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SNAILS

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Snails are univalve, gasteropod mollusks; that is, they have but a single shell or valve. Locomotion is accomplished by means of a broad, flat process on the ventral surface called the foot; gasteropod, in other words, means belly-footed. They are provided with the usual anatomical parts--a distinct head furnished with a mouth, tongue and teeth; tentacles on which are located organs of touch, smell and sight; an alimentary canal, kidneys, liver, heart, and organs of respiration and of reproduction. In some species both sexes are present in the same individual, while in others the sexes are distinct. They occur in fresh water, on land, and in the sea from the cold regions in the North and South to the tropics, varying in habits, disposition, form and size; some of the sea snails, the conchs, reach 10 and 12 inches in diameter, while the giant band shell, found from North Carolina to Brazil, is said to attain a length of 24 inches. In cold weather, some species bury themselves in the mud, while others remain active, even in ice-covered water.

SNAILS IN AQUARIA

Shells are composed largely of limy matter, and the amount of lime necessary for shell building may be maintained in an aquarium by adding about 1/4 teaspoonful of calcium carbonate to the gallon, two or three times a month, or by keeping in the tank broken shells or marble chips. There is no danger of overstocking the water with calcium carbonate (which is obtainable at any drug store) as it is dissolved by the water only in proportion to the degree of acidity existing there. Deep, spiraled shells should not be used, as they frequently form traps in which small fishes and snails are caught.

Water with strong acid reaction will kill snails even though it is suitable for household purposes, and acids formed by the decomposition of animal and vegetable matter cause shell erosion, manifested by small white spots on the shells which gradually spread and deepen. The animal dies as soon as the shell is completely penetrated. To prevent this acidity, the water must be kept fresh and clean. Surplus food must be removed before it has time to decay. Snails sometimes produce

eating the fine green algae which sometimes cover them. They breathe by means of gills and do not come to the surface for air. The shells sometimes are covered with a growth of algae, which if undisturbed will reach a length of an inch or more. Roomy quarters should be provided and fresh clean water, with about two inches of sand or mud in which the females may bury when ready to bring forth young. At this time they may remain hidden for days.

After fertilization the females continue to produce young indefinitely without the presence of males, and 50 or more have been borne by a single female during one year. The eggs hatch in the oviduct, and as many as 80 young may be present there in all stages of development. They are deposited under the sand, a few at a time at irregular intervals, where they remain for some days, during which period the translucent gelatinous covering in which they are enveloped is absorbed.

Japanese snail (*Viviparus malleatus*).

This is said to be one of the most desirable aquarium snails, being long-lived, hardy and active when not buried in the sand, where it may remain with closed operculum for a week at a time. Though reputed to be a light eater, if fed with discrimination it will do its part in keeping the aquarium free from algae and surplus fish food. This snail is similar to the Potomac species in appearance but grows larger, reaching a diameter of two or more inches; the shell is darker and has a distinct keel or ridge around center of the body whorl, which is without bands. The fleshy part, or body is light tan, powdered with golden dots; in some specimens dirty gray. The male is said to carry the right tentacle curled when crawling, while the female carries both straight. In captivity they breed when about three years old, perhaps earlier under natural conditions.

The Japanese snail is native to China and Japan and in those countries is said to be an article of human food. It has been introduced into California where it is established in a little valley at the foot of Mount Hamilton.

Potomac snail (*Viviparus contectoides*).

This species is common to America and Europe. In the United States it is found in slow streams, still water and marshy places from Michigan and Arkansas to Florida. The shell is thick, well rounded and oblong, with four or five inflated whorls, olive green or brownish in color, with the large body whorl marked by three reddish brown bands, easily seen in young individuals, but disappearing in old examples as the shell becomes discolored or covered with algae. The fleshy part is bluish gray with light orange or yellow spots; the foot is oval and broad; operculum also oval. The shell grows to $1\frac{1}{2}$ inches in length. Except for the fact that it is short-lived, it is a good aquarium species. When a snail is found lying on the bottom with its foot relaxed and does not contract it when touched, it is dead or dying and should be removed.

THE RAMSHORNS: TRUMPET OR ORB SNAILS,
AND OTHERS OF THE FAMILY LIMNAEIDAE

Snails of the family Limnaeidae are without gills, breathing by means of lungs, and from time to time must come to the surface for air. They are hermaphroditic, both sexes being present in each individual. Any two individuals of a species are capable of reproduction, but self fertilization is said to occur. Their natural food consists of confervae, other aquatic plants, and such animal matter as may be lying within reach. They are preyed upon by fishes, frogs, birds and other aquatic animals. As they are air-breathers they do not exhaust the oxygen supply of the water and need not be considered in this respect when arranging a balanced aquarium.

Planorbis, or Ramshorns

The ramshorns, of the family Limnaeidae, are among the species known as trumpet or orb snails, the generic name, Planorbis, meaning flat orb. Species of Planorbis are found all over the world in stagnant and slow-running water and vary in diameter from the size of a pin head to $1\frac{1}{2}$ inches. The largest known American species is Planorbis magnificus, reported from the Cape Fear River near Wilmington, N. C. It reaches a diameter of $1\frac{1}{2}$ inches and a thickness of one inch; it is dark brown in color. The shells of the trumpet or orb snails are flat-spiral in form, with the fleshy parts ordinarily dark colored. They have red blood, which is not noticeable in dark individuals unless wounded, but in albinos or partial albinos, such as our red ramshorns in which the dark pigment is absent, the red blood shows through the body tissues and the transparent shell.

Planorbis corneus rubra, or the red ramshorn, was discovered about the year 1900 in a pond near Berlin, Germany. From there it was taken to Copenhagen and from Copenhagen to America, from this incident deriving the names "Copenhagen" and "Danish" snail, sometimes applied to it. The dark form (Planorbis corneus) is common both European and American fresh waters and readily interbreeds with the red; therefore, if one desires to maintain a good red stock, the dark form should not be placed in the tank with the reds. As it is, some breeders claim that it is difficult to keep their snails red on account of their occasional reversion to type, even though no crossing with the dark Planorbis has taken place.

The eggs of the red ramshorn are encased in flat, transparent, gelatinous capsules of a faint pinkish cast, about three-fourths of an inch in diameter, and containing from 10 to 20 eggs which usually hatch in two to four weeks, according to the temperature. For some little time before hatching the young snails are visible through the gelatinous covering. As many as 500 young have been produced by two or three individuals in one season. The capsules are deposited on the stems and broad leaves of plants and on the sides of the aquarium, where they adhere until hatched. Spawning occurs at intervals throughout the year, but is most pronounced in late winter or early spring. Egg deposition may be induced by cleaning the aquarium and replacing the stale water in part or entirely with fresh, cool water. After two or three such

changes, perhaps only one, the snails will begin depositing eggs on every flat, clean surface within reach. They seem to prefer the broad leaves of such plants as Ludwigia and Sagittaria.

Ramshorns, as well as other species, are very sensitive to foul water and if subjected to it will come to the surface and try to escape. When most of them are found at the surface, or partly out of the water, the water should be changed if a bad odor is perceptible. Sometimes they appear to dislike a change to fresh water, especially if there should be chlorine in it, when they may be found partially above the water line. There is no remedy for this, except to aerate the water by dipping and pouring it back and forth a few times, or allowing it to stand a few hours, in order that the chlorine gas, so often used in city water, may have time to evaporate before placing the snails in it.

While sand is necessary in the aquarium to complete the picture and for rooting the plants, in a tank in which snails are being bred in numbers cleaning is easier if no sand is placed on the bottom. Broad leaved plants, such as Ludwigia, Sagittaria or Vallisneria, may be planted in small flower pots in the tank, and removed whenever cleaning is necessary. Many young snails will cling to the plants, while those that do not may be removed with a fine meshed net. If one is careful, not many will be lost in the cleaning.

Both the red and dark varieties are excellent scavengers, and if not fed too abundantly will keep the plants free from confervae or algae which sometimes cover them. They are long lived when properly cared for. Their tentacles are long and tender and easily bitten off by Guppies and other fishes, which also devour the eggs and young. They thrive on finely powdered foods, and often relish lettuce and fresh meat. Lettuce, however, is apt to produce a bad odor, or sour the water as soon as it begins to get slimy; it should, therefore, be removed before it decays. Provided with sufficient food, clean, cool water, and calcium carbonate for shell-building, red snails grow rapidly and steadily and may reach a diameter of 3/8 to 1/2 inch in six or eight weeks. They usually find a ready market, bringing from 5 to 15 cents each, wholesale, according to size and demand, and retailing for about 25 cents.

Ear Snail (*Limnaea auricularis*)

Another member of the family is the ear, or so-called "African" snail (*Limnaea auricularis*), native to fresh waters in the region of the Mediterranean and to some other parts of Europe. The body of this snail is dark gray, with small black spots and larger white ones that show through the transparent shell, which is light horn in color. The body whorl is broad and much larger than the rest of the shell, with the aperture large and oar-shaped. The eggs are deposited on the stems and under the leaves of aquatic plants, in long, vermiform gelatinous capsules, with about 80 eggs in each capsule, and hatch, according to temperature in 16 to 20 days. The ear snail feeds on algae and such foods as are acceptable to the ramshorns. It is short lived, but prolific.

Australian Red Snail

In recent years a red snail known to the trade as "The Australian red" has been imported from Germany. This species is variously referred to in literature as Isidore proteus, Physa proteus, and Bulinus australianus. Although introduced from Germany, it is an Australian species and not known to be indigenous to any other region. It is a left-handed form and in the shape of the shell resembles more or less our little pond snail (Physa), often a pest in aquaria. According to Dr. Pilsbury, normal individuals have dark pigmentation which hides the red blood, but albinos, or unpigmented individuals, occur in which the red blood shows through the body tissues and the transparent shell.

The Australian snail, like the ear snail, is short lived but prolific. The eggs are deposited on plants in gelatinous masses. The feeding habits are similar to those of the ramshorns and ear snails.

Pond Snails (Physa)

The little pond snails are often unwelcome in an aquarium; they are, however, quite harmless and help to keep the plants clean. If not wanted, they may be destroyed by introducing a few goldfish two or three inches in length, or one or two adult paradise fishes.

THE APPLE OR FLASK SNAILS AMPULLARIIDAE

The snails of the family Ampullariidae are of tropical distribution, nocturnal, amphibious in habit, and have full, well-rounded shells. Several species of the genus Ampullaria are found in South America, and one member of the family (Pomus depressa), occurs in Florida. These snails are able to survive out of water for months and are suited to a terrarium. In their native habitats they burrow into the mud in times of drought.

Four-horned snail (Ampullaria gigas)

The four-horned snail, a native of Brazil, is our largest aquarium snail, reaching a diameter of four to six inches. The shell is olive in color, with many narrow green bands which probably disappear with age; the aperture is wide and deep with a flaring rim; the lip is yellowish and spotted; within the aperture the shell is marked with a number of blue bands.

Nothing can be said as to the time of spawning, or period of incubation; the eggs are coral red and deposited on plants in limy capsules. The Florida species (Pomus depressa) is said to lay 30 to 70 eggs on plants above the water; soft when first laid, but becoming coated with a limy crust after exposure to the air, and hatching in about 12 days; the young are about the size of a pea.

The food of Ampullaria gigas consists of vegetation — algae and other aquatic plants, as well as lettuce. It is said to destroy hydra which sometimes infest aquaria, but if used for this purpose it should be removed as soon as the hydra disappear, as the aquarium plants may then be eaten.

DANGEROUS SNAILS

In the literature consulted, only two species of fresh water snails were described as dangerous to fishes or other aquatic animals. They were the great pond snail (Limnaea stagnalis) found throughout the northern hemisphere and in the United States from Greenland to Alaska and south to Texas, and Limnaea paregna, common to Great Britain. These two species are reputed to attack and consume small fishes, tadpoles and newts, but both are fine scavengers and destroyers of confervae in aquaria.

LITERATURE THAT MAY BE CONSULTED

Further information regarding snails will be found in the following publications:

The Shell Book: A popular guide to a knowledge of the families of living mollusks, and an aid to the identification of shells native and foreign. By Julia Ellen Rogers. 485 pages, 8 color plates, and 96 black and white plates. Garden City, New York, Doubleday, Page and Company, 1914.

Goldfish Varieties and Tropical Aquarium Fishes. By Wm. T. Innes. Philadelphia, Innes & Son, 1931. (Snails, pp. 17-19).

Complete Aquarium Book. Wm. T. Innes (Over 200 illustrations, diagrams, and full color plates). Blue Ribbon Books, 1936.

Fishes in the Home. By Ida M. Mellen. New York, Dodd, Mead & Co., 1928. (Snails, both fresh and salt-water, pp. 15-19 and 162-167).

Goldfish Breeds and Other Aquarium Fishes. By Herman T. Wolf, Philadelphia, Innes & Sons, 1908. (Chapter X on Fresh-water Mulluscs, pp. 217-246).