. maxima* and *L. pallida* is the bladder kelp, *Macrocystis angustifolia*, the least common of the west coast kelps. This kelp is a relatively delicate, vine-like species bearing numerous blades at regular intervals along its slender stipe. At its apex, the new blades are fused, gradually separating as they grow. The blades possess numerous marginal spines and a single gas-filled bladder at their bases, which allows this kelp to remain afloat and erect in the water column. Unlike the other two species of kelp, an individual rhizomatously spreading holdfast in this species can bear multiple stipes. Large populations of *M. angustifolia* are only found at two locations near Cape Town; one at Kommetjie, the other at Robben Island. Unique to this species of kelp are its haphazardly rippled blades (evident in the upper graphic image). This feature is especially important, as it allows for increased absorption of nutrients in relatively low flow environments typical of sheltered lagoons or bays.

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