
CHAPTER 1

THE AQUARIUM

You cannot study living plants and animals unless you watch them closely. Most of us, unfortunately, have no time to study living things in their natural surroundings. We may frequently go out on nature study excursions, but to study animals and plants properly, we must watch them day by day. As we cannot go out every day to make our observations, we must bring the living things into the classroom, where we can watch them.

Pond life is a very fascinating study in school, as the animals and plants can be kept under natural conditions. If we are to study the animals and plants that live in a pond, we must first of all set up an **AQUARIUM** in which we shall keep them, and then we can go on a fishing expedition to catch as many animals as we can find.

Setting up an aquarium

You may already have a large aquarium in your classroom, but if this is not so, you may use old glass accumulator tanks or two-pound jam jars. Before setting up the aquarium, visit a pond, and collect various kinds of pond weed. Collect some small stones and shingle, wash them thoroughly, and place them on the bottom of your aquarium. Small stones give hiding places for small animals, and also allow the decaying animal and plant matter to fall between them. This

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decaying matter is easily washed away from the stones when you are cleaning out the aquarium. Sand, on the other hand, holds all the decaying matter, and gives off a very unpleasant smell when the aquarium is cleaned out. Place one or two large stones on top of the smaller ones, and then fill up your aquarium with water. Tap water may be used, provided that

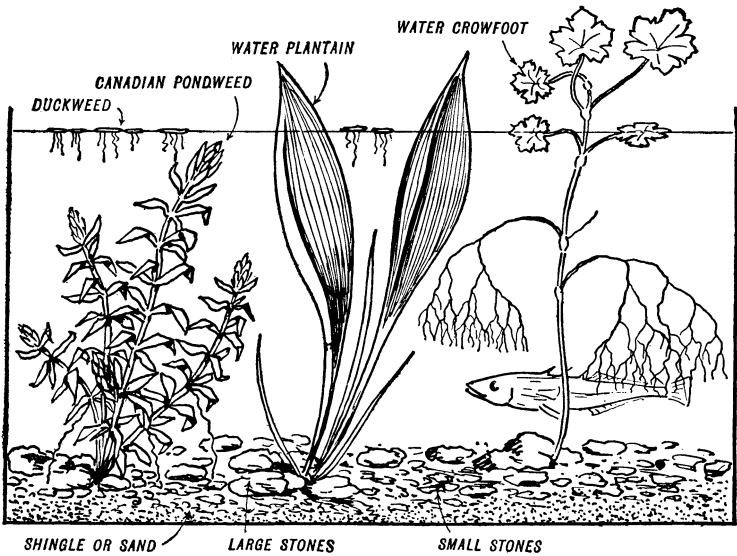


Fig. 1. *An aquarium*

it does not contain too much chlorine. For certain animals (see Chapter 2), you must put some pond water into your aquarium.

During the daytime the green parts of plants give out oxygen, which dissolves in the water, and is breathed in by many animals that live in the water. In return, the animals breathe out carbon dioxide, which the plants use up when making their food (see Book II). We say that the plants

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AERATE the aquarium. It is obvious therefore that we should put some water weeds into our aquarium. Most of the submerged water plants have only a few or no roots. Place these weeds in your aquarium, with one end of the weed held down by one of the large stones. Plants with underground stems and roots must be planted in a layer of shingle (Fig. 1).

If animals which you have caught in running water, or large animals, are kept in an aquarium, you may have to aerate the water artificially, or keep a constant supply of running water into and out of the aquarium. The only satisfactory method of artificially aerating an aquarium is to use an electric aerator.

Keeping an aquarium clean

If a proper balance between the animals and plants is reached, it should not be necessary to clean out an aquarium too frequently. You may keep an aquarium going for several years, if you look after it carefully. You must frequently wipe the inside of the glass with a clean piece of rag or scrape it with a razor blade, to get rid of the green film which grows there. Do not expect the snails to do this for you. Snails may eat a little of this green stuff, or **ALGA**, as it is called, but they prefer eating the leaves of the pond weeds. The water which has evaporated must be replaced by siphoning (see Appendix B) water carefully into the tank without stirring up the decaying matter from the bottom. If, in your aquarium, you keep animals such as pond snails and caddis-fly larvae which eat weeds, you must add fresh water-weed to replace that which has been eaten.

Some common pond weeds

When you visit a pond, stream or canal to collect your water plants, you will notice that some plants grow completely under the water. They are **TOTALLY SUBMERGED**, whilst other plants grow partly in and partly out of the water. They are **PARTIALLY SUBMERGED**. In addition to these plants you may find some very small plants, called duckweed, floating on top of the water. Collect and keep as many different kinds of water plants as you can find. The following descriptions should help you to identify them.

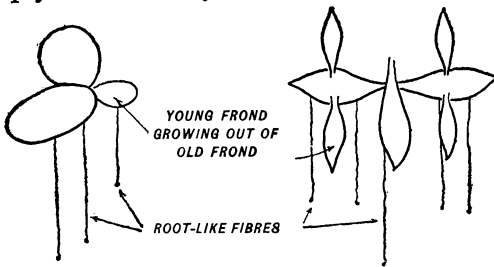


Fig. 2. Round-leaved duckweed and ivy-leaved duckweed

Floating plants

Duckweed. There are several kinds of duckweed, but all of them are floating plants without distinct stems or real leaves. The plant is made up of leaf-like fronds, which may be separate, or two or three may stick together by their edges. If you look closely at the fronds you will see a fine root-like fibre, about 1 inch long, growing from the frond, downwards into the water. New fronds grow out of the edges of the old fronds. In ivy-leaved duckweed (Fig. 2) two young fronds grow in opposite directions out of the old frond. Tiny flowers sometimes grow out of the fronds. A little duckweed floating on the top of your aquarium is useful, as it shades the surface, and gives a hiding place for small animals.

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Submerged plants

The flowers of totally submerged plants are usually very small, and are not often seen. These plants usually multiply rapidly, by means of branches, which break off from the parent plant, and continue to grow. If you look closely at some of these plants during the autumn, you will see buds, with leaves packed closely together, growing out of the stems. These WINTER BUDS (see Fig. 3), as they are called, break away from the parent plant, fall to the bottom of the pond, and remain there until the following spring, when they will grow into new plants.

Canadian or American pondweed. This plant is perhaps the most useful one to keep in an aquarium as it multiplies rapidly and freely gives out oxygen. The stems may be very long and branched, and out of them white thread-like roots may grow to anchor the plant in the mud or shingle. These roots which grow out of stems are called ADVENTITIOUS roots. The leaves are arranged in whorls of three (Fig. 3*a*). Place this plant in bunches with one end of the bunch under a large stone. In the autumn, winter buds are formed.

Water milfoil. Milfoil is a common plant in still water. Its finely divided leaves, which grow out of the stem in whorls of four, make it a favourite plant in an aquarium, because it looks well (Fig. 3*c*). It also grows quickly and readily gives off oxygen. You may be fortunate enough to see the spike of small, greenish flowers of the spiked milfoil, which grows a few inches out of the water. Place one end of a piece of this plant under a stone in your aquarium and it will soon grow roots. This plant has a root which creeps through the mud at the bottom of a pond. In the autumn, winter buds are formed.

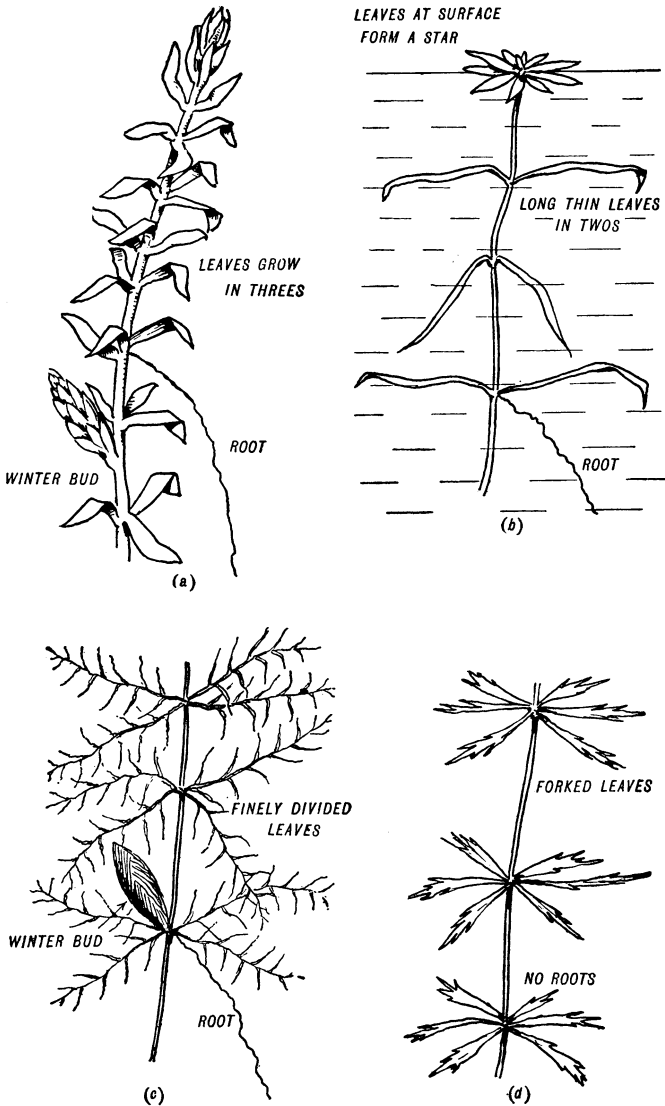


Fig. 3. (a) *Canadian pondweed*; (b) *water starwort*;
 (c) *water milfoil*; (d) *hornwort*

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Hornwort. If you glance quickly at hornwort, you may at first think that it is milfoil, but, if you look carefully at it, you will see that the bristle-like leaves grow out of the stem in whorls of six. Each leaf is divided three or four times into forks. This plant has no roots (Fig. 3*d*). During the summer you may see very tiny flowers in the AXILS of the stem (i.e. where the leaf joins the stem). In the autumn, winter buds are formed. You may anchor one end of a piece of this weed under a stone in your aquarium.

Water starwort. The leaves of starwort grow in pairs and are submerged. The top few leaves grow very close together, and form a green star on the surface of the water, hence its name starwort. Tiny green flowers may grow above the water in the summer. Hair-like adventitious roots grow out of the stem, and may enter the mud in a pond. If you float pieces of starwort in your aquarium, you will soon see roots growing out of the stem (Fig. 3*b*).

Partially submerged plants

These plants are rooted fast in the mud. The flowers are usually conspicuous and grow above the water.

Water crowfoot. The stem of water crowfoot either floats in the water or runs through the mud, sending out roots from the NODES, i.e. from where the leaves grow out of the stem. It has two kinds of leaves. The leaves which are submerged are very finely divided, and, like milfoil, look very attractive in an aquarium. This plant is often found in running water, and the water runs easily between these finely divided leaves without tearing them. Some leaves lie on the surface of the water and have three broad lobes (Fig. 1). The flowers look like buttercups with white petals, and they can be seen

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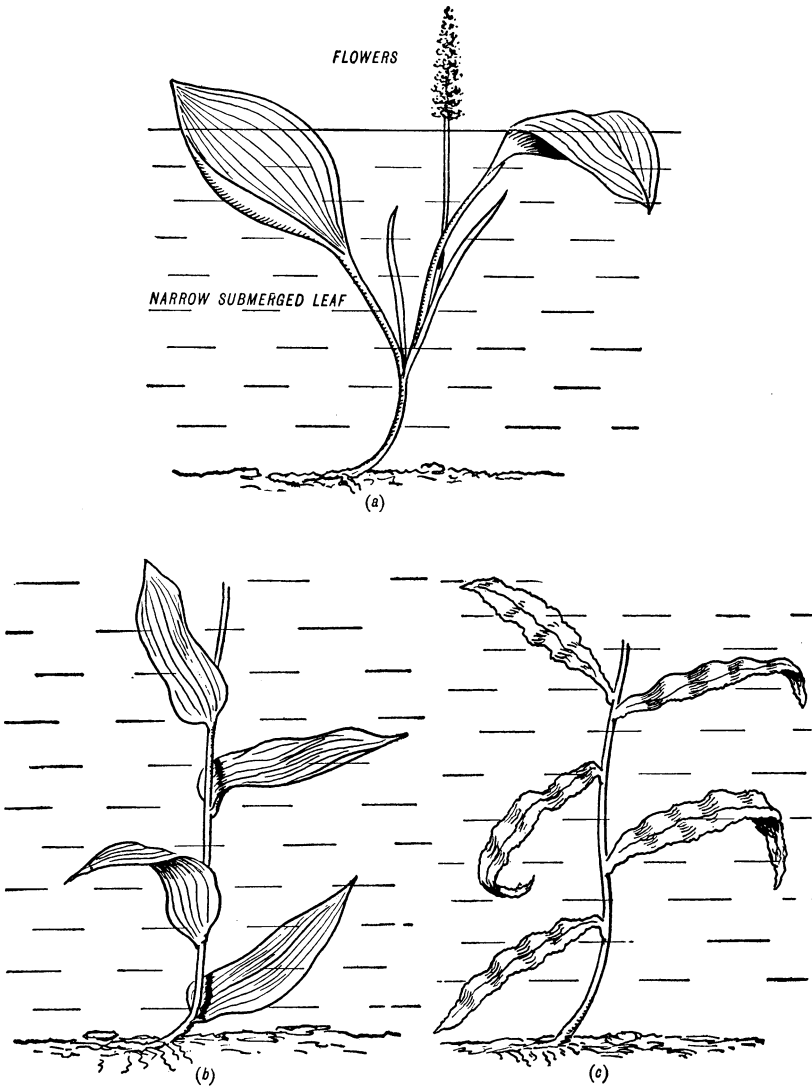
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Fig. 4. (a) *Broad pondweed* partially submerged; (b) *long pondweed* submerged; (c) *shining pondweed* submerged

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throughout the summer on the surface of the water. Place a piece of this plant in an aquarium with one end under a stone, and roots will soon grow.

Pondweed. A number of plants which have the name pondweed are very commonly found in fresh water. They all have roots which grow for many years in the mud, sending up branches into the water. The flowers grow close together on a stalk which grows out of the water. In the broad pondweed (Fig. 4a), most of the leaves float on top of the water. These leaves are wide and have long stalks. The submerged leaves are cylindrical and stalked, or they may be reduced to a mere leaf stalk. The shining pondweed (Fig. 4c) and the long pondweed (Fig. 4b) are totally submerged and have leaves which are long and wide but very thin, which grow, without stalks, alternately down the stem. The leaves of the shining pondweed are longer and thinner than those of the long pondweed and have wavy edges.

Water plantain. This plant has two different types of leaves. The leaves which grow above the water are rather similar to the floating leaves of the broad pondweed, while those which are submerged are long and narrow. The small pink flowers grow on a stem which may grow two or three feet high above the water (Fig. 1). The root of this plant must be set in shingle or sand in your aquarium.

There are many plants which are very common in fresh water which have not been mentioned in this book. Some of these plants, such as bur-weed, arrowhead, water parsnip and brooklime, will all grow in an aquarium.

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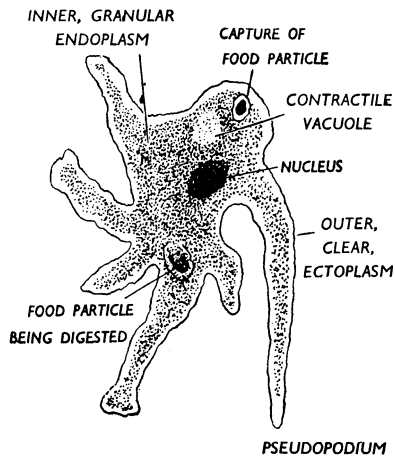
CHAPTER 2

SMALL ANIMALS FOUND IN
FRESH WATER

Your aquaria are now ready to house any animals that you may find in fresh water. If you have a pond or a canal near to your home or to your school, spend some of your leisure time fishing there. You will find many interesting creatures living in a pond. Put some water and water weed into your fishing can before you begin to fish, and do not put too many animals in one can. In this chapter you will learn that some animals eat other animals. Try to recognize these fierce creatures, and put them into separate jars, or else they will eat many of your specimens before you arrive at school.

The amoeba

The only way to find an amoeba is to bring a little mud back with you from a pond, and then examine it under a microscope using a well-slide so that it will not be smashed. If you are lucky you may find an amoeba. It is only one-fiftieth of an

Fig. 5. *Amoeba*