



# Seaweed

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**Seaweed** refers to several species of macroscopic, multicellular, marine algae.<sup>[1]</sup>

The term includes some types of red, brown, and green algae. Seaweed can also be classified by use (as food, medicine,<sup>[2]</sup> fertilizer, filtration, industrial, etc.).

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*Ascophyllum nodosum* exposed to the sun in Nova Scotia, Canada



Dead man's fingers (*Codium fragile*) off the Massachusetts coast in the United States

## Taxonomy

A seaweed may belong to one of several groups of multicellular algae: the red algae, green algae, and brown algae. As these three groups do not have a common multicellular ancestor, the seaweeds are in a polyphyletic group. In addition, some tuft-forming bluegreen algae (Cyanobacteria) are sometimes considered to be seaweeds — "seaweed" is a colloquial term and lacks a formal definition.



The top of a kelp forest in Otago, New Zealand

## Structure

Seaweed's appearance somewhat resembles non-arboreal terrestrial plants.

- thallus: the algal body
  - lamina or blade: a flattened structure that is somewhat leaf-like
    - sorus: a spore cluster
    - on *Fucus*, air bladder: a floatation-assisting organ on the blade
    - on kelp, float: a floatation-assisting organ between the lamina and stipe
  - stipe: a stem-like structure, may be absent
  - holdfast: a specialized basal structure providing attachment to a surface, often a rock or another alga
  - haptera: a finger-like extension of the holdfast anchoring to a benthic substrate

The stipe and blade are collectively known as the frond.

## Ecology

Two specific environmental requirements dominate seaweed ecology. These are the presence of seawater (or at least brackish water) and the presence of light sufficient to drive photosynthesis. Another common requirement is a firm attachment point, although some genera such as *Sargassum* and

Gracilaria have species that float freely. As a result, seaweed most commonly inhabit the part of a sea that is close to the shore (the littoral zone) and within that zone more frequently on rocky shores than on sand or shingle. Seaweed occupy a wide range of ecological niches. The highest elevation is only wetted by the tops of sea spray, the lowest is several meters deep. In some areas, littoral seaweed can extend several miles out to sea. The limiting factor in such cases is sunlight availability. The deepest living seaweed are some species of red algae.



Seaweed cover this rocky seabed on the east coast of Australia

Others have adapted to live in tidal rock pools. In this habitat seaweed must withstand rapidly changing temperature and salinity and even occasional drying.<sup>[3]</sup>

## Uses

Seaweed has a variety of purposes, for which it is farmed<sup>[4]</sup> or foraged from the wild.<sup>[5]</sup>

At the beginning of 2011, Indonesia produced 3 million tonnes of seaweed and surpassed the Philippines as the world's largest seaweed producer. By 2011, the production was estimated to have reached 10 million tonnes.<sup>[6]</sup>

## Food

Seaweed are consumed by coastal people, particularly in East Asia, e.g. Japan, China, Korea, Taiwan, and Southeast Asia, e.g. Brunei, Singapore, Thailand, Burma, Cambodia,



*Onigiri and wakame miso soup, Japan*

Vietnam, Indonesia, Philippines, and Malaysia, and also in South Africa, Belize, Peru, Chile, the Canadian Maritimes, Scandinavia, South West England,<sup>[7]</sup> Ireland, Wales, California, and Scotland.

In Asia, Gim (Korean food) (김, Korea), nori (海苔, Japan), zicai (紫菜, China) are sheets of dried *Porphyra* used in soups, sushi wrap or *onigiri* (rice balls). *Chondrus crispus* (commonly known as 'Irish moss' or carrageenan moss) is another red alga used in producing food additives, along with Kappaphycus and gigartinoid seaweed. *Porphyra* is a red alga used in Wales to make laver. Laverbread, made from oats and the laver, is a popular dish there. In northern Belize, edible seaweed are mixed with milk, nutmeg, cinnamon, and vanilla to make a common beverage affectionately called "dulce" (or "sweet").

Seaweed are also harvested or cultivated for the extraction of alginate, agar and carrageenan, gelatinous substances collectively known as hydrocolloids or phycocolloids. Hydrocolloids have attained commercial significance as food additives.<sup>[8]</sup> The food industry exploits their gelling, water-retention, emulsifying and other physical properties. Agar is used in foods such as confectionery, meat and poultry products, desserts and beverages and moulded foods. Carrageenan is used in salad dressings and sauces, dietetic foods, and as a preservative in meat and fish products, dairy items and baked goods.

## Herbalism



Laver and toast



Small plots being used to farm seaweed in Indonesia, with each rectangle belonging to a different family

Alginates are commonly used in wound dressings, and production of dental moulds. In microbiology research, agar — a plant-based goo similar to gelatin and made from seaweed — is extensively used as culture medium. Carrageenans, alginates and agaroses (the latter are prepared from agar by purification), with other lesser-known macroalgal polysaccharides, have several important biological activities or applications in biomedicine.



Seaweed-covered rocks in the United Kingdom

Seaweed extract is used in some diet pills.<sup>[9][10]</sup> Other seaweed pills exploit the same effect as gastric banding, expanding in the stomach to make the body feel more full.<sup>[11][12]</sup>



Seaweed on rocks in Long Island

## Filtration

The strong photosynthesis of algae creates a large affinity for nutrients; this allows the seaweed to be used purposely to remove undesired nutrients from water. Nutrients such as ammonia, ammonium nitrate, nitrite, phosphate, iron, copper, as well as CO<sub>2</sub> are rapidly consumed by growing seaweed. Reefs and lakes are naturally filtered this way (the seaweed being consumed by fish and invertebrates), and this filtering process is duplicated in man-made seaweed filters such as algae scrubbers.

Seaweed (macroalgae), as opposed to phytoplankton (microalgae), is used almost universally for filtration purposes because of the need to be able to easily remove (harvest) the algae from the water, which then removes the nutrients. Microalgae require more processing to separate it from the water than macroalgae does; macroalgae is simply pulled out.

When used for filtration, saltwater algae commonly grows species of *Cladophora*, *Ulva*, and *Chaetomorpha*. Freshwater filtration applications are useful, too, and will commonly grow species such as *Spirogyra*.

## Other uses

Other seaweed may be used as fertilizer, compost for landscaping, or a means of combating beach erosion through burial in beach dunes.<sup>[13]</sup> Seaweed is under consideration as a potential source of bioethanol.<sup>[14][15]</sup>

Seaweed is an ingredient in toothpaste, cosmetics and paints.<sup>[4]</sup> Alginates enjoy many of the same uses as carrageenan and are used in industrial products such as paper coatings, adhesives, dyes, gels, explosives and in processes such as paper sizing, textile printing, hydro-mulching and drilling. Research suggests that the Australian seaweed *Delisea pulchra* may interfere with bacterial colonization.<sup>[16]</sup> Sulfated saccharides from both red and green algae have been known to inhibit some DNA and RNA enveloped viruses.<sup>[2]</sup>

Seaweed collecting is the process of collecting, drying and pressing seaweed. It was a popular pastime in the Victorian era and remains a hobby today.

Seaweed is sometimes used to build roofs on houses on Læsø [1] (<http://naturalhomes.org/seaweed-house.htm>)



Modern floating algae scrubber/cultivator on a reef pond



Seaweed is lifted out of top of algae scrubber/cultivator, to be discarded or used as food, fertilizer, or skin care

## Health risks

Rotting seaweed is a potent source of hydrogen sulfide, a highly toxic gas, and has been implicated in some incidents of apparent hydrogen-sulphide poisoning.<sup>[17]</sup> It can cause vomiting and diarrhea.

## Genera

The following table lists a very few example genera of seaweed.



Genus		Algae Phylum	Remarks
<i>Caulerpa</i>		Green	Submerged
<i>Fucus</i>		Brown	In intertidal zones on rocky shores.
<i>Gracilaria</i>		Red	Cultivated for food
<i>Laminaria</i>		Brown	Also known as kelp, 8–30 m under water, cultivated for food.
<i>Macrocystis</i>		Brown	Giant kelp, forming floating canopies.
<i>Monostroma</i>		Green	
<i>Porphyra</i>		Red	Intertidal zones in temperate climate. Cultivated for food.

## See also

- Algaculture
- Algae fuel
- Aonori, Hijiki, Kombu, Mozuku, Nori, Ogonori, and Wakame - seaweed preparations used in Japan, and occasionally Korea and parts of Oceania
- Cochayuyo, a form of kelp used as a vegetable in Chile
- List of seaweed of South Africa
- Sea lettuce
- Seaweed cultivator
- Seaweed dermatitis
- Silas Seaweed (mystery book series)



*Claudea elegans*  
*tetrasporangia*

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17. "Algues vertes: la famille du chauffeur décédé porte plainte contre X" (<https://www.google.com/hostednews/afp/article/ALeqM5hmSXIrejKYYs-g9Y0L71SD9qNI7w>) AFP, retrieved 2010-04-22 (in French)

## Further reading

- Christian Wiencke, Kai Bischof [editors]: *Seaweed Biology: Novel Insights into Ecophysiology, Ecology & Utilization*. Springer, 2012. ISBN 978-3-642-28450-2 (print); ISBN 978-3-642-28451-9 (eBook)

## External links

- Michael Guiry's Seaweed Site (<http://www.seaweed.ie/>) information on all aspects of algae, seaweed and marine algal biology



Wikimedia  
Commons has  
media related to  
***Seaweed***.

- SeaweedAfrica (<http://www.seaweedafrica.org/>), information on seaweed utilisation for the African continent.
- Seaweed. A chemical industry in Brittany, in the past and today. (<http://seaus.free.fr/spip.php?article136>)
- AlgaeBase (<http://www.algaebase.org/>), a searchable taxonomic, image, and utilization database of freshwater, marine and terrestrial algae, including seaweed.

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