What are seaweeds and marine algae and where do we find them?

At the interface between land and sea

Seaweeds are marine algae

Most people think of seaweeds simply as the plant-like stuff that washes up on the seashore. On a beach in northern Europe, one typically might find a mixture of bladder wrack (*Fucus vesiculosus*) and a variety of seagrasses, such as eelgrass (*Zostera marina*). But for the biologist, bladder wrack and eelgrass are completely different organisms, almost as distinct as plants and animals. In the biological sense of the word, a true seaweed is actually a so-called alga.

The word seaweeds is the popular term that is loosely applied to the larger, more complex marine algae, also called macroalgae. Because all seaweeds are marine algae, the two terms will be used interchangeably in this book.

The word algae is used to designate a large, varied, and heterogeneous group of organisms that, at present, do not have a clear-cut, formal taxonomic status. Some scientists have estimated that there might be between one and ten million different species, by far the majority of which have not yet been described. Just like plants, algae carry out photosynthesis, using sunlight to produce carbohydrates and energy. Of the 35,000 or more currently known species of algae, about half are aquatic, while the others are terrestrial. The aquatic algae are found in fresh and in salt water; it is the latter type, referred to as marine algae, with which we are concerned in this book.

Dr. William Turner (1508–1568), considered the 'father of English botany', is responsible for the linguistic association between seaweeds and plants. When he compiled the first scientific treatise on plants giving them English names in the 16th Century, he regarded seaweeds as useful herbs and included them, using the term 'seawrake'. This was an allusion to their origin, like shipwrecks, as something that washed up from the sea.

Algae come in many different sizes. The smallest of them, the microalgae, are unicellular and make up what we call plant (or phyto) plankton. Some of them are related to animal plankton, bacteria, and fungi. The largest algae are multicellular organisms, growing to lengths of up to 60 meters, which can form enormous 'forests' in the ocean. These large marine algae, which are also referred to as macroalgae, are the ones that most people associate with the word seaweeds.

Seaweeds are found in all coastal areas of the world, in all climatic zones from the warm tropics to the icy polar regions. There are about 10,000 different species, but new and formerly unknown ones, sometimes living under extremely harsh conditions, are being discovered on an on-going basis. Fossil finds have shown that seaweeds are a form of life going back at least 500 million years and that algae, of one type or another, have existed on Earth for about three billion years. There is also much evidence that they have not changed significantly during this time.

Despite their name and even though they often resemble plants, seaweeds are only tenuously related to them. The tissue of the majority of seaweeds is built up very differently from that found in higher forms of plant life and their

color of green algae is overwhelmingly due to chlorophyll *a*. In the red algae, certain other pigments, called phycobilins, impart red, orange, and blue hues. Brown algae contain only a little chlorophyll and their brownish-yellow color is due to a pigment called fucoxanthin. A similar brownish pigment is found in those plants that take on the familiar red, yellow, and brown autumn colors when their otherwise dominant green chlorophyll *a* disappears.

Because phycobilins are water soluble, seaweeds, particularly the red algae, often lose some of their color when they are pried loose from the place where they are growing and set adrift in the sea. The green color fades more slowly because chlorophyll is insoluble in water.

▲ Seaweeds grow in many shapes and colors.

Seaweeds throughout the ages

Seaweeds and human evolution

One of the characteristics of humans as a species is that our brains are large in proportion to our body mass. How did this come about? It is now generally acknowledged that the ancestors of present-day humans, the upright primates, did not evolve on dry, warm grasslands but in the damp, warm regions that formed the border between land and water. The British neurochemist Michael Crawford has pointed out that the all-important sources of essential and superunsaturated omega-3 fatty acids, especially DHA (docosahexaenoic acid) and EPA (eicosapentaenoic acid), can be found in sufficient quantities only in littoral areas, where fish and shellfish are abundant. These fatty acids, with which we are also familiar from fish oil and food supplements, are a vital requirement for the formation of a complex nervous system and a large brain. Hence, it was a determining factor in the evolution of modern humans that our ancestors, during the period from about 1,000,000 years ago until the appearance of the first modern *Homo sapiens* about 100,000–200,000 years ago, had a diet that consisted of fish and shellfish.

It is, nevertheless, more difficult to determine conclusively whether seaweeds were also incorporated into the diet of our distant ancestors. Seaweeds are, however, a primary source of omega-3 fatty acids and it is actually from them and other algae that marine animals derive these substances. Studies of fossil finds indicate that the enamel surface of the teeth of early hominids shows evidence of wear that is characteristic of eating food containing a certain content of silica particles, which are typically found in wetland plants. In addition, analysis of the minerals found in fossilized bones has shown

Collecting seaweeds in Victorian England

In the first half of the 19th Century, English laymen developed a growing interest in, and infatuation with, natural history, leading them to devote their leisure time to the independent study of Nature, often by the seashore. Not long before, the Swedish naturalist Carl von Linné had introduced a classification system, but many species had not yet been designated by unique Latin names and were known by names that varied from one district to another. English ladies, in particular, enjoyed gathering up strange objects on the beach. Often led by the local curate or doctor, they went along the shore at low tide collecting bits of seaweed which they dried, pressed carefully, and mounted on paper. These specimens were labelled with fanciful names such as mermaid's shaving brush, sea-girdles, peacock's tail, and sea lace.

The interest in seaweeds seems also to have inspired poets to point out the injustice inherent in referring to them as weeds. In the little poem below, the seaweeds themselves ask to be called "Ocean's gay flowers". Today many seaweed lovers prefer to call them vegetables from the sea.

Algae, bright order!
By Cryptogamists defended –
Translate marine plants
as Linnaeus intended.
You collect and admire us,
we amuse leisure hours;
"Then call us not weeds,
we are Ocean's gay flowers."
(Curtis)

◂ A folded book with pressed seaweed samples, probably collected by a girl on one of the English Channel Islands at the beginning of the 19th Century. The small verse quoted here is inscribed on the back page. Cryptogamia refers to an archaic botanical classification system.


ALDERNEY, CHANNEL ISLES
Marine Algae presented in 1920 by
Charles B.W. Brook of West Southbourne
determined in 1922 by Lilian Lyle

◂ *Hana-Tsunomota* and *Emi-Tsunomota*—cultivated *Chondrus* in four different natural colors.

The popularity of this wild strain of *Chondrus crispus* may lie in its appeal to both the eye and the palate. It has a distinct crunchy texture and a milder taste than other sea vegetables such as *wakame*. Its shape and three completely natural colors—pink, green, and yellow—are reflected in its somewhat poetic name, *Hana-Tsunomata*, meaning 'flower *Chondrus*' in Japanese. When fully hydrated it is very decorative, whether presented on its own or when lending an elegant touch to other dishes such as a salad. One might say that this farmed Canadian seaweed exhibits all the desirable characteristics of a prototypical Japanese seaweed salad, *kaiso*.

Similar to the changing color of leaves in autumn, the colors of *Hana-Tsunomata*, *aka* (pink), *midori* (green), and *kiku* (yellow), are all naturally produced by the seaweed. With over twenty years of experience working with this unique *Chondrus*, Acadian Seaplants ensures that each seaweed frond is produced to meet exact color specifications.

Recently introduced by Acadian Seaplants, and sister to the *Hana-Tsunomata* line of products, is *Emi-Tsunomata*, or 'smiling *Chondrus*'. With a similar texture and shape to *Hana-Tsunomata*, *Emi-Tsunomat*a is presented in its original pigment form—russet. This natural *Chondrus* offers an abundance of nutritional and functional food qualities including antioxidants, dietary fiber, vitamins, and amino acids.

▲ Rehydrating a dry piece of *Hana-Tsunomata* in sparkling wine causes the crumpled frond to unfold into its beautiful branched flower shape while it dances on the bubbles. *Hana-Tsunomata* is a special *Chondrus crispus* that comes in three different natural colors. During rehydration in room-temperature water the fronds swell up to six times their dry size and seven to eight times their dry weight.