4-H 314
4H MEG 01

Florida 4-H Marine Science Program

MEMBERS GUIDE

Florida Cooperative Extension Service
Institute of Food and Agricultural Sciences
University of Florida, Gainesville
John T. Woeste, Dean for Extension

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Preface

The thirteen projects within this manual are designed mainly for 4-H leaders and members. Each project is a unique study because a simple procedure is all that is needed to fulfill its objective.

The projects are not new to many of those who have been in the 4-H organization for the past year or so. The manual, though, is relatively new because it not only encompasses some of the earlier Special Interest projects in marine science but also some brand new projects developed by other authoritative sources.

This manual by no means fulfills the requirements of the 4-H Marine Program as a whole, but is definitely a beginning in helping to develop it. The projects herewith will help fill a void in the many new marine science programs that are being developed in the 4-H clubs throughout Florida by putting a project package in the hands of the leaders and members.

Included within this manual are both biotic and abiotic projects. Biotic projects are those which deal with the living things and the abiotic are those that are not living such as sand and tides. The biotic factors are arranged phylogenetically (from the lowest form of marine organism to the highest form) while the abiotic factors (Exploring Beach Sand, Florida's Sandy Beaches and What Makes The Tides) are placed in their respective order so that the learning from one project will help in working with the next.

It is important today for the people of the United States as well as the entire world to understand the complete ecosystem process of our earth. Hopefully this first 4-H Marine Program Manual will help to do just that with respect to the marine world.

Resources provided by the National Oceanic and Atmospheric Administration and the Florida Sea Grant College, aided by Dr. Hugh Popenoe and Dr. William Seaman, Jr., have facilitated the development of this manual.

Special thanks and appreciation should go to Dr. James J. Brasher who has given support and encouragement in the 4-H marine program, Dr. Tom Greenawalt who initiated the program in the 4-H organization, Carolee Boyles who wrote most of the guides for the Special Interest Series, Jeff Fisher and Jane Jones for their sponge project, Nancy McDermott for the barnacle and stinging animals of the sea projects, Dr. Frank Maturo, Dr. Joseph S. Davis, Dr. Carter R. Gilbert, Dr. Perry W. Gilbert, Dr. H. K. Brooks, Dr. Archie Carr, Dr. Oliver Austin, John Paige and Michael Oesterling for reviewing the various projects, Dr. Craig D. Shaak for locating various barnacle drawings, Becky Gaver and Helen Huseman for their top-notch illustrations, Yaeko Duran for the layout and publication design, and Gary Hermance for helping in directing the entire publication.

Neil Crenshaw
Florida 4-H Marine Education Specialist

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OCEAN-GOING PLANTS
seaweeds

Have you ever eaten seaweed?

Most of you would probably answer this with a most emphatic "no!" Seaweed is slimy, smelly stuff.

Let's ask it this way, then. Have you ever eaten ice cream? If you can answer "yes" to this question, then you have, indirectly, eaten seaweed.

A little about seaweeds

Seaweeds are plants that live in the ocean. Each seaweed captures a little energy from the sun, and turns it into part of the plant itself. This is a complicated process carried on by structures in the plant that contain the green coloring, or **pigment**, that makes plants green. This green pigment is called **chlorophyll**. Although all seaweeds contain chlorophyll, not all of them are green. Some seaweeds contain pigments other than chlorophyll so that they are golden brown, dark brown, or even red in color.

The proper name for seaweeds is **algae**. Not all algae are seaweeds; some algae also live on land and in fresh water. Not even all algae that live in the sea are called seaweeds. Only the **marine** (sea-dwelling) algae that are large enough to pick up can be properly called seaweeds.

Green seaweeds

Scientists call this group the **Chlorophyta**. Some of them are up to several feet long and are of various shapes: soft and leathery, long and ribbon-like, mushroom shaped. One kind, sea lettuce, looks somewhat like a leaf of lettuce.

Brown seaweeds

Scientists call this group **Phaeophyta**. They grow much bigger than other algae. The giant kelp may grow to several hundred feet long. Another brown algae, gulfweed (Sargassum), washes up on Florida beaches regularly. If you go to the beach and see piles of seaweed on the sand, it is probably gulfweed.

Red seaweeds

Scientists call this group **Rhodophyta**. The color of these seaweeds may be red, reddish-purple, or reddish-brown. Red seaweeds do not get as big as brown seaweeds.

Seaweeds do not have roots and stems and leaves like green plants do. Seaweeds that are attached have a thickened root-like or foot-like extension called a **holdfast**. If seaweeds are cut off or broken off above this holdfast, some of them may die, but many will keep on growing.

Instead of stems and leaves, some seaweeds have a stem-like area called the **stipe**, and a leaf-like area called the **blade**. Most seaweeds have a stipe, a holdfast, and a blade, but you may have trouble telling where they are on some kinds.

Green plants reproduce by forming flowers, which in turn produce seeds, but seaweeds do not produce either one. Instead, they produce spores on the tips of their branches, which are very tiny, and float away to start new plants.

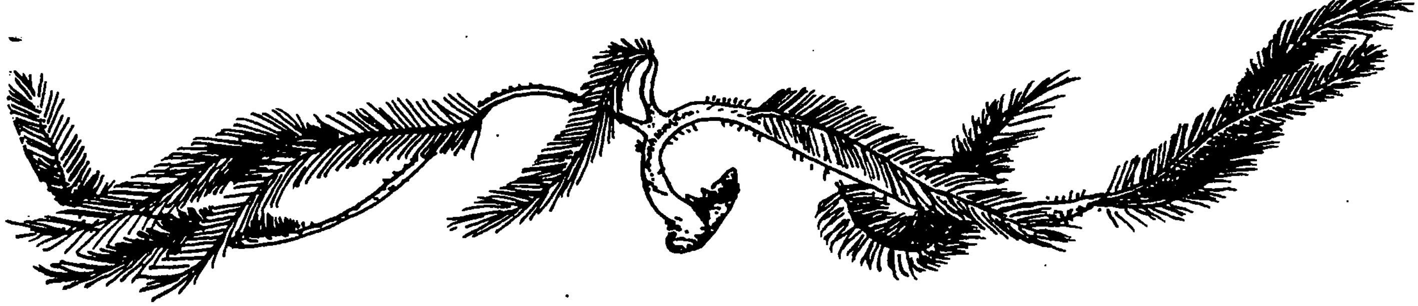
Seaweeds are a home for many small creatures. Some small fishes and crabs look very much like the seaweed they live on so they can hide from animals that eat them.

Seaweeds can be found on the shore of any beach. Some grow attached to rocks and piers. Some even grow on sea-grasses, which are a few kinds of true grasses that live in shallow salt water. Others, like gulfweed, float free in the ocean and sometimes wash up on shore. If you wanted to see the giant kelp, however, you would have to go diving on the coast of one of our northern states, because it grows in deep, cold water.

Now, about eating seaweeds:

In ice cream, as well as in some commercially prepared cakes, you will find an ingredient called agar-agar. This is extracted from seaweeds. It helps to keep the ice cream smooth and to keep the cakes moist.

In the Orient, though, people really do eat seaweed. There, seaweed is grown as a crop. Instead of being called **agriculture** (farming on the land) it is called **mariculture** (farming under the sea). If you are interested in knowing more about preparing seaweed for food, your leader has a list of cookbooks in which you can find recipes.



Other agar-agar compounds are used in making medicines and cosmetics. Your dentist may prepare impressions of your teeth with agar-agar.

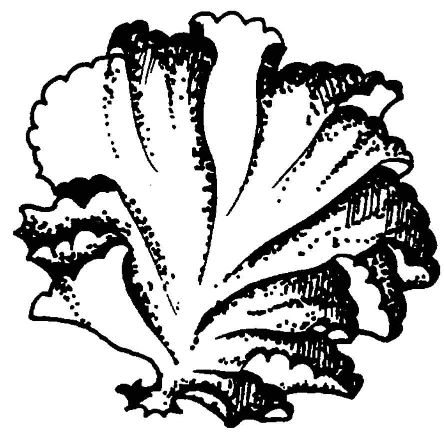
Where you can look for seaweeds

Any time you go to the beach you can look for seaweed. As you walk along above the edge of the water, you may find piles of brown seaweed heaped up on the sand. This is probably gulfweed (see the drawing of a branch of gulfweed on the next page).

If you arrive at the beach just as the tide is starting to go out, you can watch the attached seaweeds become visible as the water no longer covers rocks and sand. Notice that as the water recedes, different kinds of seaweeds appear. The kind that appears first is able to withstand a long period of exposure to the air, while the kind that is still within reach of the waves at low tides will not tolerate dryness very long. Seaweeds grow in bands, or zones, both above and below the low tide mark according to the amount of air, water, and sunlight they need. If you follow the tide down, you can observe this zonation of the different kinds of seaweeds.

Here are drawings of some seaweeds you might see on a Florida beach.

SARGASSUM - Gulfweed
(A brown alga)



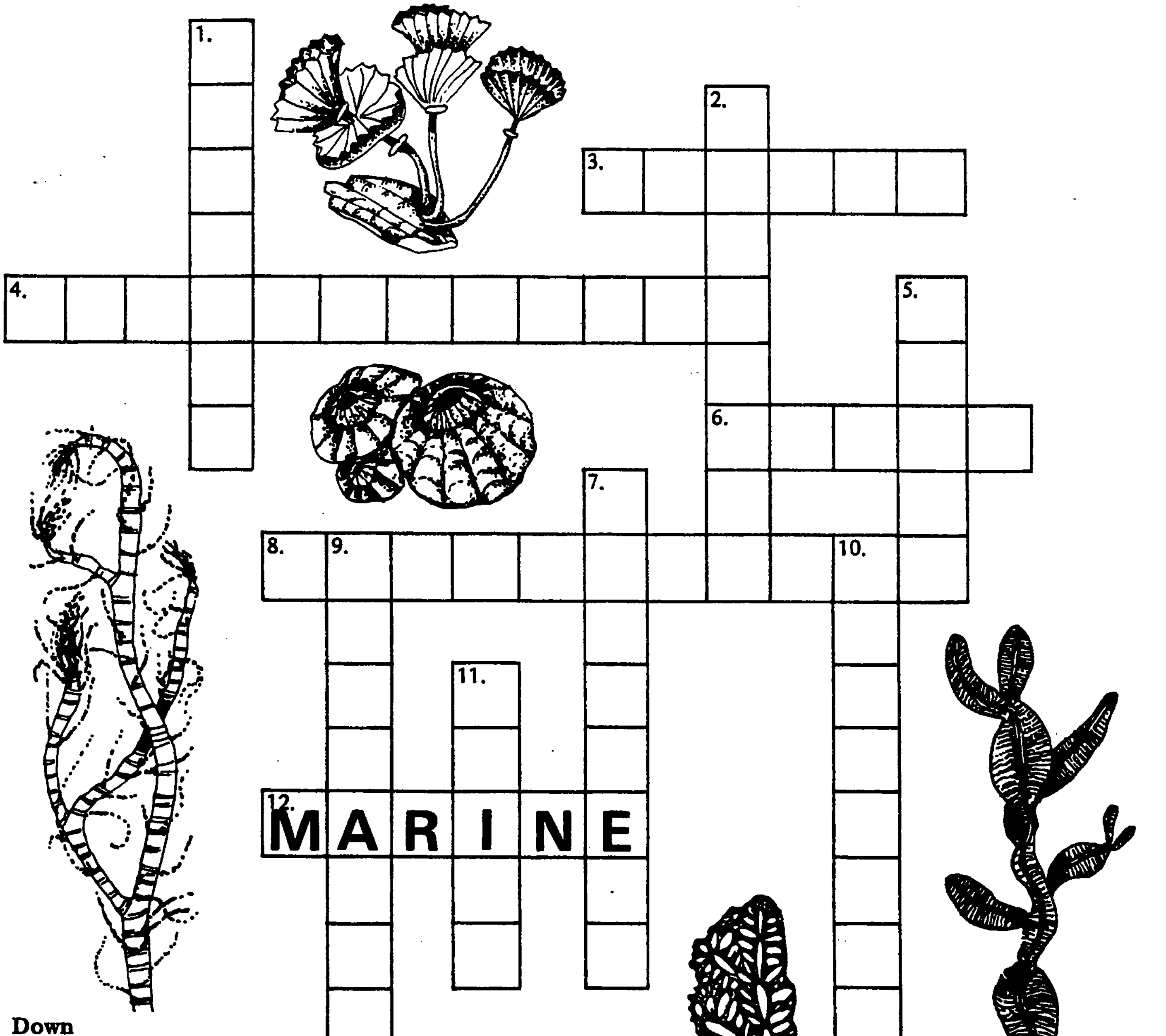
ULVA - Sea-lettuce
(A green alga)

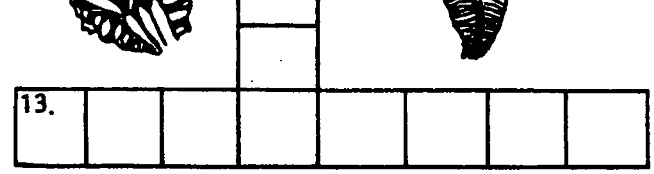
PADINA
(A brown alga)

GRACILARIA
(A red alga)

A Crossword Puzzle

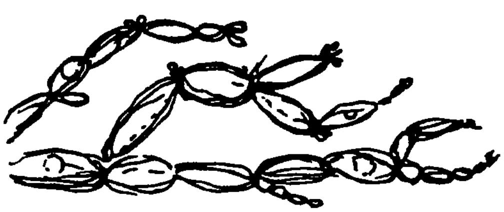
On the next page is a crossword puzzle. Many of you have probably seen or worked one of these; in case you haven't, here's how you do it: You are given a set of clues. Each clue describes a word you learned in this project. Figure out what each word is and write it in the row of boxes that begins with the same number that the clue is. An example is given for you: Clue number 12 across is "Sea-dwelling". You need a word that has the same number of letters as there are boxes; six. The word is "marine". It has been filled in for you. If you have trouble going on, your leader will help you.





Down

1. Coloring.
2. "Root" of a seaweed.
5. "Leaf" of a seaweed.
7. A brown seaweed that commonly washes ashore on Florida beaches.
9. Used commercially.
10. Red seaweeds
11. "Stem" of a seaweed.



Across

3. What seaweeds reproduce by, instead of seeds.
4. Chlorophyta (2 words).
6. The group of plants that seaweeds belong to.
8. Farming under the sea.
12. Sea-dwelling.
13. The arrangement of seaweeds in zones on the seashore.

PLANKTON
the basis of life

Look outside. See all the green plants? What if they all suddenly came uprooted and flew up into the air to grow there instead of on the ground? Then cows and horses and all the other animals that eat plants would have to chase the plants around in the air to get anything to eat.

Sounds silly, doesn't it? But there is one place on Earth that is very much like this. Plants and animals float about and are not confined to the Earth's surface. That place is the ocean.

The Sea-Garden

In the ocean, some plants are fastened to a rock or the sand, and look much like land plants. Many more of them are too tiny to see without a microscope, and float freely in the water. Organisms that are this small sometimes have only one cell, and are called **microscopic**. This great mass of microscopic plants floating in the water, is the garden of the sea. It is the place where all marine (ocean-dwelling) life, either directly or indirectly, get its food.

These tiny plants do not swim around in the ocean, but are carried by the water. Organisms that just float along with the water in this way are called **plankton**.

Two different kinds of plankton float in the water. One kind is **phytoplankton**, the plants. The other kinds is **zooplankton**, the animals. When someone says just "plankton" it means both the phytoplankton and the zooplankton, or all the floating plants and animals.

As we discuss plankton, we will for the most part be talking about microscopic plankton. You should be aware, however, that some planktonic jellyfish may be as large as three feet across. And one kind of planktonic plant, called gulfweed (Sargassum), grows in great patches that float near the surface of the water.

Where it all begins

Phytoplankton may be accurately called the "grass of the sea". It serves much the same purpose that grass and other green plants do on land.

Land plants trap and store energy contained in sunlight. Then when animals eat the green plants, they use the energy that the plants have stored. Because plants store energy and produce food for other creatures in this way, they are called **producers.**

In the ocean, the situation is very similar. Phytoplankton store energy contained in sunlight, and thus produce food for other creatures. So, they are the producers in the ocean community. Since phytoplankton need sunlight, they are found only near the surface of the ocean where the sunlight can reach them.

Where it goes

On land, many creatures eat the green plants. Cows, horses, many insects, and many other small animals feed on the food the producers have stored. Because these animals consume this stored food, they are called **consumers.** But what about other animals (such as man) that eat the consumers (such as cows)? Aren't they consumers also?

To put this a little more clearly, we can draw what is known as a **food chain:**

man (consumer)
↑
cow (consumer)
↑
green plants (producers)

This is a very simple food chain. What it says is that the man ate the cow that ate the green plants. The arrows show which way the energy that the plants stored is moving.

But sometimes we need to be able to tell whether the consumer we are talking about was one who ate the producer, or one who ate another consumer. So, we call a consumer who eats green plants a **1st order consumer.** Then, we call a consumer who eats a 1st order consumer a **2nd order consumer.** Now, our food chain looks like this:

2nd order consumer (man)
↑
1st order consumer (cow)
↑
producers (green plants)

Wait a minute! People sometimes eat green plants! OK, when they do, they are 1st order consumers. Draw the food chain this way:

2nd order and 1st order consumer (man)
↗ ↗
1st order consumer (cow)
↖ ↗
producer (green plants)

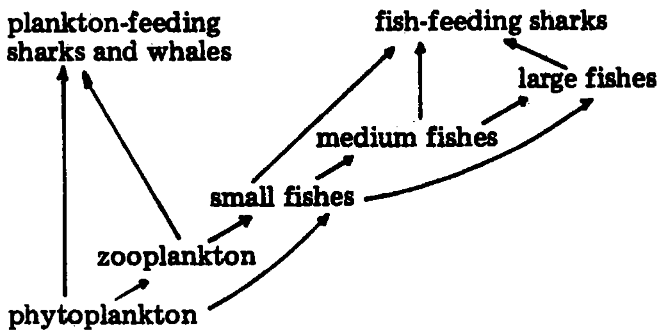
Now our food chain is a **food web.** There are many such food chains and food webs, both on land and in the sea. Sometimes they become very complicated.

We have already said that phytoplankton are the producers in the ocean. What are the 1st order consumers?

Well, zooplankton are. So, we can begin an ocean food chain this way:

1st order consumers (zooplankton)
↑
producers (phytoplankton)

Some whales feed on only plankton, both phytoplankton and zooplankton. So, let's add whales and some fishes and we can draw a food web that begins to get complicated. (To make it easier to read, we will write just the names of the organisms).



If we wanted to, we could keep adding to this, until it became much more complicated.

Now let's isolate one food chain out of this food web and see how much plankton it takes to feed, for instance, a large fish.

4th order consumer—large fish 1 pound
(an example of a large fish is a tuna)
↑
3rd order consumer—medium fish 10 pounds
↑
2nd order consumer—small fish 100 pounds
↑
1st order consumer—zooplankton 1,000 pounds
↑
producer—phytoplankton 10,000 pounds

As a general rule, it takes 10 pounds of producer for the 1st order consumer to gain one pound. It takes 10 pounds of 1st order consumer for the 2nd order consumer to gain one pound, and so on.

The drawing shows the amount, by weight, of plankton and small and medium fish that a large fish (tuna) must eat to gain one pound. Though the tuna does not eat plankton, it eats medium fish, that eat small fish, that eat zooplankton, that eat phytoplankton. Thus, the tuna is ultimately dependent on the phytoplankton.

You can see that it takes 10,000 pounds (that's 5 tons!) of phytoplankton for a tuna to gain one pound. Without phytoplankton, we would have no fish to eat. Not only must plankton be present, they must be present in enormous numbers. Plankton are the basis for all fish life in the ocean.

To demonstrate the effects of fertilizer on the growth of plankton, take two five gallon buckets of seawater or fresh lake water. Label one bucket "control", and the other "experimental", and place them in a sunny place. Each day add one or two drops or a pinch of household phosphate detergent, or fertilizer, to the experimental bucket. Record water temperature, turbidity and general appearance. Continue the experiment until water becomes very turbid and green, a plankton bloom. Answer the following questions: 1) Why is the water green? 2) Is there any difference between the two buckets? Explain the difference.

From the experimental bucket pour some water into dishes and observe the plankton. Most of the plankton is transparent. Why do you think this would aid the plankton? Perhaps their enemies cannot see them as well. Watch the plankton's weak swimming motions. Can you see why plankton are referred to as drifters of the sea? Many of the animal plankton feed on tiny one-celled plants in the water. Use a magnifying glass to look for feeding structures on the plankton.

A Crossword Puzzle

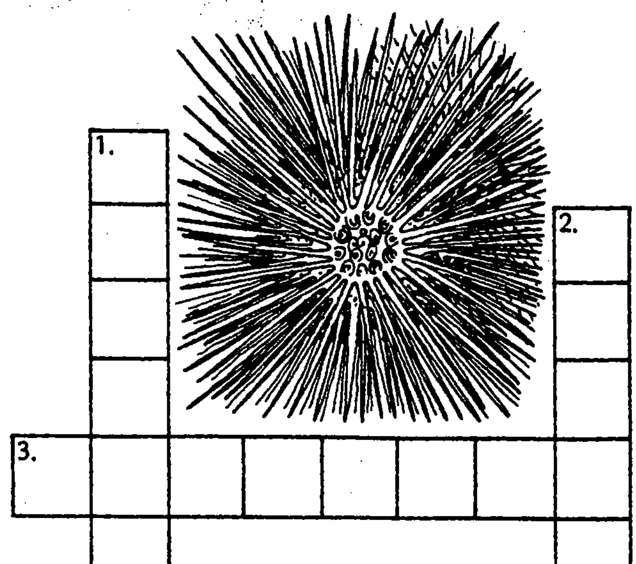
Here is a crossword puzzle. Many of you have probably seen or worked one of these; in case you haven't, here's how you do it: You are given a set of clues. Each clue describes a word you learned in this project. Figure out what each word is and write it in the row of boxes that begins with the same number that the clue is. An example is given for you: Clue number 8 across is "Food ______". You want a word that will go in the blank, and has as many letters as there are boxes (5). The word is "chain". It has been filled in for you. If you have trouble going on, your leader can help you.

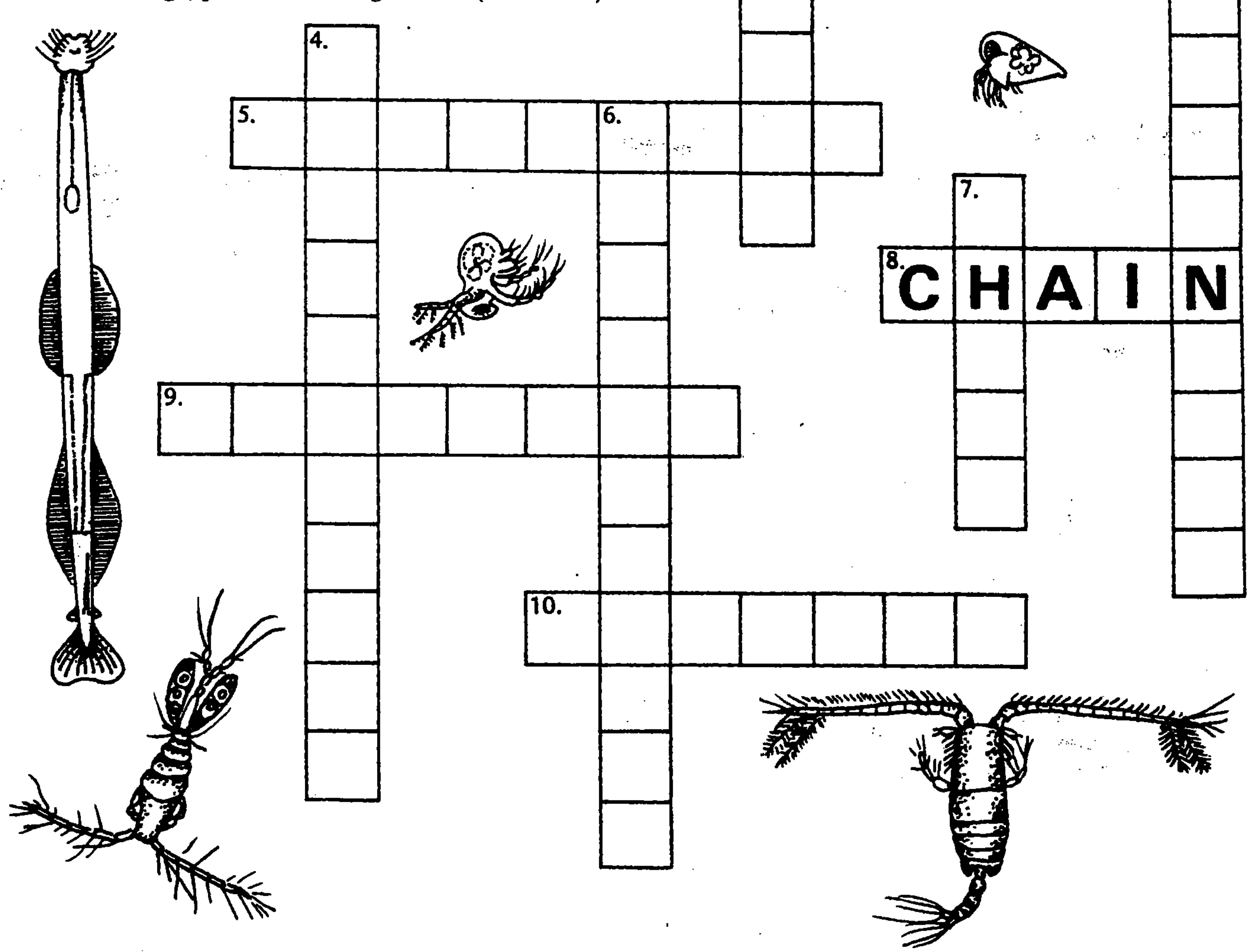
Across

3. What all green plants need so that they can store energy.
5. Animals that feed on other organisms. (1st order ______, for example)
8. Food
9. Organisms that float and drift with the movement of water.
10. Many food chains make this (two words).

Down

1. Green plants' role in a food chain or food web.
2. Planktonic plants.
4. Planktonic animals.
6. Organisms that it takes a microscope to see.
7. A large, plankton-eating animal (not a fish).





PHYTOPLANKTON
the ocean's wandering plants

Have you ever thought about what it would be like if plants didn't have roots? They wouldn't stay in the same place all the time. They'd wander around all over the place every time the wind blew.

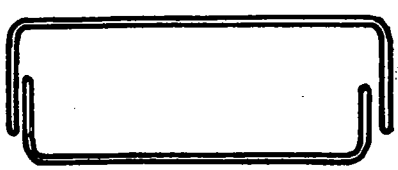
But that's the way it is in the ocean. Some plants are attached to things by a foot-like structure called a holdfast. But many ocean-going plants are not fastened to anything, and they wander about with the tides and the currents.

These wandering plants are called **phytoplankton** ("Phyto" means plant, and "plankton" means to wander or drift). Some of the phytoplankton float in great patches at the surface of the ocean. Most of them, however, are too small to see without a microscope. It is these **microscopic** phytoplankton we will learn about in this project.

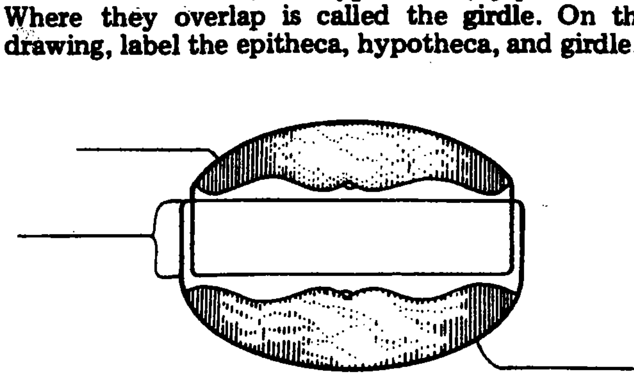
The microscopic phytoplankton are of two major types, the **Diatoms** and the **Dinoflagellates**.

The Diatoms

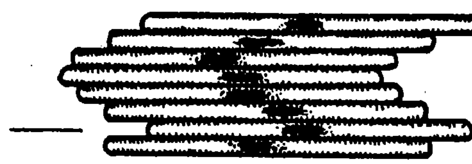
A diatom is a lot like a miniature pill box. It has an outside shell or capsule called a **frustule** (frus-chool). This frustule has two halves that fit one inside the other like this:

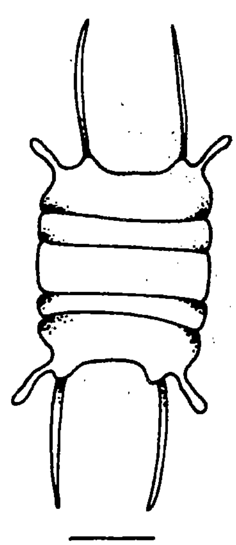


The larger half, the **epitheca** (ep-i-the-ka), fits over the small half, the **hypotheca** (hy-po-the-ka). Where they overlap is called the **girdle**. On the drawing, label the epitheca, hypotheca, and girdle.



Diatoms are divided into two groups on the basis of the shape of their frustules. Centric diatoms are usually circular, cylindrical, or triangular. Pennate diatoms are usually elongated, oblong, or feather-shaped. In the following drawings, indicate whether the diatom is centric or pennate by writing a C or a P in each space.





The Dinoflagellates

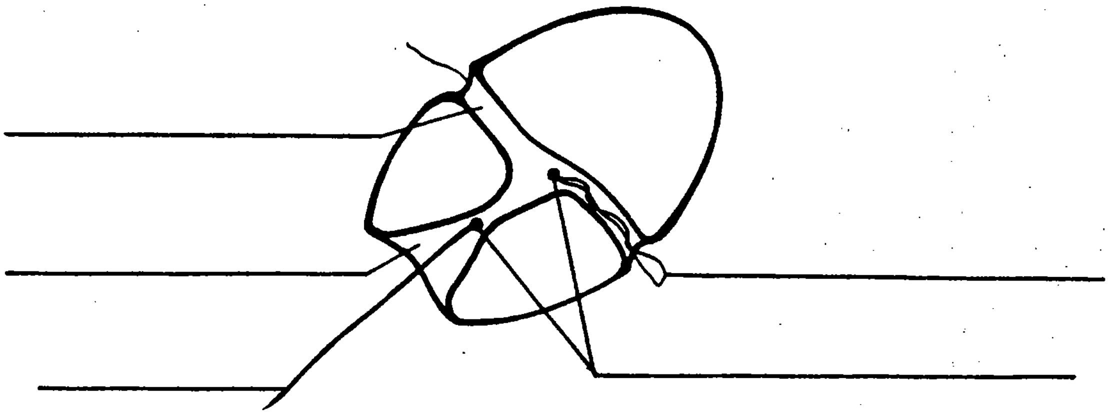
I'm sure many of you have heard of the "red tide". If you live near the beach, you may even have seen the thousands of dead and dying fish, and smelled the irritating fumes produced by such a "red tide".

Or have you ever walked on the beach at night, just above where the waves were breaking? Did you see tiny lights twinkling around your feet in the sand each time you took a step?

Both the "red tide" and the little lights (called bioluminescence) are caused by members of this group of phytoplankton.

Dinoflagellates are able to move themselves around in the water a little by the use of flagella. This is why they are called flagellates. A flagellum is very much like a thin tail, and the plant uses its two flagella in much the same way as an alligator uses its tail. By wiggling them back and forth, the dinoflagellate can propell itself through the water.

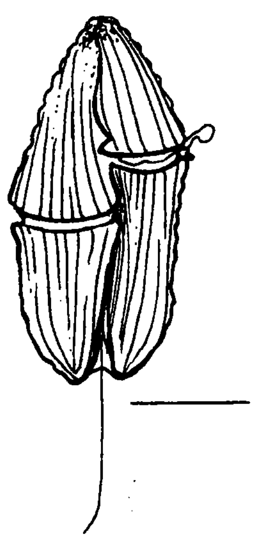
Most dinoflagellates have a transverse flagellum that lies in a groove called a girdle that wraps around for sideways motion, and a longitudinal flagellum that lies in a groove called the sulcus and hangs behind for forward motion. Both flagella arise from flagellar pores. On the drawings, find and label the transverse and longitudinal flagella, girdle, sulcus, and flagellar pores.

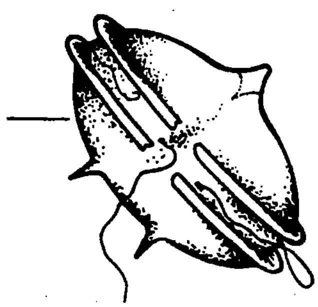


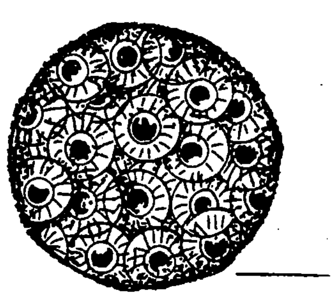
Dinoflagellates are really somewhere between plants and animals. They can produce their own food with the aid of sunlight, like plants. They can also feed on tiny particles of food in the water, and are capable of a certain degree of motion, like animals.

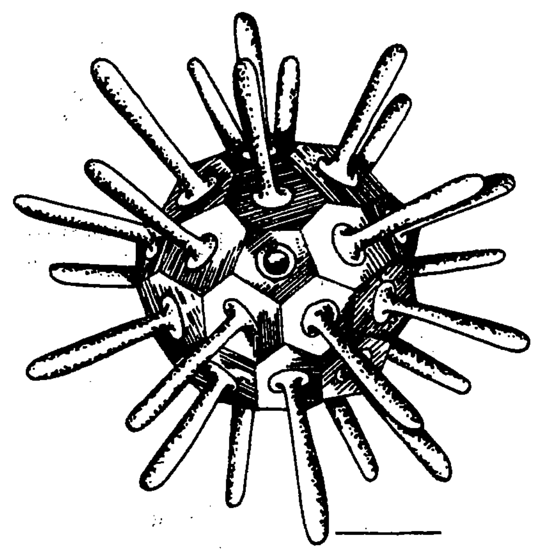
There is one other group of microscopic phytoplankton we will mention, called the coccolithophores (kock-o-lith-o-fors). Some have two flagella, but both trail behind in the water like the dinoflagellates longitudinal flagellum. They are covered with armored plates called coccoliths (kock-o-liths).

On the drawing, put a D beside the dinoflagellates and a C beside the coccolithophores.









ZOOPLANKTON
the ocean's wandering animals

Have you ever thought about what it would be like if animals were not confined to the earth's surface? Farmers would have to put their cows in cages instead of fences. You'd have to chase your dog all over the sky instead of the yard.

But that's the way it is in the ocean. Fish swim all over the place, and go wherever they want to.

There is another group of animals that moves around in the water. These animals are called **zooplankton** (zo-plank-ton). They don't swim around like fish, but they are carried by the currents and tides. Their name comes from two words—"zoo," which means "animal," and "plankton," which means to "wander or drift." All the plants and animals that float on the currents in this way are collectively called "plankton."

Since there are many, many different kinds of zooplankton, we will discuss only the kinds that are more common.

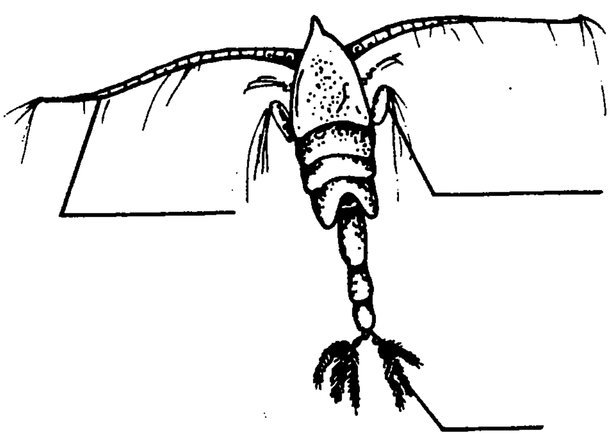
The zooplankton can be divided into two major groups: those animals that spend their whole life as plankton (**holoplankton**), and those that spend only part of their lives as plankton (**meroplankton**).

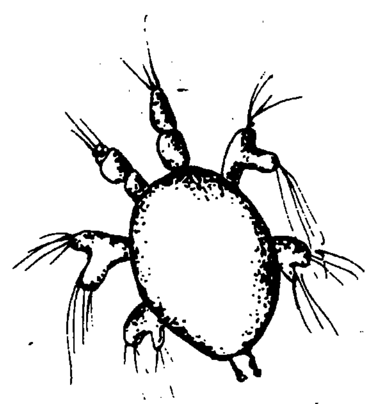
The Holoplankton

The most important members of the holoplankton are the **copepods**. These are little animals that look like shrimp, but may be smaller than the head of a pin. Copepods are one of the most common kinds of the zooplankton. Since many fish depend on the zooplankton for their food, the copepods are an important source of food.

A copepod has two long **antennae** which it uses to position itself in the water. It also has six pairs of **legs**, and a **tail**. The tail is divided into two lobes, each of which has five feathery bristles on it. On the adult copepod, below, locate and label an antenna, a leg, and the two tail-lobes.

When copepod eggs hatch, the young copepod is called **nauplius**. The nauplius does not look very much like the full-grown copepod. Both a nauplius and an adult copepod are shown below.

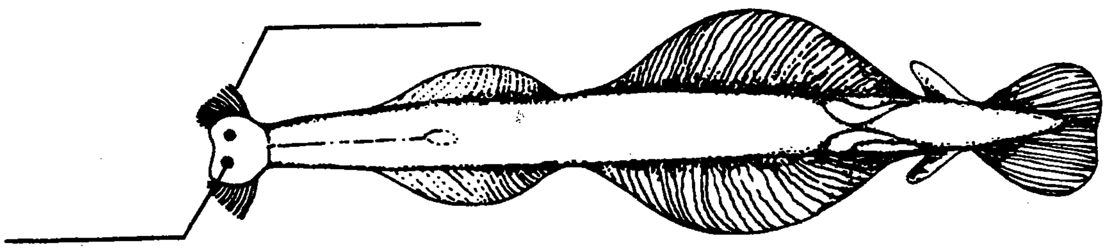




A member of the zooplankton that is only a little less common than the copepods is the arrow-worms. Arrow-worms are transparent, with three general body areas: the **head**, a long-middle section, or **trunk**, and a short **tail-piece** with **fins**. Only the two small black eyes are easy to see.

Arrow-worms eat copepods and anything else they can find that is a little smaller than they are, including baby fish. They catch their prey with the **grasping spines** on their heads.

On the drawing of the arrow-worm below, locate and label the eyes and the grasping spines.

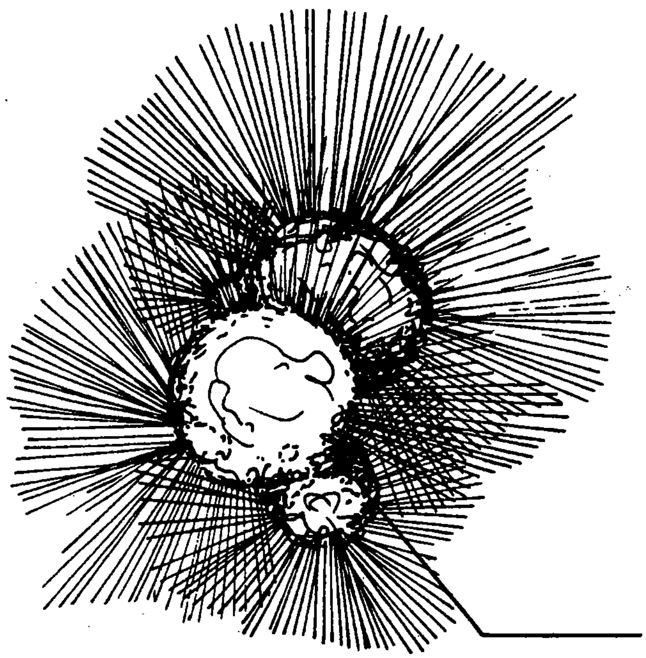


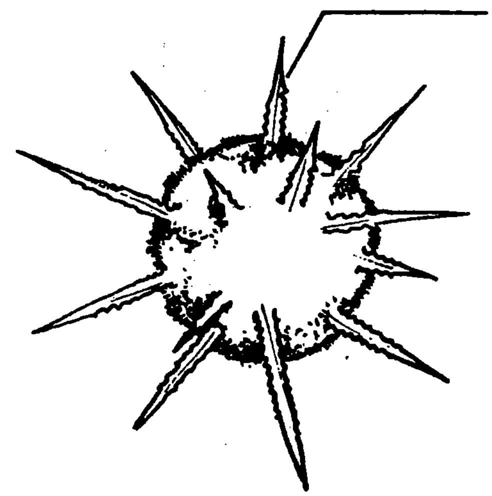
There are also one-celled zooplankton. The most familiar of these are the Radiolaria and the Foraminifera. These microscopic creatures have tiny hard capsules that protect them much like seashells protect the animals that live in them.

Radiolarians have many spines or spikes, and their capsules have only one chamber.

Foraminiferans have one to many chambers. Sometimes they have spines, but these are usually broken off when the animal is collected.

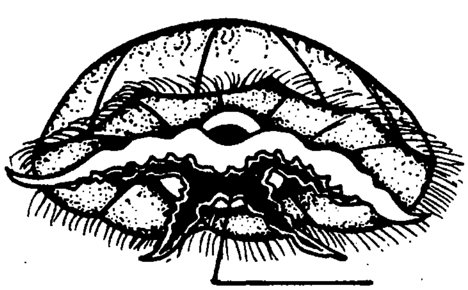
Label the drawings, below, of a Radiolarian, (R), and a Foraminiferan, (F).

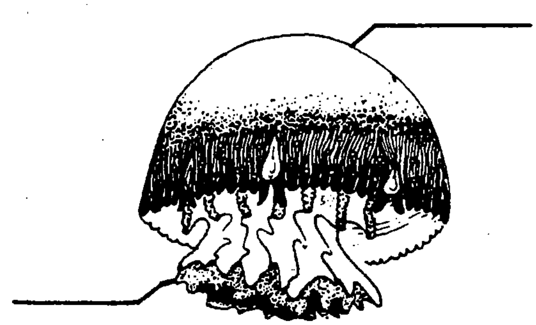




Maybe the most well-known holoplankter is the jellyfish. Jellyfish are often seen floating in the water or stranded on the beach. A jellyfish has a mouth on its underside. The mouth is surrounded by a ring of stinging tentacles with which the jellyfish captures prey. The dome-shaped part of its body is called the umbrella.

Below are drawings of two jellyfish you might commonly see in Florida waters. Locate and label a mouth, tentacles, and an umbrella.

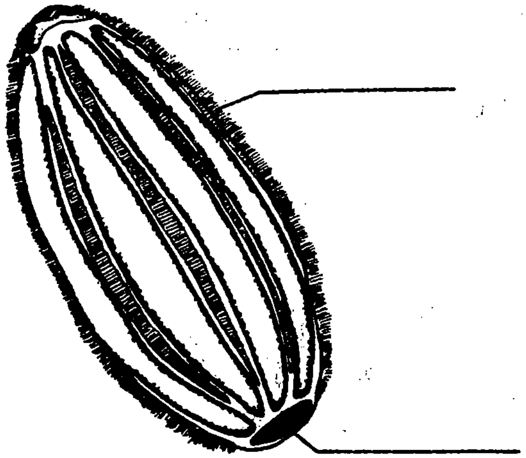


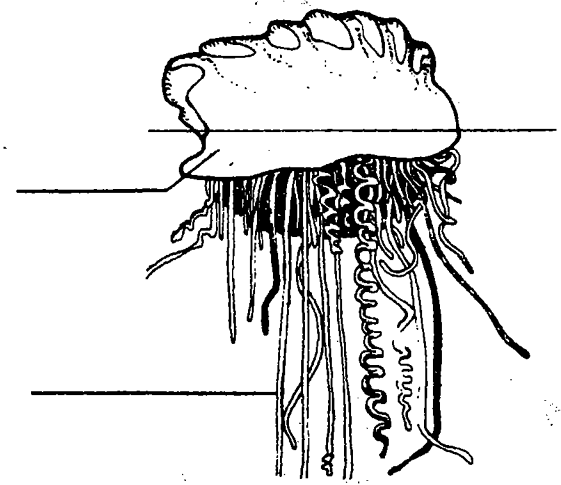


Two more members of the holoplankton we will look at are two creatures that look much alike, and are related to, jellyfish. One is the comb-jelly or sea-gooseberry. This is not a true jellyfish, but it is clear and jelly-like, much like many jellyfish. Comb-jellies have a mouth at one end. They move about by beating the water with the rows of combs on their bodies.

In the waters around Florida, you might see what looks like a light blue Baggie floating on the surface of the water. This is the float of the Portuguese Man-of-War. Below the float hang tentacles that may be up to 30 feet long, much longer than those of most true jellyfish. These tentacles can sting you very badly, so if you see this creature, stay away from it!

On the drawing of the comb-jelly below, locate and label the mouth and the combs. On the drawing of the Portuguese Man-of-War below, locate and label the float and the tentacles.





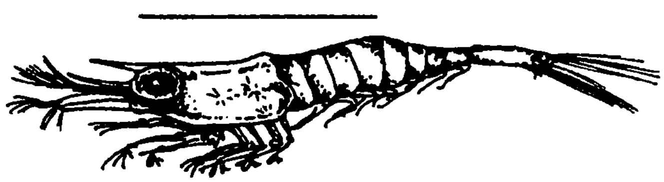
The Meroplankton

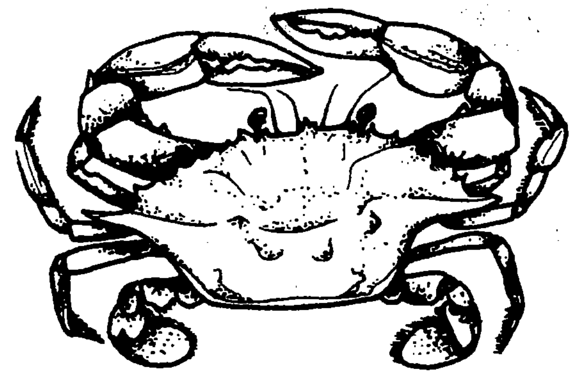
The meroplankton spend only part of their lives as plankton. For the rest of their lives they either crawl about on the sea floor, or are attached to something under the water.

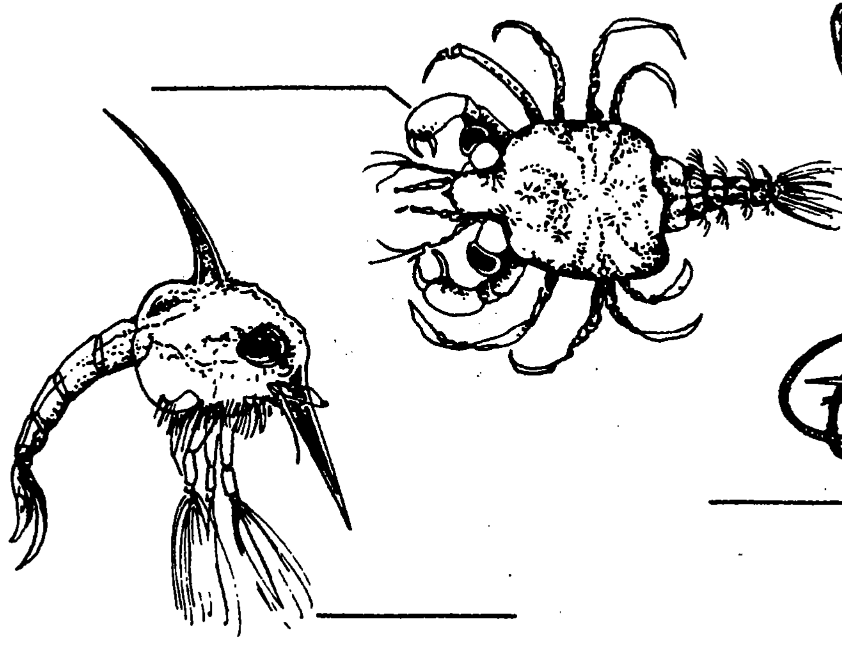
Crabs are planktonic for a short time after they hatch from eggs. At first, a crab larva is called a zoea. Before it can become an adult crab, it must develop into another larval stage called a megalops, which is also planktonic, and resembles an adult crab. The megalops will then develop into an adult.

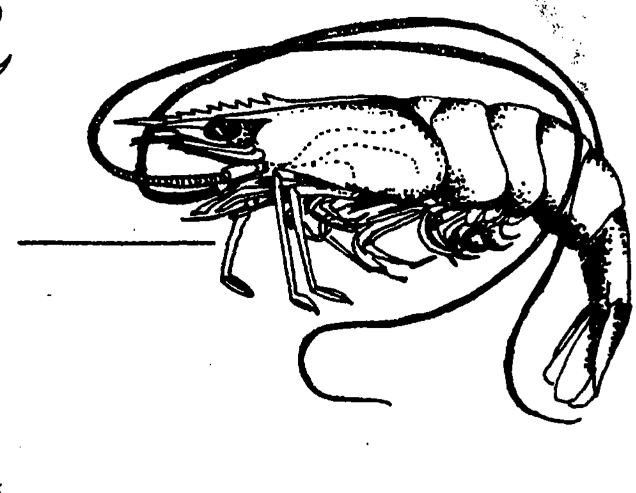
Shrimp are also planktonic when they first hatch from eggs. A shrimp larva is called a mysis, and looks very much like an adult shrimp.

Below are drawings of an adult crab with its zoea and megalops, and an adult shrimp with its mysis. See if you can label each one correctly.









SPONGES – apartment houses and water pumps of the sea

Why Study Sponges?

Sponges serve two important purposes in the sea. They offer a large number of hiding and living places for smaller animals. They also pump sea water in and out as a means of removing food and oxygen for themselves. In doing this, sponges filter and help cleanse the water. In our study you will examine the body structure of a sponge to understand how those two purposes come about.

What is a Sponge?

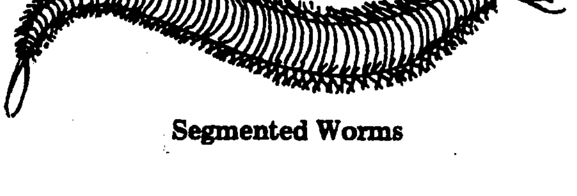
A sponge doesn't look like an animal. It won't squeak if you pinch it. Sponges never bite. They never run from you and can't see or hear you. It has no organs, arms, or spines. Yet, it is an animal.

About Sponges

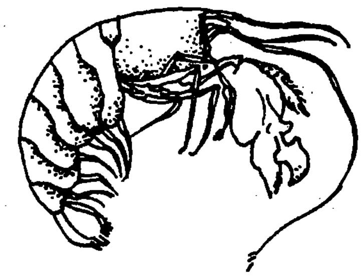
Sponges have been on earth for at least 500 million years. They probably evolved from one-celled animals that lived in colonies. The cells became dependent on each other and lived together for mutual benefit. This close association of cells resulted in what we call a sponge.

A sponge is the most primitive animal on our planet. There are about 10,000 different kinds. They live only in water—there are no land sponges. They exist in tropical seas and polar oceans. The vast majority live in salt water. Some live in deep water up to 3.5 miles but most prefer shallow water. None move about. They are always found attached to rocks, timber, sand, coral, floating debris, shells, boats, piers, buoys, etc. Some require a microscope in order to see them; others reach 6 feet in diameter.

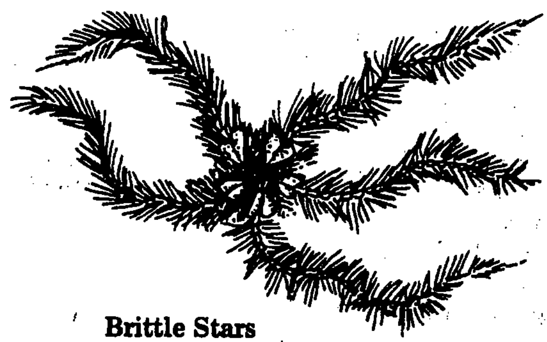
The single most important characteristic of a sponge is that it is a system of holes, pores, chambers, and compartments. A sponge therefore is made up mostly of enclosed spaces. It uses this system of spaces to pump a current of water and filter out its food. Other animals also use the spaces as places to live in. Sponges can contain thousands of different kinds of residents. Without the sponges they would have no place to live. Thus sponges permit large numbers of individuals to live in a small area.



Segmented Worms



Snapping Shrimp



Brittle Stars

Sponge Study

Method I

Materials Needed:

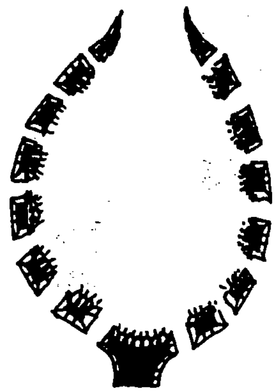
Brown paper bag from grocery store

Natural or artificial commercial sponge from hardware store

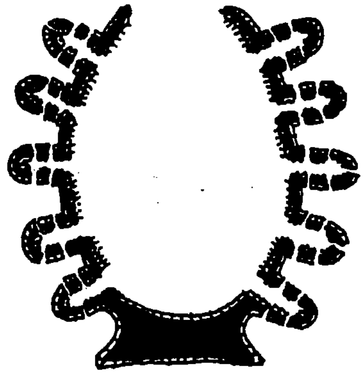
Bread knife or scissors

Punch small holes in the paper bag with the scissor tips. Blow up the bag as you would do a ballon, holding it at the opening where it has been folded and gathered together. You simply want the bag to open up and round out. Now, permitting the air to escape, squeeze the bag's sides together. Continue to fold, squeeze and wrinkle in all directions until the bag is a ball of paper. You now have a copy of a sponge body. Take a minute and study the bag. Gradually flatten and straighten the bag, remembering that it is just like a sponge.

Now study the three basic canal systems of sponges which scientists call ascon, sycon and leucon:



Ascon
bag with no folds, only the punched holes



Sycon
bag with slight folding

Leucon
bag completely folded and squeezed into a ball

The above drawings are the side views of the three body types of sponges after they are cut in half from top to bottom.

To verify the structure, cut your commercial sponge into pieces. Note the spaces and compartments. This is what holds the water and makes the sponge good for washing things. What kind of canal system does the commercial sponge have?

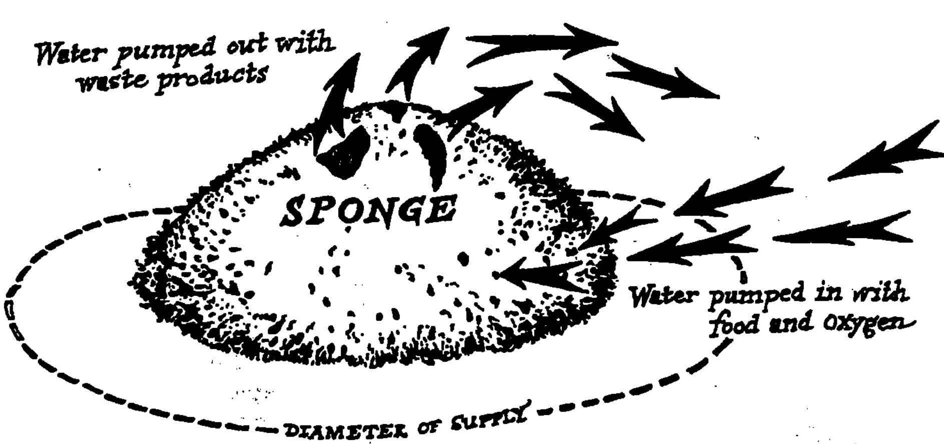
Method II

With an artificial or natural sponge you can get an idea of how much "space" there really is by conducting the following experiment:

(1) throughly dry a sponge
(2) weigh the dry sponge
(3) soak the sponge completely in a pan of water
(4) weigh the wet sponge
(5) calculate the per cent weight gain over dry weight
   a. wet wt. - dry wt. = water wt. gain
   b. water wt. gain/dry wt. x 100 = per cent wt. gain from water in spaces
   c. this tells us how much the weight of the dry sponge increased due to water
(6) calculate the per cent of water in total wet sponge weight
   a. follow steps 1 through 4 above
   b. total wt. = water wt. + dry wt.
   c. water wt./total wt. x 100 = per cent water of total wt.
   d. this tells us how much of the total weight of a wet sponge is water
   e. for example, if your figure is 50% and your soaked sponge weighed 2 pounds, then .50 x 2 = 1 or 1 pound of water

Water Pumps Pump Water

Besides providing a place for other small animals to live, sponges must live too. They need to have oxygen and require food. They must also remove their waste products. They do this by maintaining a constant flow of water through their bodies. Usually the water is pumped in the side canals and out the top at the site of larger holes. The imaginary ring around a sponge which provides the water and food is known as the "diameter of supply."



Take a Guess

Using what you now know about sponges, try to answer the following, giving your reasons.

1. What does a sponge eat?
2. How does it breathe?
3. What are 2 or 3 of the main characteristics of sponges?
4. If sponges don't locomote how can they be found in every ocean?
5. How does a sponge reproduce?