

SEAWEEDS

Seaweed is macroscopic, multicellular, marine algae that lives near the seabed.

The term includes some members of the red, brown, and green algae.

Seaweeds can also be classified by use (as food, medicine, fertilizer, filtration, industrial, etc.).

The study of seaweed is known as Phycology.

SEAWEEDS



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Taxonomy

A seaweed do not have a common multicellular ancestor, the seaweeds are a polyphyletic group.

A **polyphyletic** (Greek: for "of many races") group is characterized by one or more homoplasies: phenotypes which have converged or reverted so as to appear to be the same but which have not been inherited from common ancestors.

Alternatively, polyphyletic is used to describe multiple ancestral sources regardless of convergence.

“Seaweed” is a colloquial term and lacks a formal definition.

Structure

Seaweeds' 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

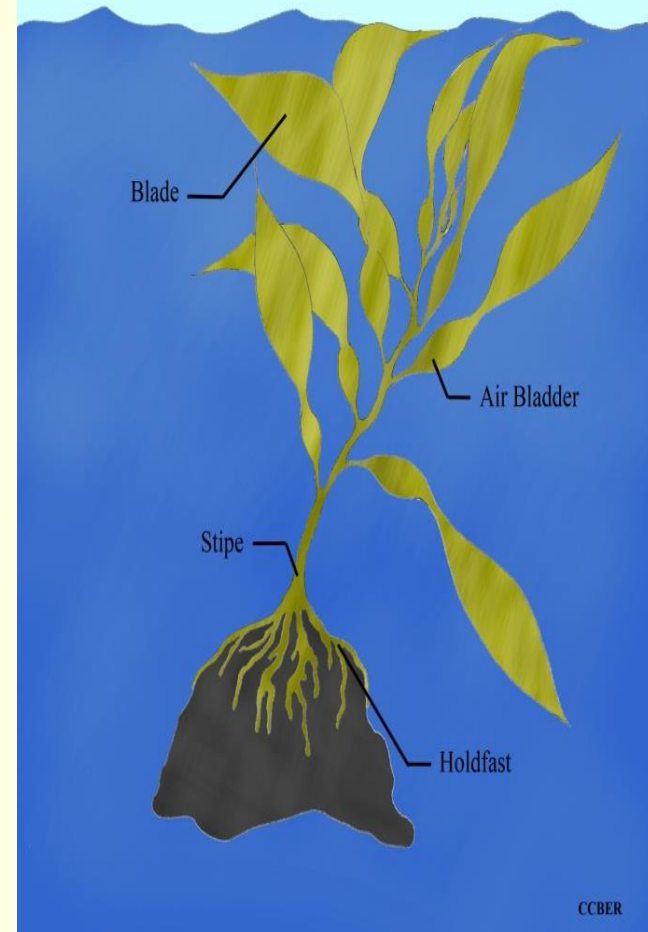
Stipe: a stem-like structure, may be absent

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**.

Basic Kelp Structure



Ecology

Two specific environmental requirements dominate seaweed ecology. These are the presence of seawater (or at least brackishwater) 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, seaweeds 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.

Ecology

Seaweeds 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 seaweeds can extend several miles out to sea. The limiting factor in such cases is sunlight availability.

The deepest living seaweeds are some species of red algae. Others have adapted to live in tidal rock pools. In this habitat seaweeds must withstand rapidly changing temperature and salinity and even occasional drying.

SEAWEEDS DIVERSITY



Ulva sp.



Sargassum sp.



Gracililaria sp.



Chaetomorpha sp.

Totally 844 species of seaweeds so far reported in India.

Seaweeds-Classification and Occurrence

Green Algae

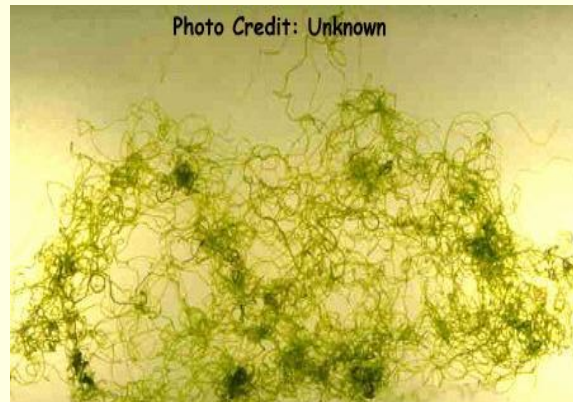
They are typically, bright green because chlorophyll is not masked by other pigments.

- Phylum- Chlorophyta restricted to freshwater and terrestrial environments.
- About 7000 species are marine, uncommon in the sea. Some species are dominant in bays and estuaries.
- Some species are epiphytes and some are endophytes.
- The filamentous algae form grows on a wide variety of surfaces such as rocks in shallow water and rocky shore tide pools.

Seaweed-classification and Occurrence

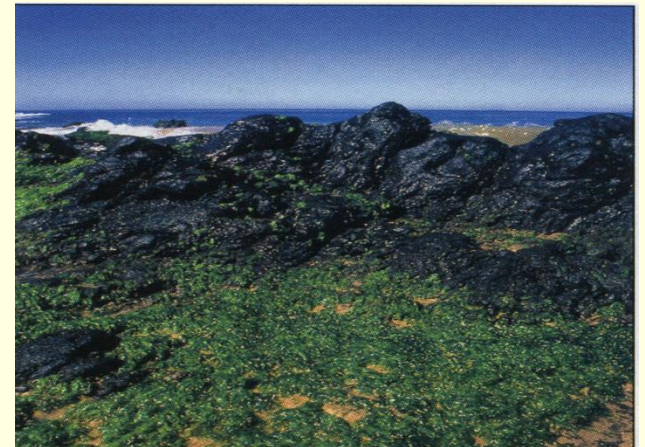
Green Algae

- ❖ *Enteromorpha* are characterized by a thin thallus in the form of a hollow tube.
- ❖ They sometimes flourish in areas distributed by pollution.
- ❖ *Chaetomorpha* occurred in tropical, sub tropical, western Atlantic ocean and Caribbean sea.



Seaweed-classification and Occurrence

- ❖ *Ulva* forms paper-thin sheets whose shape varies depending on environmental factors.
- ❖ Different species of *Ulva* distributed in Arctic and tropical waters. Some species are found common in brackishwater.



Seaweed-classification and Occurrence

- *Valonia* is forms large spheres or curious spherical clusters in the tropics and sub-tropics.



Seaweed-classification and Occurrence

- Several green algae consist of balanced, thin tubes with many nuclei.
- *Caulerpa* which is restricted to the tropics and sub-tropics.



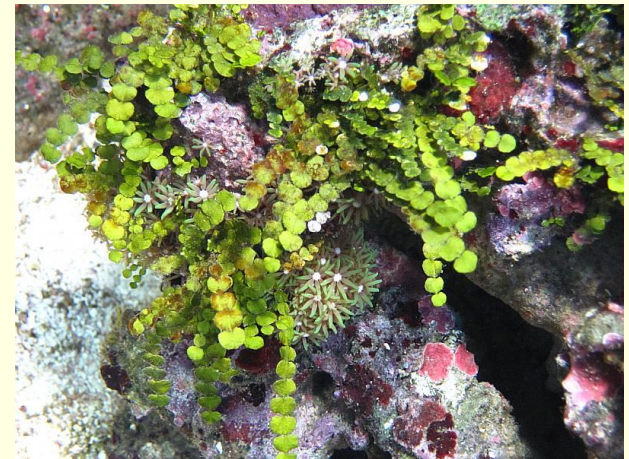
Seaweed-classification and Occurrence

- Many species show a variety of shapes, dead man's fingers (*Codium*) found in temperate waters including North America. Its forms branched thallus.



Seaweed-classification and Occurrence

- *Halimeda* is consisting numerous segments with deposits of calcium carbonate, so this is known as a calcareous green algae.
- The accumulation of its dead, calcified segments has an important role in the formation of coral reefs.



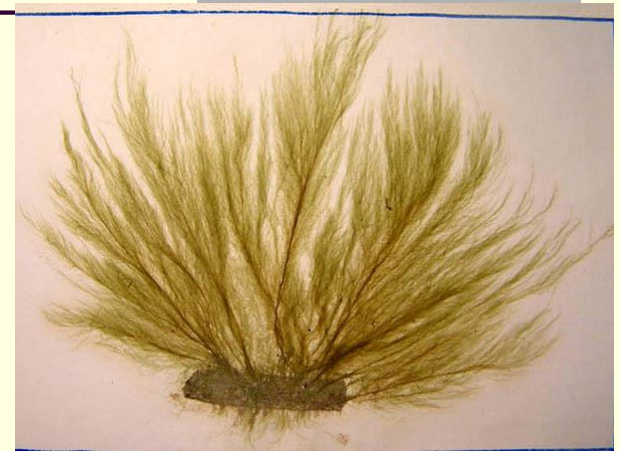
Seaweed-classification and Occurrence

Brown algae

- ❖ Phylum-Phaeophyta
- ❖ Which varies from olive green to dark brown is due to presence of yellow-brown pigments, fucoxanthin, over chlorophyll.
- ❖ About 1500 known species are marine.
- ❖ Brown algae are often the dominant in temperate and polar seas.

Seaweed-classification and Occurrence

- Brown algae have a filamentous thallus, as in the widely distributed species of *Ectocarpus*.
- The flat and branched thallus in *Dictyota* and fan-shaped in *Padina*. Both are found mostly in tropical and subtropical waters.



Seaweed-classification and Occurrence

- *Turbinaria* occurred in tropical and subtropical waters.
- Some brown algae have gas-filled floats known as rock-weeds.
- *Fucus* found in Atlantic and Pacific coasts of North America.
- *Ascophylum* is found in Atlantic coast.



Seaweed-classification and Occurrence

- *Sargassum* found in warm waters including Gulf of Mexico and California.
- *Sargassum* is found in huge masses in the Atlantic north of west Indies, so which is called as Sargasso Sea.

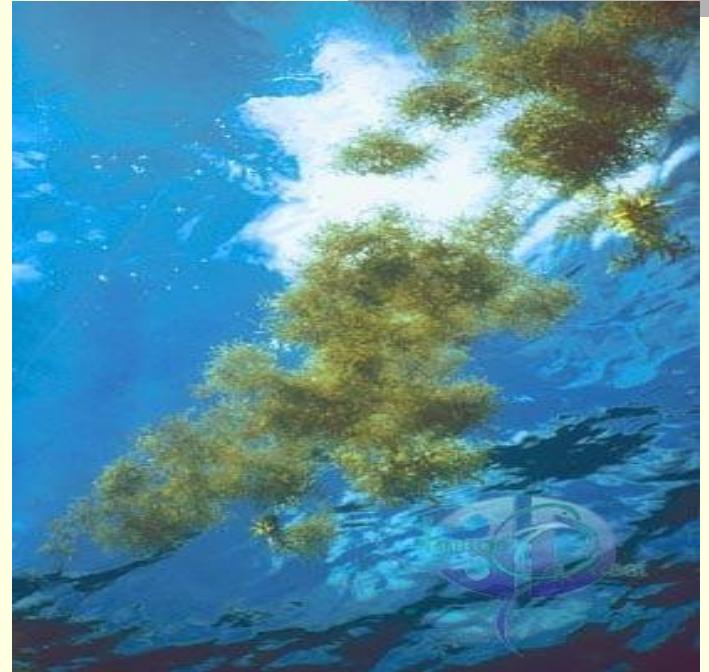


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Seaweed-classification and Occurrence

- Kelps, *Laminaria*, their large blades upto 3 m in length.
- *Postelsia* commonly known as the sea palm because of its appearance, grown on intertidal rocks exposed to heavy waves.
- It occurs in thick clusters from central California to British Columbia.



Seaweed-classification and Occurrence

- The feather-boia kelp, *Egregia* are common on Pacific rocky shores.



- The large kelp is *Pelagophycus* is antler like branches.



Seaweed-classification and Occurrence

- *Macrocystis* is the largest of the kelps. Its massive holdfast, which is attached to a hard bottom, may weigh several kilograms, blades are long which is filled with gas, there by helping kelp the blades close to the surface.
- Individual as long as 100m have been reported. Its found in north and south pacific.



Seaweed-classification and Occurrence

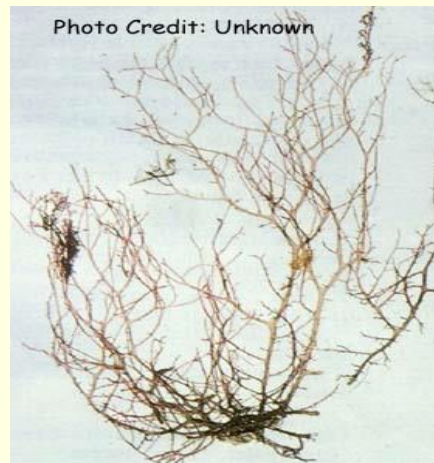
Red algae

- Red algae (phylum-Rhodophyta).
- Red algae are the largest group of seaweeds. Their chlorophyll is typically masked by a red pigments. They have red pigments called **phycobilins**.
- Most species are red, some may show different colours depending on their daily exposure to light.
- The group is essentially marine.
- Red algae found in most shallow water marine environments.

Seaweed-classification and Occurrence

- *Gelidium* and *Gracilaria* are characterized by large blades as long as 2m.

Hypnea thin and tube like red algae occurred in tropical waters.



Seaweed-classification and Occurrence

- *Porphyra* are common on rocky shores from polar to tropical coasts.
- The coralline red algae are deposit calcium carbonate within their cell walls. The colour of these seaweeds varies from light to intense reddish-pink; dead calcified thalli are white.
Eg. *Corallina*.

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Economic importance of seaweeds

As food

- Raw, cooked and dried seaweeds are used as food in many countries.
- Good source of some **vitamins**, **minerals** and substantial amount of **proteins**.
- *Ulva*, *Enteromorpha*, *Prolifera* and *Gracilaria coronopifolia* can be eaten fresh in salads.
- Red alga, *Porphyra* is washed and boiled then formed into flat cakes, rolled in oatmeal and fried it is called **laverbread** used in British Isles.
- Red alga, *Chondrus* is dried and used in preparing **blancmange** in eastern Canada, New England and parts of northern Europe.

Economic importance of seaweeds

- Red alga, *Rhodymenia* is dried and eaten in Canada, northern Europe. Used as chewed like tobacco.
- *Laminaria*, *Alaria* and *Fucus* are dried and shredded and process known as *kombu*. They used to make tea and candy.
- *Undari* kelp is used as food when fresh are cooked.
- *Porphyra* is used to prepare thin sheets of *nori*, used in soups and for wrapping, boiled with rice stuffed with bits of raw fish, sea urchin roe or other ingredients.

Economic importance of seaweeds

- *Connoisseurs* used in salads, soups, omelets and sandwiches.
- *Postelsia* is known as “Sea noodles”, coastal Indians cooked it and made it into cakes.
- *Nereocystis* is used to make pickle.



Economic importance of seaweeds

- Seaweeds produce several types of gelatinous chemicals called **phycocolloides** that are used in food processing and manufacture of different products.
- **Algin** is used as a stabilizer and emulsifier in the manufacture of dairy products such as ice creams, cheese and toppings.
- Used in the baking industry to prevent frostings and pies from becoming dry.
- Used as thickener and emulsifier in pharmaceuticals and chemical industries making shampoo, shaving cream and to plastics and pesticides.

Economic importance of seaweeds

- Used in making rubber products, paper, paints and cosmetics.
- Major uses in textile industry- **algins** thickens the printing paste and provides sharper prints.
- **Carrageenan** is used as an emulsifier, its gives body to dairy products.
- **Agar** is used to protect ham, fish and meats during canning and as a thickener in low calorie foods.

SOURCE OF DRUGS AND MEDICINES



Seaweeds are the best source of antibacterial, anti-inflammatory, anti-tumor, antiviral, psoriasis, asthma, arteriosclerosis, heart disease, ulcers and cancer compounds.

Economic importance of seaweeds

As medicine

- Seaweeds have **sulfated polysaccharide** and have several important biological activities or applications in biomedicine.
- In the biomedicine and pharmaceutical industries, **alginates** are used in wound dressings, and production of dental moulds.
- Seaweeds may have curative properties for tuberculosis, arthritis, colds and influenza, worm infestations and even tumors.
- Agar is used as a medium in which grow bacteria and molds. It is used in medical research purpose.
- A gel from seaweeds is being investigated to prevent HIV viruses.

Economic importance of seaweeds

Other uses

- Seaweed also used as fertilizers for crop and food additives in animal feeds.
- Coralline red algae used to reduce the acidity of soil.
- Seaweed fermentation to produce methane for fuel has been proposed.
- Seaweeds cultured to study their anti tumor capabilities.
- Kelp contains **Iodine 127**. **Iodine 127** will prevent the body from absorbing radioactive iodine 131.

Seaweed Products

