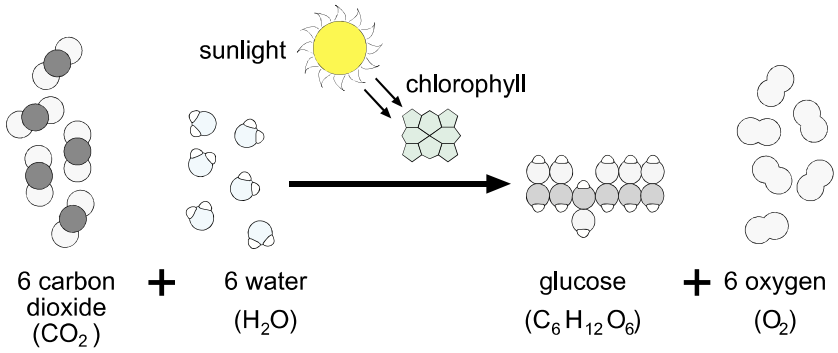
Introduction: Marine Plants—The Producers

The ocean contains many plants and plantlike organisms. Some are similar to plants we see on land. Others are very different. But all of these plants and plantlike organisms have one thing in common. They are producers. Producers produce their own food through a process called *photosynthesis*. Through photosynthesis, producers capture sunlight with special pigments, such as **chlorophyll**. Producers combine light energy with water and carbon dioxide to form a sugar called *glucose*. Oxygen is a by-product of this reaction. Energy for the process is supplied by sunlight to create sugars that fuel the producers' life functions.



Through photosynthesis, carbon dioxide and water combine with sunlight, supplying the energy to form a sugar called glucose. Oxygen is a by-product of the reaction.

Most of the producers we are familiar with on land are classified as plants. Plants also grow in the ocean. Grasses are the most widespread example. However, most of the producers in the ocean, such as phytoplankton and seaweed, are very different from plants. Because of these differences, many biologists classify them with a totally different group of organisms—the **protists**.

Protists are organisms whose cells are very simple. A protist may have just one cell, as do the millions of tiny producers that float in the phytoplankton. Or protists may live together with thousands of other cells—all alike—to make a large, plantlike structure. This is the case with many species of green, brown, and red **seaweeds**. These seaweeds are also known as marine **algae**.

Plants: Complex Producers Rooted to Land

Plants differ from protists in that their cells are not all the same. The structure of a plant cell is usually customized, or specialized, for a particular job. This job depends on where the cell is located in the plant. For example, plant cells in leaves are specialized to carry out photosynthesis. Plant cells in stems are specialized to transport nutrients up and down the stem.

Plants that live in the ocean or along the shoreline are members of the most complex and specialized group of plants. This group is known as the *flowering plants*. Some flowering plants in the marine environment live totally beneath the water. They are **submergent**. Others are rooted in the ocean floor but rise up above the water level. They are **emergent**.

Coastal plants stabilize and prevent erosion. Many organisms depend on grass beds and beach plants for food and shelter. Because housing and recreational developments have destroyed many of these plants and their habitats, they have become endangered and are protected by state and federal laws. Treat plant life at the beach and in the ocean with care. Do not pick or pull plants growing on the beach or under water.

Submergent Plants: Plants That Live Underwater

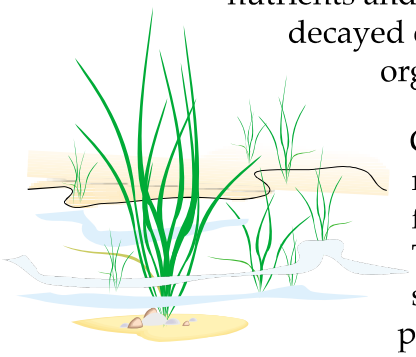
Seagrasses are submergent plants that have adapted to life under water.

Seagrasses are submergent plants that have adapted to life under water. They help maintain water clarity by trapping sediments with their leaves and roots. Just as trees and plants on dry land help to hold soil and lessen erosion, seagrasses are important in stabilizing soft bottoms. They also provide food and shelter for many species of invertebrates, fish, and algae, which may grow on the leaves of seagrass. There are seven types of seagrasses found in Florida: manatee grass, shoal grass, turtle grass, paddle grass, star grass, widgeon grass, and Johnson's seagrass.

Emergent Plants: Plants That Are Salt-tolerant and Adaptable

Plants that grow near the shore or out of the water are classified as *emergent* plants. These plants are salt-tolerant and have specific adaptations to this harsh habitat. Many salt-tolerant plants have thick,

waxy coverings that prevent water loss. Others have a wooly coat of hair. Emergent plants, such as mangroves, help stabilize shoreline sediments and prevent erosion so that other plants can also grow in this habitat. *Pioneer plants* are the first to colonize, or start growing on, exposed land. They are the first step in stabilizing sediments. Grasses, vines, and sprawling shrubs are common pioneer plants. Examples include sea oats, railroad vine, and sand bur. As plants die, they are broken down into nutrients and contribute to the *detritus*, or rich layers of decayed organic matter, that provides food for many organisms.



Plants that grow near the shore or out of the water are classified as emergent plants.

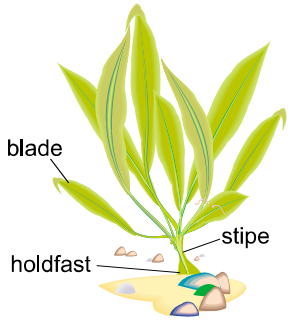
Grasses such as salt grass (*Distichlis*), needle rush (*Spartina*), and cord grass (*Juncus*) can be found growing in marshes and swamps. These plants adapt to saltwater by excreting salt from the edges of their leaves through pores. Other emergent plants include trees, such as several types of mangrove, all of which protect themselves from salt in different ways.

Marine Algae: Different and Colorful

Marine algae—green, brown, and red seaweeds, for example—often resemble the plants we see on land. Actually, as we discussed before, seaweeds are not plants but are simple-celled producers called *protists*. Some seaweeds float in the water like their smaller relatives, phytoplankton. Other seaweeds, like kelp, anchor themselves and grow quite large.

Although all seaweeds contain photosynthetic pigments, they are not all green. Other pigments such as carotene (orange) and xanthophyll (brown) mask the green color of chlorophyll, help in photosynthesis, and give seaweeds their color.

On our Florida beaches we often find colorful stringlike material draped over rocks and lining the beaches. This widespread marine algae is seaweed. Seaweed can be either attached or free floating. Seaweed attached to the ocean floor or stable objects have a thickened, rootlike extension called a **holdfast**, which helps the seaweed anchor itself in soft

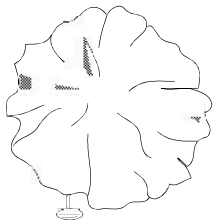


The Structure of Marine Algae

mud or grip onto rocks, barnacles, or mussels. The holdfast, however, does not provide any nourishment for the algae and, unlike plants with roots, the algae will not die if the holdfast is broken off. Some seaweeds have a stemlike structure called a **stipe** that holds the blades near the water surface. The **blade** is the leaflike section of a seaweed. Floating seaweeds may have air sacs that keep the blades afloat at the water surface to get sunlight.

Types of Seaweeds: Green, Brown, or Red

Scientists classify seaweeds partly on the basis of their color: green seaweeds, brown seaweeds, and red seaweeds.



The sea lettuce, Ulva, is the best known of the green seaweeds.

Chlorophyta, or the green seaweeds, are more common in fresh water than in the ocean. The sea lettuce, *Ulva*, is the best known of the green seaweeds. It resembles thin, flat, clear sheets of lettuce and is sometimes collected by humans for food.

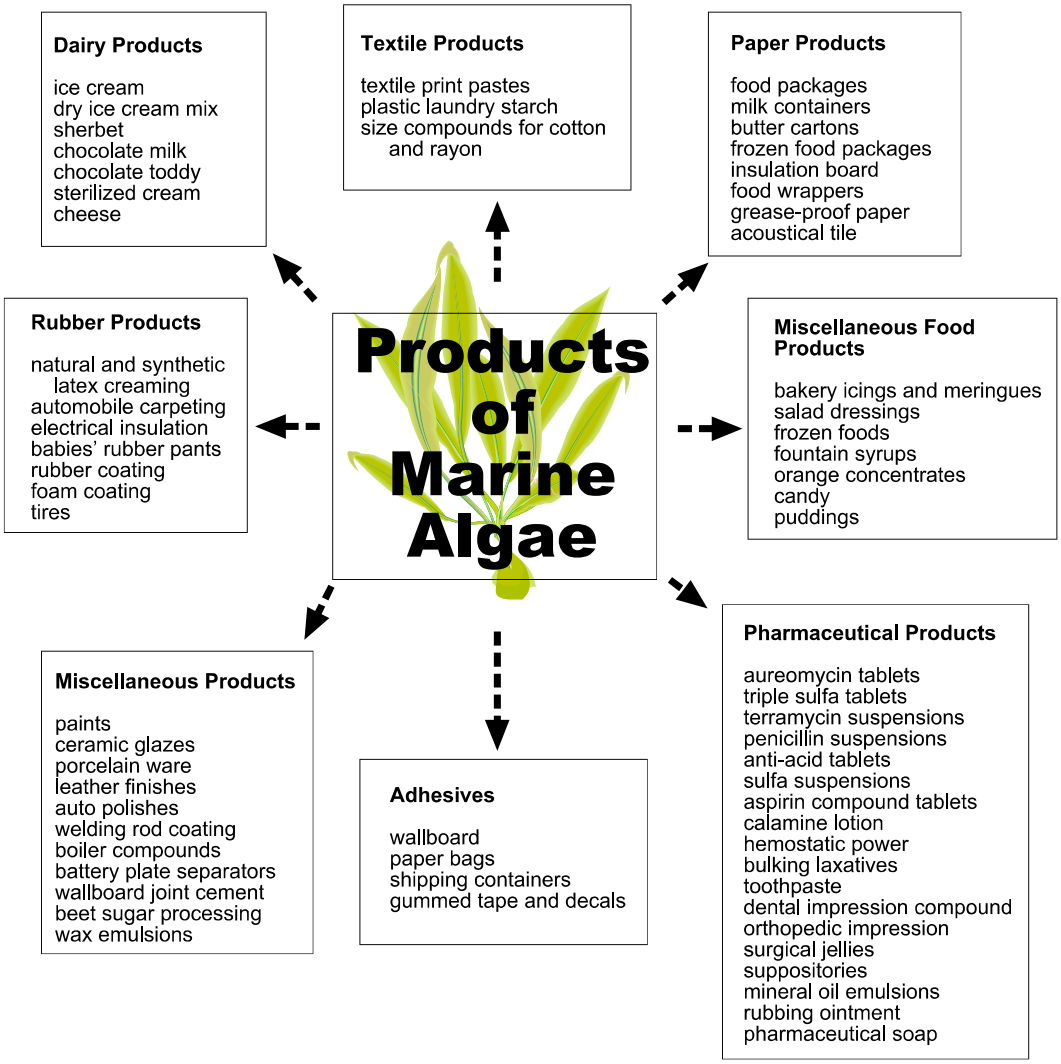
The brown seaweeds, or **Phaeophyta**, are common along the coastal areas, especially in colder waters. The Phaeophyta are the largest of the seaweeds, some growing to over 100 feet long. Some common brown seaweeds are kelps, *Macrocystis* and *Nereocystis*, and the floating seaweed *Sargassum*. *Sargassum* can be found washed up all over Florida beaches. It is leafy with small air sacs that help it float. This seaweed provides shelter and food for juvenile crabs, shrimp, and fish. Because brown seaweeds are so plentiful and easily harvested, some industries use them as a source of iodine, trace minerals, fats, and even vitamins.

Red seaweeds, or **Rhodophyta**, are almost entirely marine. Most red seaweeds grow attached to rocks or on the seabed where light barely penetrates. Many red seaweeds are reddish-purple or reddish-brown in color. Most of them are found growing on coral reefs or oyster beds. Red seaweeds are used to make soups and seasonings.

Seaweeds are usually found in zones or bands along the edge of the shore. Red seaweeds live at the deepest levels, whereas brown and green seaweeds survive closer to the surface. The depth at which different seaweeds live depends upon the amount of light they need to carry out photosynthesis.

Uses of Seaweeds: From Foods to Fertilizer

For centuries, people of the Far East have nurtured and harvested seaweeds in their **mariculture**, or farming of the sea or ocean. As early as the 17th century, people processed brown seaweed into soda ash for use by glass and pottery makers. Potash, a fertilizer, is derived from burned or dried seaweed. Iodine can also be derived from seaweeds. Today many types of seaweeds are prized as specialty foods because they are rich in minerals and vitamins.



Currently, brown seaweeds or kelps are harvested by the use of a *mower*. The mower cuts off the top four or five feet and pulls it up onto a barge. The kelp is then dried and used to produce **algin**, **agar**, and **carrageenan**. The kelp left in the sea grows back in several weeks to be harvested again.

Algin is a powdery extract that absorbs large quantities of water. Algin is added to ice cream to prevent ice crystals from forming. It keeps frostings and gels from sticking to packaging. Algin is also used to suspend antibiotics in solution and pigment in paints. *Agar*, the gel that is extracted from seaweeds by boiling, is used as a medium for growing bacteria in microbiological studies. The agar gel is nontoxic and is widely used in canning meat and fish and in the glue of postage stamps. Many products use another seaweed extract called *carrageenan*. Carrageenan helps to keep substances suspended in solution. It is commonly used in chocolate milk, toothpaste, and cosmetics. Most people have eaten or used seaweed and never known it.

Summary

The ocean contains many plants and plantlike organisms. These are producers that make their own food through the process of *photosynthesis*. The producers in the ocean are divided into two major groups: plants and *protists*. Plants are complex organisms whose cells are specialized for different jobs. Protists are simpler organisms. They may have one cell or many cells, but protist cells are all alike, with the same structure.

Marine plants may be either *emergent* or *submergent*. Emergent plants raise their stems and leaves out of the water. Submergent plants are totally covered with water. Plants do many important jobs. They stabilize shoreline sediments and help to prevent erosion. They also provide food and shelter to marine animals.

Emergent plants raise their stems and leaves out of the water.

Marine protists include single-celled *phytoplankton* and multicelled marine *algae*. Marine algae is also known as *seaweed*. Seaweed often has plantlike parts and air sacs that help it float. By floating, seaweed can stay close to sunlight. There are green seaweeds, *Chlorophyta*, brown seaweeds, *Phaeophyta*, and red seaweeds, *Rhodophyta*. Seaweeds have been used both as food and fertilizer. Substances removed from seaweed are also used in many products, including glue and cosmetics.