

WATER LIFE

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The Hibernation of Frogs and Toads

By L. G. PAYNE

WITH the increasing interest taken in amphibian life by Nature lovers, this question of hibernation has become of some controversial importance, and it would appear evident, both from letters received, and from inquiries made, that dogmatic statements and exact conclusions on methods of hibernation are not necessarily confirmed by general experience.

A correspondent in WATER LIFE has recently asked if frogs hibernate in mud at the bottom of ponds. His experience inclines him to believe that hibernation is terrestrial rather than aquatic. We have to remember, however, that where a creature's habits are concerned there is often considerable individual variation, and observations based on a particular case are not necessarily universally applicable.

It is, of course, a little difficult to comment on the conclusions of a correspondent without knowing the whole of the relevant circumstances, but, with regard to the Edible Frogs which appeared round the pond margin during the process of cleaning out the pond, I would suggest that these had been hibernating in the pond, but had been disturbed by the cleaning, and had crawled out of possible harm's way on to the bank.

In my experience Edible Frogs invariably spend the winter deep in the mud of my garden pond, this mud being covered by 2-ft. of water. They are occasionally disturbed about February by the Common Frogs, which also quite definitely pass the cold months below water with the others. The mating time of the Common Frogs is in February and March, while that of the Edible Frogs is not until June. The Common Frogs are therefore in full vigour when the Edible Frog is still in a torpid condition.

Some years ago, during an exceptionally severe winter, I thawed out two Edible Frogs from solid ice, and found that they had suffered no harm from their experience.

With regard to Common Frogs, the safest statement one can make is that hibernation may equally well be under water or on land; if on land, suitable sites will be in old rabbit warrens, in holes under decayed trees, in the debris of old buildings, or, indeed, in any place which provides safe retreat from frost.

It is probable that in no species of hardy amphibian is hibernation complete over a defined period. The short spells of comparatively mild weather which occur during most winters usually induce a few individuals to make a temporary appearance, and, even as I write these notes, at 10 p.m. on January 8, with a ground temperature of 48°, the following species are active out of doors: Tree Frogs, Green Toads, Natterjacks and Midwife Toads. Of Newts there are Japanese, Crested, Alpine, and Marbled.

The inquiry printed in WATER LIFE further referred to a number of frogs being found dead in the pond after the ice had been broken, and another query before me records a similar catastrophe, and adds that in all cases the bodies appeared distended. This dis-

tribution, however, is not necessarily symptomatic of disease, and may be caused by infiltration of the water after death has occurred. I have no convincing theory to advance to account for the death of these frogs. Lack of oxygen content in the water over a long period of time might be contributory, but the size of the pond and numbers of frogs involved would be factors of considerable importance in assessing the probable cause of death. A friend informs me that, when skating, he has frequently seen frogs swimming under the ice.

In a state of Nature it is probable that the Edible Frog has the longest winter sleep, and is the least likely of the hardy species to be deceived by a temporary break in the weather. His hibernation is from October to April, and is generally in mud below deep water. The Agile Frog also hibernates below water.

The Common Toad, the Natterjack, and the Green Toad, so far as I am aware, never hibernate in mud or below water, but seek out refuges similar to those of the Common Frog, or make direct excavation into light soils in sandy districts.

Toads of the genus *Bombinator*, i.e., the Red-bellied and Yellow-bellied Toads, also the Midwife Toad, prefer to work their way down below heaps of stones or deep into rock fissures. The hibernation of the *Bombinator* species is generally long and unbroken.

The Tree Frog normally burrows several inches into soft moist earth, and always approximates to earth colour during hibernation. The Mud Frog, or Spade Foot, is another burrower; although in the wild state he is reported to dig himself in to a depth of several feet, he appears content, in confinement, with about 6-in. of soil.

It would therefore appear that, though the several species have their own special preferences, their requirements are sufficiently elastic to allow them to be found occasionally hibernating in environments of widely different character.

* * *

THIS WEEK'S PLANT

Umbrella Grass

Although there are many species of *Cyperus* not hardy in this country (and of these the Egyptian Papyrus is one) there are a few which can easily be grown outside. They may be planted any time between October and March along the edges of a pool, lake, or stream, where their roots will be in moist soil. The plants have rush-like leaves and stems, and the flowers are produced in umbrella-shaped heads.

C. longus is a native species, called the Sweet, or English Galingale. It grows two to four feet tall, with tufts of grass-like foliage and dark, chestnut-brown flowers. *C. vegetus* has broad leaves and mahogany-coloured flowers. It grows 2 feet high, and may be planted in two or three inches of water.—J. ST. CLAIR WRIGHT.

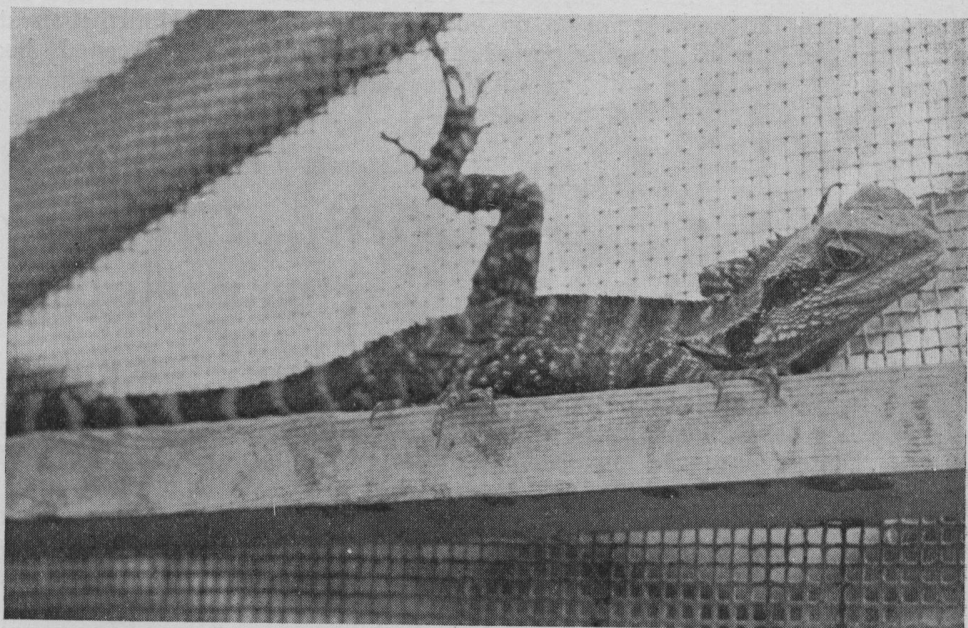
Lesueur's Water Lizard

By "AMPHIBIUS"

DURING the winter, while the temperate reptiles sleep, the thoughts of the reptile keeper turn to those animals from tropical and sub-tropical regions which are easy to keep in health in captivity. Several such have been mentioned in these columns from time to time: Zonures, many Skinks, Geckoes, etc., being among the lizards. We may quite confidently put the subject of this article in the category of easily managed lizards, subject to there being enough room to house it adequately.

Physignathus lesueuri is an Agama, a member of an Eastern Asiatic and Australasian genus. It comes from North Victoria, and is common in the rivers of the Gippsland Plains, which have, incidentally, been ravaged by bush fires recently. There is one species of *Physignathus* (*longirostris*, I believe) which occurs farther south than the *lesueuri* in Australia, but it does not seem to have been imported. It might prove to be a very desirable animal, since all the reptiles from the same habitat are quite robust in captivity over here. Lesueur's Lizard is nearly always available, but is more often called the Australian or Gippsland Water Dragon than it is by its proper name. It is a lovely lizard, fortunately just small enough to escape the attention of the leather merchants. To say that it averages from 18-in. to 24-in. in length makes it sound rather larger than it is actually found to be, since most of the length consists of tail. The body is short and plump, especially in the male, and the head is large, and carried on a distinct neck. The limbs are very long, and altogether the lizard looks very like a small Iguana. It is not brightly coloured, but, after sloughing, the bold silver and brown patterning makes the lizard very handsome indeed. The colours lose some of their sharpness a few days after each sloughing, and the greyish tones are then, doubtless, of considerable protective value. Males are distinguished by their much larger head, deeper dorsal crest, and crimson belly. The females have the belly grey or pinkish. Unfortunately, about nineteen out of every twenty examples here seem to be females, and the acquisition of a male is something of which to be proud.

From their activity rather than their size, these lizards are quite unsuited to close confinement, and if they cannot have a case at least three times their own length, or, preferably, be given the run of a small greenhouse, they should be left alone. They are always busy, and rapidly recognize their fosterer sufficiently well to run on to his feet to see if any food is forthcoming. If hand fed on mealworms, which they pick up on the tip of a sticky tongue, their initial



shyness is soon overcome, but it takes rather a long time before they will allow themselves to be freely handled.

They sleep either in deep water or else climb to the highest point they can find. Unlike the Iguana, which may be allowed out in the garden whenever it likes, Lesueur's Lizard must certainly *not* be allowed out, for he runs like the wind, and seems to skim over obstacles in a most phenomenal way. Like the Frilled Lizard, his near relation, the Water Dragon, when running his fastest, uses only his hind legs, like some diminutive Dinosaur. Catching up an escapee is a most exhausting process.

During the summer these lizards may be kept outdoors, but a wire netting cage is the only means of confining them. An enclosure would require walls so high that the whole thing would have to be extremely large if the sun is not to be cut off. During the night I take mine indoors again. I experimented, two years ago, with a pair, which I left permanently outdoors from May until September. I dug a hole in which I buried a box, half filled with leaves, and left a small passage for the beasts to run in and out. Over the box I put a glazed seed frame, 6-ft. long. The lizards soon found the box, and liked it so much that they hardly ever left it, and took practically no food, and not even a bath. The male would occasionally take a small mouse which was placed directly in the entrance to the box, and the female a few mealworms. In September they were extremely vigorous, but rather thin, and very dirty, and had forgotten all their nice manners; so I returned to my former practice of liberating them only in the daytime, after they had had a good feed indoors.

They are easily fed, since they will take raw meats and egg and banana just as readily as they will meal-

worms, earthworms, and young mice. No insects seem to come amiss. Green Lizards and any smaller should be kept out of their way, but Eyed Lizards and others of that size or larger are not molested. They may also be kept with Terrapins, small Alligators, and Crocodiles. I have on numerous occasions observed the males courting the females—an odd procedure, during which the male seems to bounce up and down all round the female, stopping periodically to suddenly nod his head. He is quite unchivalrous when not

under amatory influences, and will not hesitate to chase his wives in order to rob them of some choice bit of food he covets for himself.

I strongly recommend this lizard, but at the same time emphasize the fact that it must have a great deal of room to be seen at its best. One must take care that hot pipes are well screened, or these beasts will sit on them and burn their stomachs. Likewise all windows must be screened because they can climb near-vertical surfaces with an ease that is quite astonishing.

Diatoms and Man

By W. WADDINGTON

ALTHOUGH this class of simple, unicellular, microscopic plants is little studied, except by specialists, they are, biologically, of great importance to man.

Diatoms are the lowest class of water plants, and every one of the numerous genera, and perhaps 12,000 species, is of one primary form. They consist of two parts or valves, one of which fits just inside the other, and together form what is known as a frustule. Around the central part or the edges of these two valves there is a band which unites them, but all three parts are free and play freely.

They possess all the attributes of ordinary plants: cell wall, protoplasm, nucleus, chromatophores, and chlorophyll, the latter being masked by a brown colouring matter called diatomia. They live by taking in carbon dioxide in solution from the water and exhaling oxygen. The product of assimilation is oil, which can be seen in the cell cavity in the form of oil vesicles. They take in also a large quantity of silicic acid in solution from the water, and the depositing of the silica in the walls of the valves makes them very strong, and, in fact, almost indestructible. They will, for instance, stand being boiled repeatedly in nitric acid. The valves are most beautifully marked with what are termed *costæ*, *striae*, and punctures. These markings are extremely small and on some of the valves there are 100,000 to the square inch. It is this fact which makes diatoms of such value to the opticians, for they make the very best test-objects for the lenses of microscopes.

Although diatoms are generally invisible to the naked eye, some of them can just be seen as specks in the water. Their size varies from about a twenty-fifth of an inch to a thousandth of an inch, and it has been estimated that it would need 250,000 of these in sea plankton to measure three inches if set in a line.

Distributed generally over the world, in both fresh and salt water, they are particularly abundant in the plankton at the surface of the sea; while diatomaceous earth, the remains of countless millions of dead diatoms, forms large parts of the earth's crust, especially in California, Nevada, New South Wales, the base of the Andes and elsewhere; while, to come nearer home, the mud forming the floor of the River Thames consists, to a large percentage, of the valves of these tiny creatures.

Diatoms are divided into two main groups, *Centricæ*, or those of an approximately round shape, and *Pennatæ*, or those with one axis longer than the other, and often boat-shaped. The former are seldom motile, and float

and drift about; while the latter are generally able to move about in a slow manner by jerks and side movements. Until about twenty years ago it was disputed as to what caused these movements, but now it is known to be due to vibratory cilia, or fine hair-like processes, which are developed from the openings in the valves and cause the organism to move. They multiply generally by simple division, often every six hours, and one frustule will thus produce a very large number very soon. There are, in addition, other methods of reproduction, such as by spores and by conjugation.

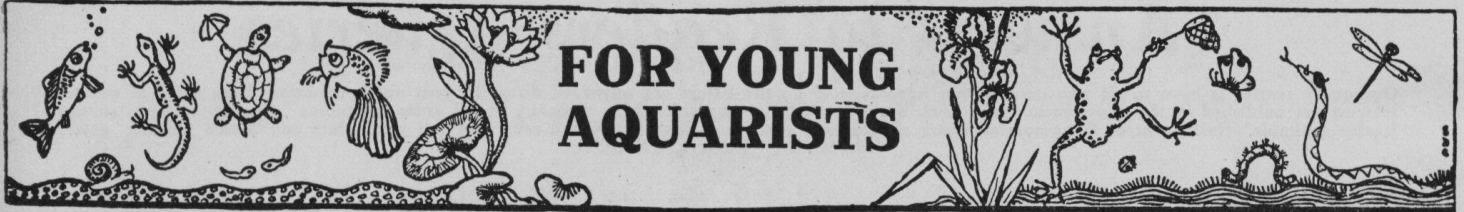
Diatoms exist in such enormous numbers in the sea in Arctic and Antarctic regions that the water is coloured for many miles in area, and since there is very little other aquatic vegetable life there, it can readily be seen what an important part they must play in providing food for the fish and indirectly for the larger creatures, including man himself. Perhaps the most striking example of their immense numbers is the fact that some of the whales, huge creatures though they are, live almost, if not entirely, on diatoms, straining them out of the water by means of baleen sieves.

Turning to their commercial use to man, diatoms are largely employed in the manufacture of explosives, and their small cavities serve to retain and insulate nitroglycerine to preserve it from shock and premature explosion.

Polishing powders usually contain a large percentage of diatoms, and among these are included one or two well-known toothpastes and powders, while the manufacture of porcelain and the making of firebricks for furnaces are other commercial processes in which their valves are used. Diatomaceous earth has thus become of great commercial importance, and in Lancashire the silted portion of one river mouth is being removed for use commercially.

Those pond hunters who study diatoms will know that they have a very strange way of appearing in seasons, when their numbers are enormous, and then just as suddenly disappearing.

Those who wish to obtain some living diatoms for themselves should take a wide-necked bottle, such as a jam-jar, and with it scoop up a thin layer of the sand or mud from the bottom of a pond. If some of this debris is then examined by pipetting small quantities on to a microscope slide and slipping a cover glass on it, using the $\frac{1}{4}$ -in. or $\frac{1}{6}$ -in. objective of the microscope, it is almost certain that some specimens will be seen.



A SMALL OUTDOOR VIVARIUM

By GRAHAM COOPER

I PROPOSE to describe the construction of a small outdoor vivarium of simple design, which you will be able to do without any special tools, and which can be made without any previous experience.

When I made mine I paid a visit to a local ironmonger and purchased a piece of perforated zinc, size 16-ft. long and 1-ft. 6-in. wide, at a cost of about 5/-. This was

then cut into four pieces, two size 6-ft. by 1-ft. 6-in., and two size 2-ft. by 1-ft. 6-in.; these were to form the sides of the enclosure.

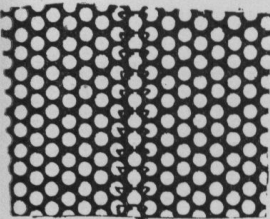
On each of these pieces a ledge size 6-in. was folded on the short side (i.e., the original width of 1-ft. 6-in. was reduced to 1-ft.), and a small

piece of the ledge was cut out at 45 degrees on both ends. The pieces were then stood up to form four walls with a ledge running round the top.

Then came the only part of the job which required any patience. The four sides had to be fastened together, and for this purpose some thin wire was bought, and threaded in and out of the holes where the pieces met, thus forming a box-like arrangement 6-ft. by 2-ft. (plus ledge).

My idea now was to embed and firmly cement it in the ground. For this purpose I scooped out a trench the exact size of the vivarium (i.e., 6-ft. by 2-ft.), and about 3-in. deep, with a trowel. I lined this with stones, rammed into the soil so as to give the cement a good foundation. I then filled the trench in with liquid cement, and while still wet, stood the vivarium in it. The cement I used was in the proportion of two parts sand to one cement, and when I made it, I was careful to see that the mixture was thoroughly blended before adding any water.

In two days' time the cement had hardened without a single crack, and the vivarium was held in a firm grip, rendering the escape of the inmates almost an impossibility.



Lacing the Corners

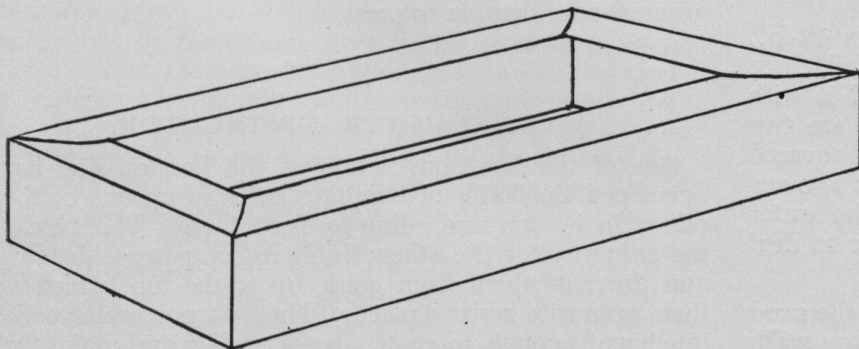


Diagram showing shape of Vivarium

FOR YOUNG AQUARISTS

The next thing I had to do was to provide a pond, and in this respect I was fortunate in possessing a white-enamelled bath, 2-ft. x 1-ft. x 9-in. deep, and this I planted thickly with about two dozen shoots of *Elodea crista*, after sinking it to the level of the ground. A cement pond would, of course, have served equally well.

Inside the vivarium were planted a group of ferns, a couple of clumps of Stonecrop, and some Saxifrage. I also arranged some rocks to serve as a shelter, and scooped away some of the earth in one corner and substituted sand to a depth of about 3-in., forming a sand pit.

The finished vivarium has a most professional appearance, and will, I think, serve as comfortable quarters for almost any reptiles or amphibians.

PUGNACIOUS PANCHAX

By B. MEAD

A short while ago I introduced into a good-sized community tank a male *Panchax lineatus*, about 1 1/4-in. long. Now it is 2 1/4-in. long, and gorging itself on bloodworms and *Daphnia*. A week ago I noticed it chasing my Zebras and small livebearers. Going to my tank one morning, I found a good number of male and female Guppies missing. Thinking they had died, I searched all over the tank for them, and it was not until I saw *Panchax* hiding in a corner without an appetite, and a somewhat swollen stomach, that I realized the Guppies had gone to a better land. I hurriedly sought some means of getting rid of this fish, as it had already mauled the Zebras; I managed to exchange it. There is a moral to this somewhere!

MORMYRIDS IN NEW YORK

The three fish who are the latest arrivals at the New York Aquarium will probably give the other boarders there an inferiority complex, for they are haughty Mormyrids, said to be the brainiest fish in the world.

In proportion to their size (they are from two to three inches long), their brains weigh about a sixtieth of their whole body. These interesting specimens are a dull silver-grey colour, their most noticeable feature being their high foreheads. Their home is in the Nile, and pictures of them may be seen in ancient hieroglyphics. Superstitious Egyptians refuse to harm these fish, believing that the souls of the departed take refuge in them.—*The Children's Newspaper*.

* * *

Of each hundred pet keepers, forty have dogs, thirty-seven cats, eighteen birds of some kind, and four fish. The hundredth pet keeper either has a hedgehog, guinea pigs, a tortoise, rabbits, or the like.—*Home Gardening*.

warm weather, however, they must be given frequent waterings; indeed, this question of watering is an important one for tub plants, and during hot, dry weather give them plenty.

Of course, the plants already described are not the only ones fitted for tub culture, and doubtless others will have suggested themselves to the reader. For example, I saw two very good ideas in a friend's water-garden last year. In a rather low tub he had sown some seeds of the new double *Nasturtium*, Golden Gleam, and when I saw them, the light green foliage had draped itself round the outside of the tub, and was literally smothered with masses of sweetly scented golden-yellow blossoms. Another tub had been planted with one or two of the smaller flowered Fig Marigolds (*Mesembryanthemum*), and, like the *Nasturtiums*, these were also draped over the side of the tub, their fleshy stems spangled with hundreds of lovely magenta-coloured flowers. The rather dry and stony quality of the soil suited these particular types of plant admirably, and seemed to encourage the production of blooms.

The type of receptacle used is a matter of personal choice. If you are handy with tools, it is a simple matter to knock together a nicely shaped box, or a couple of inexpensive tubs may be had by cutting a butter- or wine-cask in halves. The inside of the cask must be cleansed by burning some newspaper, or, if this does not prove sufficient, a blowlamp can be used. An additional iron hoop should be placed around each tub for added strength, and then they can be either stained with creosote or painted. After boring half-inch holes in the bottom for drainage, the job can be completed by fixing a couple of strong iron handles on each tub so that they may be easily moved when filled with soil. When in use the tubs should be raised slightly off the ground by means of bricks or tiles.

With regard to position, it should be remembered that if the tubs are placed close to the edge of the pool, a good reflection of the plant will be obtained in the water below. On the other hand, if the receptacles are large, and the pond of only moderate size, it is best to place them some little distance back.

The Reptiliary in February

By L. G. PAYNE

IN the open-air reptiliary lengthening days and an occasional burst of warm sunshine may induce the reappearance of your Wall and Green Lizards.

These do not seem to be attracted by the desire for food so much as by a definite urge to bask in the direct rays of the sun. The Wall Lizards will retreat to their holes after a period of sunbathing, but it is very necessary to make sure that the Green Lizards return to safety, even to the point of replacing them by hand.

Common Frogs will normally be active, and spawn may appear by the end of the month. Whether you retain this or not must depend on your intended summer programme. This is of some importance. Tadpoles of the Common Frog make an excellent food for all species of newt, if these form part of the fancier's collection, but on the other hand the tadpoles can hardly be allowed in the pool of a mixed reptiliary where subsequent spawnings of more valuable amphibians are expected.

If Edible Frogs share a pool with Common Frogs the former are liable to be disturbed this month by the Common Frogs, which may cluster round individual Edible Frogs in considerable numbers in mating frenzy. Such unfortunates must be forcibly released if they are not to be mauled to death.

At this time of the year it is desirable to remove surface water from pools designed for amphibians, and replace with fresh water. This is especially necessary in the vicinity of large towns where films of soot and oily deposits are very liable to occur.

The planting of the reptiliary should be attended to. Dead stems of catmint and other perennial plants should be cut right back. If fresh plantings are to be made, take great care in making a hole for the roots, or you may destroy a hibernating occupant. Arabis, aubrietia, and thyme are all useful plants, providing as they do low cover for the inmates, and a profusion of flower colour.

In the Terrapin pool there will be little to do in February, for all hardy species should be in complete hibernation. Occasionally, however, an individual may be tempted out by warmer weather as in the case of the Lizards. It is then necessary to ensure that it has returned below water by nightfall.

In the Newt vivarium many species will be active, and must not be allowed to go short of food. Small earthworms are easily obtainable for this purpose, and bloodworms are an excellent alternative.

Salamanders may be active on warm, damp evenings, and will look for food in the shape of gentles and worms.

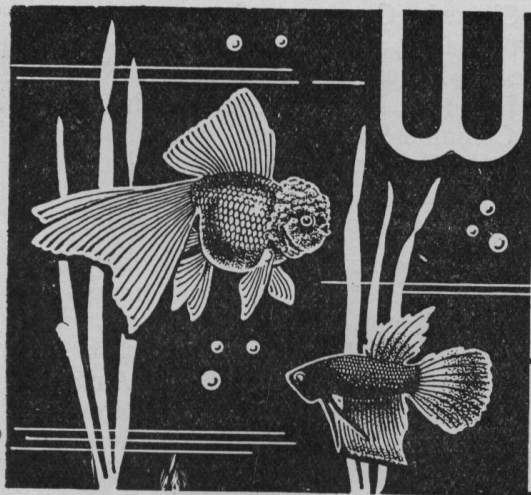
In similar conditions Tree Frogs may be making lethargic movements about their vivarium, but will be in no mood for feeding, which is fortunate for their owner, as food is not likely to be available. Provided they have fed well during the previous summer and autumn, no harm will come from this early appearance.

In conclusion, knowing that in the long run the welfare of our reptiles and amphibians is best served by a cold winter, let us hope that February will not prove to be too mild a month.

* * *

SNAKE VENOM

At Brownsville, Texas, a most unusual industry is the animal farm of "Snake King." "King" has probably the greatest hoard of crystallized rattlesnake venom in existence—nearly twenty pounds of it, packed in jars. Saucers of fresh venom look like honey. It is allowed to dry in the air of a screened room, and after a day or so it thickens and "checks," finally appearing like grains of hardened glue or fragments of resin. Small quantities of the crystallized venom are sent to laboratories in various parts of the world where research work in the production of anti-venom is carried on.



WATER LIFE

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Reptiles in Paris

By "AMPHIBIUS"

IT would have been quite obvious, even if the authors' names had not appeared, that the two reviewers of the Paris aquariums were aquarists exclusively, so I venture to raise the subject a third time in these columns in order that one of the other groups for which WATER LIFE caters may learn what the French capital offers to their interest.

The aquarium at the Colonial Museum houses one of the most important collections of living Tortoises in Europe. Not numerically, since all told there are only about sixty examples, but because of the rarity of many of the species shown, and the excellent state of health in which they are to be found.

In the centre of the Crescentic Annexe described by Mr. Atkins is a deep pit measuring about twelve by eighteen feet. The edges are overhung to prevent escape, and the overhung edge conceals the ring of electric lamps which illuminated—rather inadequately, I fear—the pit and its contents. Approximately half the floor level constitutes the pool, in which may be seen many splendid examples of the now scarce *Podocnemis* Terrapins, with shells from eight inches to two feet in length. I am unaware of the existence of any other such large specimens at the present time in Europe. Also to be seen are numbers of the African and Malagasy black, side-necked Terrapin, of the genus *Pelusios* (formerly *Sternotherus*), including several partial albinos; American Mud Terrapins (genus *Cinosternum*), Asiatic Box Tortoises and Ground Terrapins (genera *Cuora* and *Geoemyda*). There is also a large Trionyx which looked to me to be the rare *Cyclanorbis senegalensis*.

Other than these terrapins, the pit holds a Tabulated and a Radiated Tortoise and two very tame Monitors, the larger of which gives quite a performance at feeding time. Up to last summer several small to middling Crocodiles lived in the pool as well, but I drew the keeper's attention to a very nice Derbyan Terrapin which was in the act of disappearing down a croc's

throat; and now there are no crocodilians there except a small False Gharial (*Tomistoma schlegeli*) from Borneo.

Between this pit and the main hall of the aquarium is a very well-thought-out tank which, dimensionally, is the mirror image of the Terrapin pit. It begins at the head of a small staircase, and finishes at the bottom. The lower end and part of the sides are glazed. One is able, therefore, to inspect the contents of the tank either over the top or through the sides. It will hold sea water, and has been built for marine Turtles, of which the Museum has one old male and six baby Tortoiseshell Turtles (*Eretmochelys imbricata*) and one Green Turtle (*Chelonia mydas*).

Next to the tank containing the Fancy Goldfish previously described, is one containing a very fine pair of Matamatas (*Chelys fimbriata*), a young Nile Trionyx (*Amyda triunguis*), several Chinese Trionyx (*Amyda sinensis*), and a Ceylon Trionyx (*Trionyx punctata*). All appear to be in fine condition, although there is nothing for them to burrow into. The water is, of course, in constant circulation, and quite clean, but in still water all the species mentioned would require a good, thick layer of fine gravel or sand in order to cleanse themselves.

The *pièce de résistance* of the whole aquarium is, of course, the huge terrarium containing the Crocodiles and Giant Tortoises. It is about 120-ft. in circumference inside, and one walks round a top gallery and views the animals lying underneath. There is a chain of three pools, the first, which is the deepest, being fed by quite a spectacular cascade of warm water. Its overflow feeds the second and third, which are shallow. The species exhibited are *Alligator mississippiensis*, *Crocodilus niloticus*, and *Crocodilus cataphractus*. All of the beasts are fat, well, and active, and many are so tame that feeding time is quite an entertainment. There is a large *Podocnemis*, which seems to be always in the same spot in the same pool. The two large

Tortoises are the domesticated hybrids from the Seychelles.

The tortoises, terrapins, and, I believe, the crocs, too, are fed every day between half-past two and three. Few of the zoos nowadays hold to the archaic notion that reptiles require to be fed only once a week. A tank holds two well-grown gigantic Salamanders, which, for their length, are very thin indeed. In the summer there were six. Last week I saw that one had badly bitten the other. I have found, with these beasts, that if they are kept short of food, they are likely to attack one another.

There is nothing to interest the terrariophile in the dank aquarium at the Trocadero, but visitors to Paris should make a point of seeing the Vivarium in the Jardin des Plantes. It is next to the old reptile house. Its interest to us lies especially in that it does not contain a single case which, for size and furnishing, the most amateur among us could not duplicate in his own home, and yet all the exhibits are happy, active, and well. Included are Iguanas, various Chameleons, Common, Ocellated, and Algerian Skinks, Sand, Sharp-nosed, Eyed, and Green Lizards, Slow-worms, and Scheltopusiks. There are various European and North

African Snakes, Common and Spanish Terrapins, Surinam, Smooth, Clawed, Common, Green, and South American Giant Toads, a most superb *Ceratophrys*. Urodeles include the largest living Pleurodele Newts I have ever seen; Japanese, Marbled, Crested, and Alpine Newts, and the Common Salamander, which abounds wild around Paris. Perhaps the most notable exhibit is a tank of *Proteus* varying in colour from the normal flesh colour to a grey so deep that it looks quite black.

It always seems remarkable to me that *anything* survives in the dark cases of the old reptile house, and yet many animals seem not only alive, but most comfortably so. Such are a large Boa Constrictor, an Anaconda, quite a herd of Nile Crocs, and American Alligators, eight Giant Tortoises, six being from the Seychelles, and two from the Galapagos. There is a Mexican Heloderm (not the common one from Arizona) who is now quite an old inhabitant; and a collection of smaller reptiles living in permanent twilight. All seem motionless, and the darkness prevents one seeing precisely what they are. During the summer the Alligators and Giant Tortoises live outdoors in the three enclosures that fill the space between the reptile house and the vivarium.

Hatching Young Trout

By CLIFFORD BOWER-SHORE

THE Trout eggs were received in the third week of November. There were twelve eyed ova sent to me in a matchbox filled with damp moss; four had turned white, and were apparently of no use. The remaining eight eggs were placed on two watch-glasses and put in a small glass tank. Every alternate day the tank level was reduced by four inches and fresh water introduced.

The first egg hatched on Wednesday, December 7, and, like the other seven alevins which hatched later, it came out tail first. For many days these alevins, almost grotesque with their large eyes and yolk sacs, lurked on the bed of the small tank, one side of which was painted dark green. They all showed a definite dislike for strong light, and clustered together at the darkened end. When they moved it was with an ungainly flopping movement, similar to the normal motion of the loach. They rarely rose more than an inch from the tank bed, except when startled, when they swam erratically to and along the surface.

The water in the aquarium was now aerated for about four hours each day, the vessel supplying the water to work the simple aerator being in turn fed by a large glass tank situated on a high shelf. The pH value of this water was normally constant within a range of 7—7.2. One afternoon, when the young Trout were three weeks old, the water in their tank was tested, and to my surprise showed an acid reaction, the pH figure being under 6.0. The supply tank was tested, and this also showed an acid reaction. No satisfactory explanation of this sudden change was found. I was pleased to find that the Trout did not appear to be distressed

On Thursday, January 5, a day of very severe frost, the heating system failed, and when I went into the room in the evening it was to find the aquarium a solid block of ice, with the young Trout suspended at various depths. The ice was thawed out gradually, a small paraffin lamp being used. Much to my surprise, the young Trout came round and were apparently none the worse for their freeze-up, which serves to show the strength and tenacity to life of young Trout.

They were now transferred to a much larger tank. Gradually the yolk sac diminished, and then came what I have found to be the most difficult part of rearing Trout in tanks—the starting of the feeding proper. Chopped earthworms and many other fine foods were refused, or, at best, not taken readily. The introduction of *Infusoria* was more successful, but after many experiments very finely chopped prawns and shrimps have become the staple diet. The substitution of pond water for tap water has also been found very beneficial. In the case of some of the fish the yolk sac disappeared more quickly than in the others. The size and the colouring also vary a good deal, although each specimen has now the characteristic spots of the species.

Even at this early stage of life two of the alevins are showing individual traits. They will take finely chopped food from the blade of a palette knife as the end is immersed just below the surface of the water. One of them, the smallest fish of the eight, is the greediest and also the most pugnacious. If any of the others come too close to him he darts quickly at their tails—and they never stop to argue.

not be used: it will pack hard in a short time, and cease to filter efficiently. On top of the layer of charcoal another layer of pebbles is placed, to break the flow of the water and prevent disturbing the finer charcoal or grit. It is an advantage to interpose a sheet of fine galvanized wire gauze between each layer in the filter. Copper gauze should not be used, as it will poison the fish. The filter improves with use, as a gelatinous layer develops, composed of harmless bacteria. This may slow the rate of flow, but will hold back the very minute particles.

A $\frac{1}{4}$ -in. rubber tube conducts the filtered water back to the aquarium. This should not be allowed to sag into loops or it may develop an air lock. It is best led straight from the filter to the edge of the aquarium.

Oxygenation is carried out immediately before the water enters the aquarium. This depends on a very interesting principle. The *modus operandi* will be obvious from perusing the large diagram. The delivery pipe terminates in a length of narrow glass tube. This should be approximately 4-in. long, and

is made to fit loosely into another glass tube of similar length, but of *slightly* larger calibre. The smaller tube should be wedged or otherwise fixed into the larger tube, protruding into it for a distance approximate to that shown in the diagram. The water rushes from the smaller tube into the larger tube under pressure at point A in the diagram. The higher the filter, the greater the pressure, and the more efficient the oxygenation. Air is sucked in at the gap between the smaller and the larger glass tube, as shown at B in the diagram. The result is an *intimate* mixture of water and air which, if properly arranged, shows in the aquarium like a cloud of smoke.

It is good news that the rotary pump requires the minimum of effort to operate—it is not like pumping up a bicycle tyre! Cleaning can be more effectively performed if the bottom of the aquarium is agitated with a stick whilst the pumping is in progress. Some men do the stirring whilst the wife does the pumping. In some cases the wife holds the stick. Newly-weds go fifty-fifty!

The Reptiliary in March

By L. G. PAYNE

MARCH is likely to see the return of Midwife Toads to active life in the reptiliary. They will require feeding, and on the moist, still evenings when we may expect to see them, food will probably be available in the reptiliary in the shape of small beetles, woodlice, and earthworms. It will, however, be desirable to increase this food supply; small, round tin lids sunk in the earth will hold a large number of gentles, which will be readily accepted by Midwife Toads.

The Spade Foot Toad is almost certain to make an appearance this month, and his hoarse, clucking call, produced under water, will show that the breeding season is at hand. These toads are perfectly hardy, and do well on the usual types of food.

March is usually a critical month for Tree Frogs which have wintered in captivity, and it is this month which proves the success or otherwise of the general conditions under which they have been kept during the previous year. If your specimens emerge to sit contentedly in the sunlight, normal in shape and bright of eye, all will be well; but beware of any which appear "wasp waisted," and drag their legs as they move about; these did certainly not feed well last autumn.

An effort should be made to encourage pupation of gentles for the production of flies by keeping them glass covered in a warm room. I find that flies of the bluebottle type are the only satisfactory food for Tree Frogs in captivity.

While on the subject of Tree Frogs, it may be well to remark that the dealers' first importations of amphibians frequently arrive towards the end of March, and these often consist of Tree Frogs.

All species of lizards will now be in evidence, and should be tempted to feed by being offered mealworms on a spoon. They will soon learn to recognize the

significance of the spoon, and show an appreciation of its contents. Do not leave mealworms lying about in feeding tins where sparrows can get at them, for in this case the lizards will not benefit at all!

Where hardy newts have been kept out of doors in tanks throughout the winter, with the water area reduced to a minimum, it will be quite safe—and indeed necessary—in March to reverse the proportion of land to water. At least half the available area should now be given over to water, and a strong growth of plants such as *Callitriche* and *Elodea* encouraged. If March should prove to be mild we may expect to see newts displaying signs of the breeding season. We shall note a steady intensifying of the colours in the males, and the reappearance of the crests in those species which possess them.

If the amateur is intending to go in for selective breeding, it will be high time to separate the species, for, unless this is done, where newts are kept on a community system, indiscriminate interbreeding is likely to occur. Much interesting work may be done in cross-breeding, but unless the parents are definitely known, most of the value of resulting hybrids is lost.

* * *

ANGEL v. WIDOW

A few weeks ago I was feeding my fish in a community tank; they consist of Black Widows, Angels, Three Spot Gouramies, and other fish. A piece of food fell from the surface, and an Angel and a Widow raced towards it from different directions. The Angel got there first, but missed the food and pulled out the Widow's eye quite unintentionally. The Widow swooped and caught the food and ate it! The Widow, although it misjudges distances badly, is still thriving.—N. CAMPBELL.

putrefaction soon has its effect on the water, which assumes a grey and unhealthy appearance, and loses its pleasant and clean "pondy" smell, becoming quite offensive. The fish become listless, and their fins are not held erect and jauntily. In advanced stages, of course, they continually swim at the surface, and begin to die one by one.

The best remedy is, naturally, not to introduce excessive amounts of food, but when the damage is done

and the tank fouled, then clean it right out and start all over again, this time taking care to use your eyes and the dip-tube intelligently.

We hope that these notes will prove valuable to many beginners, but we have a shrewd suspicion that it will not be a very great time before they have to be repeated in some shape or disguise for over-estimating the size of a fish's stomach is the beginner's most frequent mistake.

The Walthamstow Albino Frog

THE Albino Frog, described and illustrated in *WATER LIFE*, July 12, 1938, has been successfully mated with an ordinary light-coloured female frog. Needless to say I am waiting anxiously for the spawn to appear. Owing to the severe weather that we had in December last, I was greatly relieved to see this frog come out of hibernation, although I had taken great care with it.

There have been many queries recently in *WATER LIFE* concerning the hibernation of frogs, owing to the large numbers which have been found dead in garden ponds; and my experience this year may be of interest to readers.

The Albino Frog was kept in an outdoor vivarium containing a small pool, about 6-in. deep, and towards the end of the summer months I dug a tunnel under this pool, into which the Albino retreated when the cold weather began. The entrance to this tunnel was covered with straw, leaving a small space, so that the frog could, during mild weather, come out of his retreat. He eventually came out of hibernation at the end of February, and on March 5 I managed to find a light-coloured female. I put them both into an aquarium 30-in. by 15-in. by 15-in. The water was from 2-in. to 4-in. deep, and plenty of *Anacharis* and some large pieces of stone for landing places were present. The frogs soon settled down in the aquarium and within three hours they mated; now I am waiting with much interest for the result.

In conclusion I wish to add that all the frogs that hibernated in my pond, which is 2-ft. deep, were found dead during the cold spell in December last. I have had this experience previously, and that is why I took care that the Albino did not share this fate. It appears that frogs prefer to hibernate as near as possible to a pond. Some unfortunately choose the garden pool, and if this is a cement one, the results are often fatal. In my garden I have sunk a bath, and round the edges I have left a margin with some rockery on top, and on disturbing this rockery recently I found quite a number of frogs hibernating. These are the only ones that have survived this winter in my garden.

This convinced me that the rockery is the place for frogs to hibernate in safety, although I have found them in the mud at the bottom of a garden pond, when I have



to empty it during winter, but in their natural surroundings, I believe they prefer a damp spot close to the pond in which they intend to spawn in the spring months.—F. B. Fox.

* * *

THE ZOO'S SLEEPER AWAKES

A sure sign that spring is at hand is the wakening of Agamemnon, the Zoo's 25-ft. Python, from a sleep that began last November. As he roused himself he prepared to go through the annual procedure of changing his skin before breaking a long fast. The keepers seized this opportunity to examine his jaws, which had a lop-sided look. That something was wrong with the Python's mouth was first noticed after he took his last meal in the autumn, and it was thought he had strained the jaw in some way. Close examination has revealed a small cyst inside the upper "lip." By holding the head in a noose the keepers managed to lance the growth, but could not remove it completely, for Agamemnon is a formidable and difficult patient. When he had finished changing his skin, the Python sought a meal, and greedily swallowed a duck. Now he has taken another meal, and since his mouth gave no trouble it is expected that the cyst will disappear.—*Birmingham Post*.

The Amboina Box Tortoise

By "AMPHIBIUS"

ASIA has its own Box Tortoise, and quite a sizable consignment of one of the species arrived in London early last summer, and they were christened erroneously by the importer, "North African Terrapins."

The animal in question was the Common or Amboina Box Tortoise, now known as *Cuora amboinensis*. Readers will find it referred to in the older literature as *Cyclemys amboinensis*. The other members of *Cuora* are *C. yunnanensis* and *C. flavomarginata*, which are extremely rare here, and *C. trifasciata*, which is occasionally to be had.

The Amboina Box Tortoise is found in Burma, south-east to the Moluccas, and also in the Philippine Islands—an immense range. It grows to a larger size than do the American Box Tortoises; my largest male and female measure twenty-five centimetres over the shell. From being typically Terrapin shaped (*i.e.*, flat and rather oval) when young, the females become dome-shaped with age, while the males remain flat, although, of course, increasing considerably in length and breadth. The carapace in the young is dark brown, and it becomes blackish with age, the plastron being yellow and flecked with black throughout life. The head markings are remarkably constant, consisting of lemon-yellow streaks passing backwards along the side of the head and part of the neck. The top of the head is covered with a very smooth and shiny-black skin which may have a greenish tinge in the young.

The shell has three longitudinal ridges in youth. The adult male completely loses his, but the female may retain the middle one throughout life.

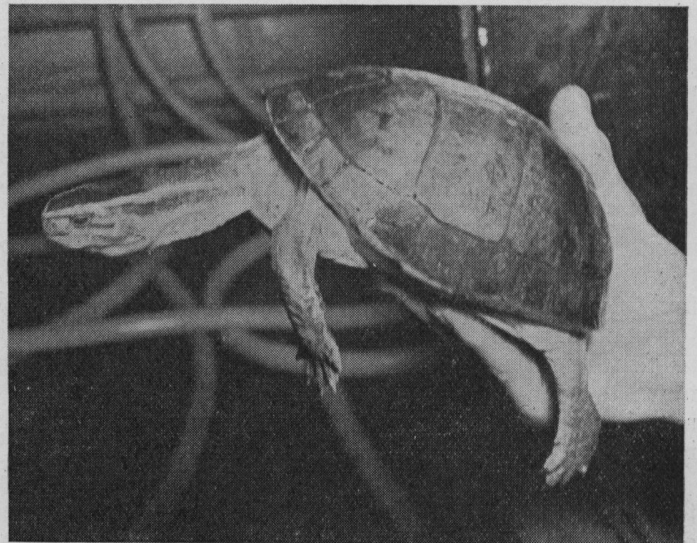
Although those specimens available were only about half grown, they could be easily sexed, since the males early develop a concave plastron and have a large tail. The female's plastron is slightly convex, and her tail is reduced to quite a ridiculous rudiment. Limbs are quite well developed in front, but the hind limbs always seem to me to have been made for a much smaller animal and to have been put on *C. amboinensis* by mistake.

In disposition I regret that this species cannot be put among the most attractive tortoises, and adults might even be described as morose. The young ones exhibit more response, but, even so, activity is always related to food, which seems to be the only thing which will overcome their persistent shyness.

Now, as regards food. Dr. Malcolm Smith, in "The Reptiles of India," states that they are dainty feeders and strictly vegetarian. Readers will, therefore, be well advised to offer them vegetable foods in suitable small quantities. I, however, find the animal to be not only strictly carnivorous, but also a remarkably heavy feeder. One female in my possession has eaten the following meals at various times: A ten-inch alligator, which she killed and of which she left only the last inch of tail, eating even the head; twenty-three baby mice; two and a half smelts; four inches of a large eel, and four table-spoonfuls of chopped raw beef. She is fed every day, of course, during autumn, winter and spring, when the

quoted meals were taken; less regularly in summer. The rest of my specimens are no less heavy feeders, and it falls to them to clear up each day everything in the meat line which is left over from feeding the other animals. I might mention here that the examples at the Zoo eat only meat, as do all the specimens of *C. trifasciata* in the Musée des Colonies at Paris although the last have fish as well. Also, in the letter that has called forth this article, the writer says that her specimen began by eating worms.

They do not seem to me to be very good subjects for outdoor life in this country, but, being swamp animals, it ought to be possible to fix them up an enclosure in



Young Male Amboina

which they would be happy. They are very awkward in deep water and swim very badly, so their enclosure requires to have a pond not more than six inches deep. My enclosures are unsatisfactory for them apparently, and the creatures seek out the most densely planted spot into which they creep as far as they can, and then sit down and shut up. In the wild these tortoises are found only in very damp places. It is difficult to get them to feed except during the hottest parts of the summer, but this is not of much importance, and the enormous quantities of food they eat indoors during the cooler seasons are apparently enough to keep them going during a summer outdoors as well. They can eat either in or out of water.

It is easier to make them happy indoors, and they do not necessarily need a very high temperature—that of a constantly warmed living-room or kitchen is quite adequate, but under such conditions, of course, they eat considerably less than when kept at about 80 deg. F., as their metabolic requirements are correspondingly reduced. Such a slackening in appetite need give no cause for alarm. A baking-tin makes a good bath for them, and the rest of the floor of their case should be liberally covered with damp peat moss. Most of their time is spent in the pan of water waiting for food, but

Reptiles and Amphibians of

Corsica By JOHN ARMITAGE

KNOWN as the "Scented Isle," Corsica, in the western Mediterranean, is famous for its fragrant scrub, or *maquis*, and its varied plant life generally. The field naturalist interested in all living things, finds in the island's birds, mammals, reptiles, batrachians, and insects, a vast array of subjects for study and entertainment. Throughout the month of May, and into June, I roamed about the picturesque countryside, revelling in matchless weather; and, from the first, I was deeply fascinated by the great number of lizards running about the rocks and old walls, flycatching, sporting with each other, and basking in the warm sunshine.

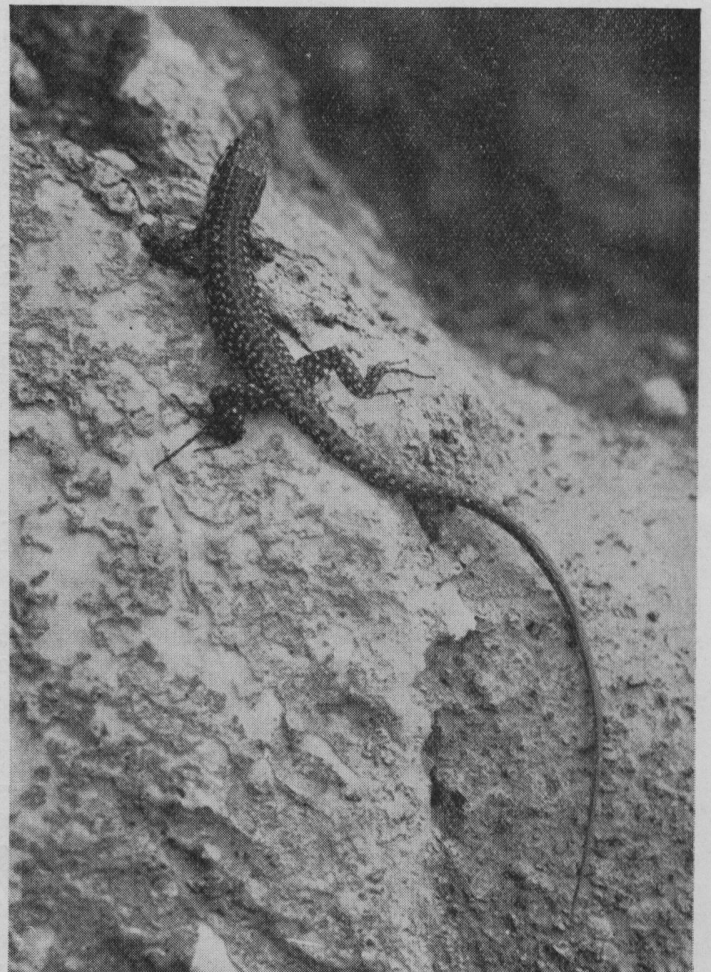
The Striped Wall Lizard was remarkable for its range in colour from green and grey to brown, and although some were strongly marked with longitudinal lines, others were freckled. They proved exceedingly troublesome to photograph, but were easy to capture by means of a noose of thread at the end of a stick. The Dalmatian Lizard was plentiful, chiefly in low-lying districts, such as Calvi and Bastia, but I noticed a few inland above Corte at about 2,000-ft. This species is wrongly called the Green Wall Lizard, and is not a variety of *L. muralis*. It was found that many Wall Lizards had definite runs and particular bolt-holes among the rocks, whereas some Dalmatians lived more in the open, and one was followed over rough ground for a considerable distance before it was lost in a mat of tangle.

There is a sharp contrast in colour between the handsome Dalmatian Lizard with its combination of rich green, brown, blue, and grey-mottled legs, and the Corsican Lizard of mountainous regions. It has been my good fortune to see dozens of different species of Old World and New World lizards, but none has fascinated me so much as this island form which lives among the high rocks and in nooks and crannies of old bridges. *Lacerta bedriagæ* is larger than the two kinds described above, and is of a uniform olive-brown tint with a pattern of dark reticulations. As it peeps from its favourite cranny and comes into the sunshine with slow deliberation, there is a sinister appearance in its movements; but at the least sign of danger it will turn tail and vanish in a flash. Yet, by exercising patience, I managed to catch some and posted them to a friend in Manchester. They were enclosed in small bags stuffed with moist grass and packed in tubular containers with perforated metal ends labelled "Scientific Specimens," and all the animals reached their destination in excellent health.

There were plenty of Geckos on old walls about Calvi, and although the only species which seems to have been recorded from the island is a small Tyrrhenian Gecko,



The Corsican Lizard



The Striped Wall Lizard

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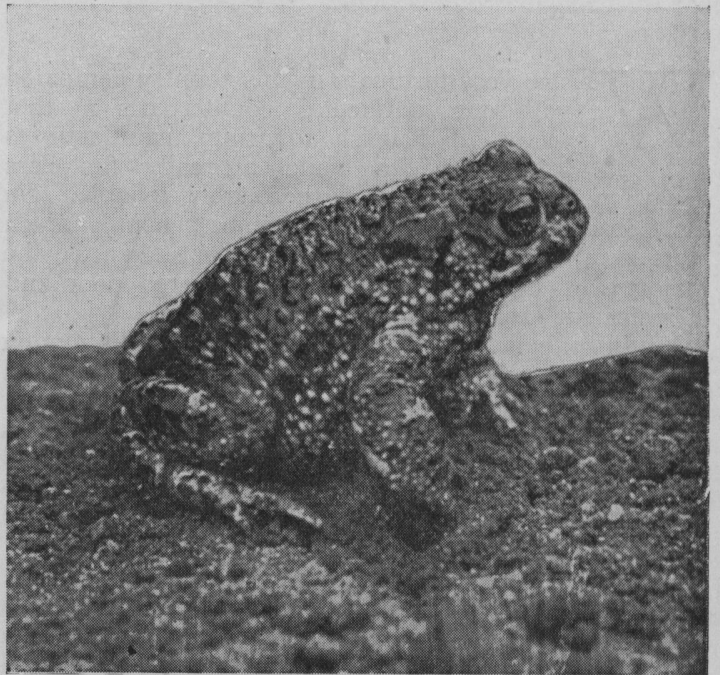
A Spring Chorus of Toads

By ERIC HARDY, F.Z.S.

THE sign of spring among the brackish slacks or bogs in the sand dunes, of our river estuaries is not the coming of the Wheatear or the Sand-Martin, but the great chorus of the Natterjack Toads, which swells to such volume at dusk that you can hear it from the main road a mile away. You probably do not know what this noise is, for from a distance it resembles the deep rattle of the Nightjar kept up without cessation for hours on end. Indeed, so much of a nuisance have been the spring choirs of these toads in generations back when they literally swarmed over the dunes, that local residents tried every means of getting rid of them. On the Lancashire coast they are nicknamed "Southport Nightingales," and at one time bred numerous in the damp dunes as far south as Bootle (where they were called "Bootle Organs") but building operations and the drying of the dunes have reduced their numbers.

I have just returned from taking a party of naturalists over the "slacks" to study these colourful and entertaining little toads. Colourful is a true description for, unlike the ugly, black, warty Common Toad, the little Natterjack, only 3-in. in length, is a beauty excelled amongst the batrachians in spring dress in our countryside only by the Great Crested Newt. The Natterjack gets its name from two old country words, "natter," meaning adder, and "jack," meaning small (as in Jackdaw, Jack-Pike, Jack-Curlew, or Whimbrel, Jack-Snipe), for country folk saw, in the yellow line down his light brown back, a resemblance to the adders of our dry summer heathlands. In addition to these colours, the Natterjack has brilliant green tints around its eyes, and green, red, and dark brown warts along its sides: moreover, its underparts are a beautiful, silvery grey, that flash noticeably when it turns in the water; and, like all its clan, it can change its colour according to its surroundings, becoming quite buff when upon light sand, and quite dark brown when upon mud.

Natterjacks are not nearly as common as the ordinary large toads, and not nearly as repulsive in looks or ways. Only the spring months are spent in water, where the males create their prolonged chorus of calls—not exactly croaks, as you might expect, but a distant rattling sound, entertaining enough when first heard, but very monotonous if you have to live or camp in their haunts night after night. In late March and early April we find their spawn—in long strings with small, black eggs inside—amongst the slacks, while in the autumn we find the toads trekking into the pinewoods, where they pass the winter more or less in hibernation. On the move over the dry land, they are much more active than the Common Toads, and, raising their bodies



THE NATTERJACK TOAD

an aquarium as possible is desirable. Shallow water, 6-in. to 8-in., seems to be greatly preferred by the fish, and also results in the eggs having a shorter journey to the safety of the pebbles below. A temperature of 80 to 84 deg. F. will hasten the onset of spawning.

The spawning is vigorous, and the males pursue the females all over the tank, the eggs being extruded and scattered as they go. Here it might be noted that an objection to spawning several fish together is that any fish not spawning will have an opportunity to pick up the eggs as they fall. The adults should be removed as soon as possible after they have finished spawning.

The fry hatch in about a day to a day and a half, and in two days are seen as small, black, hair like creatures hanging to the plants and sides of the aquarium. A good spawning will produce as many as four to five hundred fry. In three days they are swimming freely, and require quantities of food. Copious supplies of *Infusoria* are most desirable, but a high degree of success in rearing can be obtained by feeding with flour-fine prepared foods or hard-boiled egg yolk squeezed from a cotton bag.

When about a month old the fry are nearly three-quarters of an inch long, and the stripes are developing

rapidly. At this stage they are extremely beautiful, and the brilliant flashing blue of these tiny fish is a sight never to be forgotten. Growth is very rapid, and well-fed fish should reach maturity in about four months or so, and mature fish kept in good condition will spawn every two or three weeks.

The Zebra used to be considered the easiest of tropicals to spawn. Perhaps that distinction should now be transferred to the White Cloud Mountain Minnow, but of the beginner's fishes the Zebra remains the most satisfactory egg-layer for the tyro's initial experiments, and the beauty of the result always surpasses his expectations. One final word—the Zebra is a great lover of sunshine and bright light, and often will not spawn in situations where the light is subdued. Bright early morning sunshine or its artificial substitute is a great spawning stimulant.

A YOUNG AQUARIST ?

We have pleasure in informing readers that a son was born on April 5 to our Editor, Miss Margery G. Elwin, B.Sc., who in private life is Mrs. Louis C. Mandeville. Mother and son are both doing extremely well.

The Common Lizard

By A. LEUTSCHER

A PART from the legless slow-worm, there are two Lizards to be met with in Great Britain: these are the Common Lizard and the Sand Lizard. The former is by far the more numerous and is usually to be found on a ramble if heathlands and forest glades are included in the day's hike.

As we walk through the heather or grass in a quiet woodland glade during the late spring and summer, tiny, active little creatures are seen to dart away through the crowded undergrowth at our approach. Then is the time to sit down carefully and keep a good watch. In a short while the little creatures will reappear and resume their quiescent attitudes as they bask in the sun, and can be studied better. In length they appear about 6-in., of which the tail contributes a good half.

Last summer, while on holiday in the New Forest, I captured a Lizard and was able to examine it closely. It was a pretty thing, a full-grown male of a rich, dark-brown hue, which reflected the sun as it wriggled to escape. This colour background was broken by a series of black dots forming longitudinal lines down its back and down the inner margins of the legs. Regular rows of even-sized scales covered the body from neck to tip of tail, but on the head were much larger scale plates. A row of larger scales were also to be seen across the throat. The underside was a bright shade of vermilion covered with dark spots. In a female this would be replaced by a yellow or pale green hue with paler and less obvious spots.

Colouring, however, varies a great deal with these Lizards, and may range from a general greyish tint to a deep brown, and I have found almost black specimens. These differences in pigmentation have no doubt resulted

from local conditions. I have, for example, noticed a marked tendency for darker colouring to predominate in those Lizards which inhabit heath-covered glades. The skin is sloughed off in patches at odd times, often giving the owner a somewhat ragged appearance.

Having fully examined my captive, I was about to release it. I opened my hand, and for a moment it rested in the palm. Then with a sudden dart the little Evvet, by which name it is known down there, leapt from hand to knee, rippled down my leg, and dived into the thick grass. It appeared for a moment on a heath clump, jerked its way over the top, and once more dived from view, this time for good. My last impression of its movement was that it seemed to make little use of its legs during these aerial acrobatics. A fast-moving Lizard gives one the impression of a torpedo as it shoots through the heather stalks and grass stems, its forelegs tucked close to the sides of its body. However, a good landing is always effected, since the hooked claws on the five long digits of each foot ensure a safe grip when the animal comes to rest. The claws of the fore limbs are much shorter than those on the hind, and are often worn blunt from the habit of scratching the soil.

Observing this curious mode of progression, one wonders whether these Lizards are examples of a transitional stage from limbed to legless animals and whether they will eventually follow the snake's line of evolution. The slow-worm has certainly gone this way, and the curious, torpedo-like movement of the Common Lizard in motion suggests a similar tendency.

Watching a Lizard moving across a flat surface, one gets the impression that, swift though the progress may

(Continued on page 190)

THE COMMON LIZARD

(Continued from page 184)

be, the method adopted is laborious. The creature seems to pull itself along rather than support the body on its limbs, as does a mammal, for the body always remains close to the ground and, in fact, subsides immediately the Lizard comes to rest. In its typical resting attitude the Lizard lies with tail and hind parts on the ground, supported by the hips, and fore parts raised up on the front legs, the head usually being held to one side. Lizards are said to appreciate musical sounds, and though I have managed to charm Grass Snakes with a flute, with some small degree of success, my musical efforts on Lizards have so far been wasted.

The Common Lizard is an attractive addition to the vivarium, and owing to its small size should really be kept from other inmates, larger Lizards included, which would not hesitate to make a meal off it. A small community of such reptiles will afford endless entertainment with their quaint habits.

The alternative name of Viviparous Lizard is brought to light when one becomes acquainted with the method of reproduction. About midsummer, shortly after mating, the females become swollen with young and a collection of newly born youngsters, tiny black mites an inch in length, will be found, probably still enveloped in their egg cases, thin and somewhat sticky membranous coverings all connected in a mass, and from which, later, the babies wriggle clear. These youngsters will remain motionless for many hours after birth, and a day may elapse before they start to search for food, such as small spiders and insects. They will accept greenfly from a thin stick, in captivity.

On sunny days, which are not too hot, the Lizards will all collect on open patches in the vivarium; they have a decided preference for lying along small branches against which they flatten their bodies.

Vivarium construction I leave to individual taste, but would suggest that as well as the usual rock plants and stonework, heather and dried bracken also be included. I must stress, however, the importance of fresh water daily. People are apt to think that scaly and dry-looking reptiles do not require water. True, they are constructed to conserve moisture, but an occasional drink is as important to their well-being as it is to our own. Common Lizards in a natural state would obtain their water supply from the morning dew on the grass.

* * *

THE WHIP SNAKE

The following recent letter to the *Daily Telegraph* is of especial interest to students of English snakes:—

In reference to your letters about Grass Snakes eating birds' eggs, the climbing and egg-eating habits suit the European Whip Snake (*Zamenis gemonensis*) much better than the Grass Snake. In 1936 I caught near Coate, Wilts, a perfect specimen of the Whip Snake actually raiding a nest. In 1938 I caught a small Whip Snake near St. Anne's Hill, Chertsey, and another on Chobham Common. Has the Whip Snake been given its liberty in this country and taken kindly to our climate? The Whip Snake, unless handled and examined, might easily be mistaken for a large female Grass Snake, which usually is without the yellow collar. —GEOFFREY A. VALMORE, Shepperton.

CLUB REPORTS

BRISTOL TROPICAL FISH CLUB held its first annual meeting on Monday, April 3. It is interesting to note that this club, which started in March, 1938, with a handful of enthusiasts, has now grown to such proportions that new quarters have to be found to accommodate the ever-increasing membership. The next meeting, on May 1, will be devoted to "Breeding Angels," by Mr. H. J. Shepherd. Anyone interested will be welcome, but as the meeting-place has not yet been fixed, a line to the Hon. Secretary will be appreciated. — F. M. CRABBE, Hon. Sec., 91, Stoke-lane, Westbury-on-Trym, Bristol.

MEDWAY AND DISTRICT AQUARIST CLUB.—At a meeting held on Monday, April 3, at 10, New-road, Avenue, Chatham, Mr. Stevens (of the British Museum) gave a lecture on water beetles. He explained that most insects were very localized, and that it was therefore important that each district should have its own local authority on insect life. Although the British Museum and the Government spent large sums annually on research, there remained a great deal of work still to be done, and aquarists could help by recording their observations in the wide field of their study. Mr. Stevens showed several home-made appliances necessary to pond-hunters. The first pond-hunting ramble will take place on Sunday, April 23. Meet Chatham Railway Station, 1.40 p.m.—W. BEALE, Sec.

* * *

PARADISE REGAINED

This little story was told to me by a friend of mine, and I can vouch for the facts. This friend, not being very well versed in temperature variations had only a 60-watt heater in a tank 24 x 12 x 12-in., and lost all his fish except one during the cold spell. The tank contained Mollies, Swordtails, Fighters, and Platies, and the one survivor was a young Paradise fish. This little fellow seemed perfectly happy at a temperature as low as 50 deg. F.

As my friend is rather a busy man (this was his excuse for neglecting the fish in the first place) he could not give his time to looking after one fish in a tank, so he put it in a jug and placed it in a bakehouse connected with his business premises where he spends most of his time, thinking that in this way he could give it more attention. He placed the jug near the oven, and then forgot all about it until it was brought to his notice by an assistant a month later.

The amazing part about it is that the bakehouse is only used two days a week, so that on those two days the fish had tropical conditions, and on the others it was almost frozen. Moreover, it had nothing to eat during the whole month. When discovered it was quite fit and well.

My friend has now given it to his brother, who has put it with some Shubunkins in an unheated tank in an unheated room.

From these few facts I think it is safe to assume that the Paradise fish is one of the hardiest of tropicals. I know my Calicoes would never stand the bakehouse treatment.—H. LODER.

Club Reports

Owing to the manner in which Club Reports tend to encroach on the limited space available in this paper, only notices of future meetings and club matters of general interest to all our readers will be published in these columns. We greatly welcome reports giving interesting points from lectures, but are not prepared to devote space to club business, as this is only of local interest.

WEST SURREY PONDKEEPERS' AND AQUARISTS' CLUB.—Meeting held on Wednesday, April 12, at West Horsley. Mr. S. D. Steele gave an interesting lecture on "Waterside Plants." The main idea, Mr. Steele suggested, was to break up the large open water of the pond, and so create the illusion of a vista beyond. The first essential was to plant the larger trees, shrubs, etc., such as Willows, Kalmia, Spiræas, Alders, according to the size of the pond. One could then get down to planting the smaller waterside plants, and provide them with shade or sun as required. Primulas, Trollius, Mimulus, *Poterium obtusum* 18-in. (very lovely), Irises, Gentians, Foam Flower, and Ranunculus, were all mentioned. Red-hot Pokers, although usually seen in dry positions, did best in a very moist one, and were recommended. All moisture-loving plants should have the crown *above* the level of the water.—W. L. DEIGHTON, Hon. Sec.

ILFORD AQUARISTS' SOCIETY.—On Monday last Mr. Alfred Leutscher brought a collection of live snakes, lizards, and other creatures with which to demonstrate his lecture on "Occupants of the vivarium." The committee room in which this society meets resounded to the croaking of frogs and toads, all obligingly performing for the delight of those present. Mr. Leutscher described the habits and requirements of these creatures and various types of lizards, slow-worms, and snakes, specimens of which were handed round for inspection. Occupying the centre of the lecturer's table was a large can labelled "Poisonous Snakes. Do not touch." Interest had centred on this can all the evening, and when, after putting on thick leather gauntlet gloves, Mr. Leutscher proceeded to lift the lid, the attention of all was riveted upon him. Wriggling and squirming came two English Adders, each three feet in length, caught by Mr. Leutscher in Epping Forest two days previously. These specimens could not, of course, be handed round for inspection.

LONDON AQUARISTS' SOCIETY.—This Society held its annual general meeting at the Caxton Hall, Westminster, on Thursday, April 13. After the meeting, the President, Mr. J. R. Norman, gave a most interesting lecture on the recent discovery off South Africa of the fish believed to have been extinct for fifty million years. He said that the capture of a living specimen which belonged to the period of the Dinosaurs gave rise to the possibility of other "extinct" creatures being still in existence and to the veracity of some of the much-ridiculed stories of sea serpents. Mr. Bartmann then displayed some specimen tropical fish which he had brought from Germany to show aquarists that really good quality fish are still available to those who are willing to pay a price in proportion. He showed among others a specimen of the latest German production in *Platypoecilus variatus*, a cinnamon-yellow specimen (pelvic fins included), which was the result of four years' experiments by Herr Alf. Wrobel. Some of the Platies exhibited were coloured somewhat like Berlin Swordtails. Cordial greetings to the London Aquarists' Society and a message of goodwill to all aquarists in Great Britain were brought by

Mr. Bartmann from the world-famous Triton Society of Berlin and from Herr Alf. Wrobel, who is the leader of the Rhineland Group of Aquarists. Mr. Bartmann was asked by the meeting to convey to the Triton Society and to Herr Alf. Wrobel the appreciation and reciprocal greetings of the London Aquarists' Society. At the next meeting, Thursday, May 11, Mr. J. R. Norman will give a lantern lecture, "Fishy Myths and Legends."

THE SUFFOLK AQUARISTS held another very successful annual show at Ipswich on April 17, 18, and 19. The staging of the 130 exhibits was particularly good, the tanks being illuminated from the top in the coldwater section, and the side in the tropicals, the general light of the hall being dimmed. There was a section of about thirty exhibits devoted to amphibia and reptiles. One very interesting exhibit was a collection of pond life. Mr. H. E. P. Spencer, who arranged this section, had obviously taken very great pains to make a really comprehensive collection of aquatic insects, and he had made it particularly valuable by giving drawings and notes of the insects. A small but attractive section, arranged by Mr. L. Dickerson, was devoted to marine life. The bright and unusual colouring of the specimens in these tanks showed the possibilities of marine aquaria, and it is hoped that many people have been encouraged to try their hands at this branch of the hobby. An unusual feature was a cinema show of aquatic films. This was provided by the Ipswich Corporation Museum authorities, who also provided the hall for the exhibition. Great credit is due to the organizers for a thoroughly successful show.

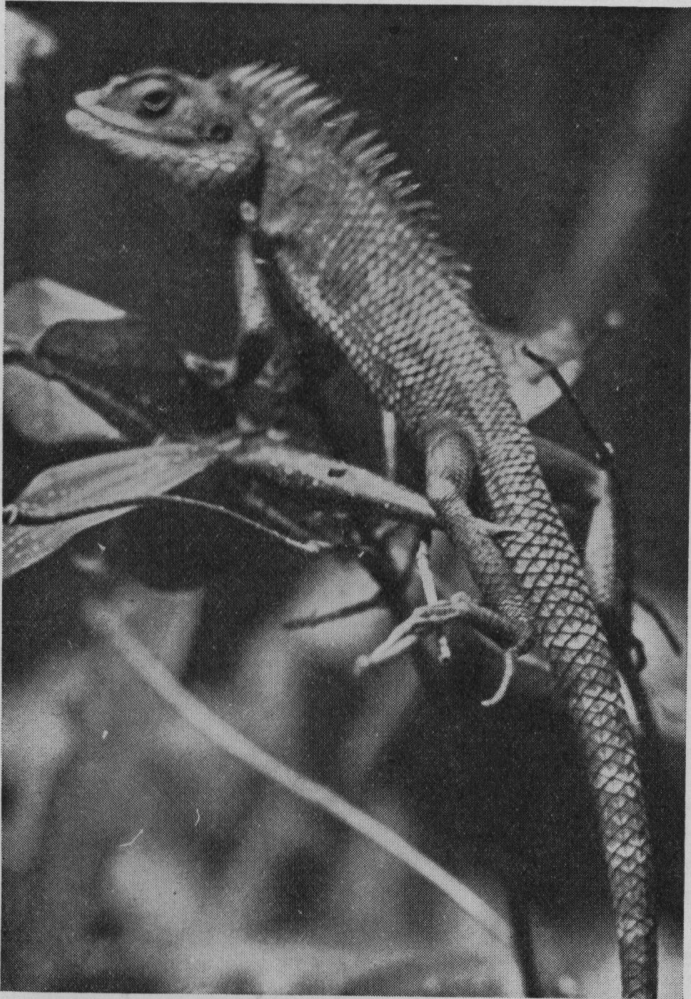
SOUTH LONDON AQUARISTS.—The Common Goldfish show, held on April 13, produced a surprising number of entries, judged by Mr. A. H. Hoare. The next meeting will be a Tropical Talk, by Mr. G. H. Thorpe, on Thursday, April 27, at the Adult School, Garratt-lane (Tooting Broadway) at 8 p.m.—H. G. ROWBOTHAM, Hon. Sec., 57, Idmiston-road, West Norwood, S.E.27.

SHOOTER'S HILL & DISTRICT AQUARIUM & PONDKEEPERS' SOCIETY.—The meeting of April 17 was devoted to a table show. In a class for home-made gadgets, Mr. L. G. Taylor, Show Secretary, won easily with an ingenious automatic fish feeder, designed to supply one meal of dry food per day for seven days. In commenting on the exhibits the Judge, Mr. C. H. Ward, said that all the tropicals were too small. This fault was becoming increasingly evident in England, and might be attributed to the poor price the average amateur was prepared to pay. Exporters were raising large numbers of small fish to meet a cheap market instead of culling their fry and raising fewer but better fish. The remedy lay with the amateur, who should concentrate on securing one chosen species, and giving it plenty of tank room. The resulting good-class fish would find a ready market with the dealer members of the breeder's own society. A visit to Chessington Zoo is being arranged for Sunday, May 14.—R. J. WOOD, Hon. Sec., 101, Eglinton-Hill, S.E.18.

Zoo Aquarium Notes

By E. G. BOULENGER

THE Zoo has recently been successful in breeding Giant Snakes, Boas, Indian Pythons, and Reticulated Pythons which have been born in the menagerie have been on exhibition in the Reptile House during the past year. The latest representatives of the giant snake family to be born in the Zoo are twelve Anacondas. The Anaconda shares



The Londok Lizard

with the Reticulated Python the distinction of being the largest of all snakes, attaining a length of up to thirty feet. The baby Anacondas, which were only 15-in. in length at birth, are extremely savage, striking violently at anyone who approaches them from the minute they are born. Though they may reach the enormous size mentioned above, actually they are mature when much smaller, the mother of the newcomers measuring only twelve feet. The Anaconda is a member of the Boa sub-family, all the members of which bring forth their young alive, in contradistinction to the Python, which lays eggs and incubates them, the mother coiling round the eggs; it has been ascertained at the Zoo that the temperature of the mother

snake rises during incubation several degrees above normal.

Other interesting newcomers to the Reptile House are a number of egg-eating snakes from W. Africa. The egg-eating snake is entirely dependent for its sustenance on eggs, and in this it is a connoisseur, refusing any but new-laid. The mouth of this snake is all but toothless, thus permitting the passage of the egg unbroken, but, on reaching the gullet, the egg comes into contact with a number of cutting, tooth-like projections or vertebræ, whose object is to break the shell, which is ejected a few minutes afterwards in the form of a pellet. The snake may, in fact, be said to possess teeth in its interior, since these vertebræ are actually coated with enamel. In spite of the fact that the head of an egg-eating snake is little bigger than the top joint of a man's little finger, it is capable of engulfing a hen's egg.

Some idea of the brilliance of the sea bed in Madeira waters can be gathered from a number of scarlet Scorpion fish now on exhibition in the sea-water hall. There they are exceedingly conspicuous against the rocks of their tank, which they appear almost to illuminate with their varied tints and ruby-coloured eyes, but, in the weedy sub-jungle off the coast of Madeira they are almost invisible. Not only do their vivid tints harmonize with the colour of the weeds and rocks, but the numerous long filaments adorning the head are practically reproductions of the weeds, coralines, etc. These fish are caught at a depth of between seventy and eighty fathoms, and when they arrive at the surface they are so blown out as to be almost spherical in shape. As soon as they come on board the collecting ship they are pricked with a needle and the air released, after which they are able to accommodate themselves to the much-reduced pressure of 2½-ft. deep tank.

The collection of lizards has been enriched by the arrival of a Londok lizard (*Calotes cristatellus*) from the Far East. As it sits among the foliage this lizard is a bright green, but it is capable of changes in colour even more remarkable than those of the Chameleon. Brilliant blues and reddish-browns are the colours the creature assumes with the greatest effect, and these are most intense at the time of courtship.

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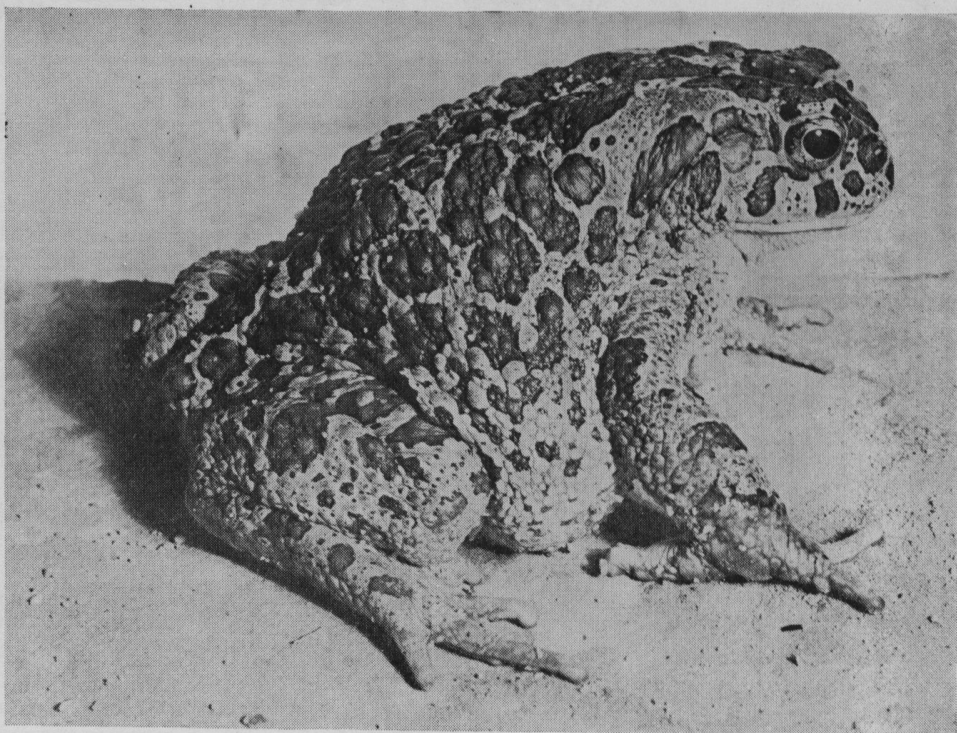
Spring Arrivals

THE first importations of the year of foreign amphibians and reptiles have so far produced two quite unusual species, one a toad and the other a lizard. It is a very long time since the Pantherine or Moorish Toad was previously imported, and the present specimens are large and in excellent condition. As toads go, this is quite a giant, the specimen illustrated being 5½-in. long. Gadow gives the length as 3-in. to 4-in., but this is exceeded by the majority of the group imported.

Its colouring makes it quite definitely the most handsome of the toads. The ground is a pale more or less coffee-brown. The irregular patches are a rich brown with a darker border. The belly and underparts are a uniform creamy white.

This would seem to be an extremely tame species, for it takes small earthworms and mealworms from the fingers readily and without any coaxing. Our specimens show no inclination to molest other quite small toads in the same vivarium, but the small fry are liable to be trampled upon by the big fellow, who gets quite active and lumbers about in a quite ludicrous fashion as soon as it gets dusk. The systematic name of the species is *Bufo mauritanica s. pantherina*.

The lizard which has excited considerable interest among fanciers is one of the Agama lizards, probably



Pantherine Toad

A. stellio, which is native to the Isles of Greece and Asia Minor. This again is quite a large species, and grows to over a foot. The horny scales are set with small spines which are especially marked round the neck and along the back. Mealworms and small insects would be the bulk of the diet in the vivarium, but it is probable that soft fruit and lettuce would be taken in small amounts also.

No two Rivers have the same Colour

NO two rivers in the world have the same colour. This fact was established at a unique exhibition in Innsbruck, where a man exhibited samples of the water of various rivers. The owner of this unusual collection, Thomas Schindler, had made it the hobby of his life to collect water. He spent much time and still more money on this passion. However, he now finds himself well repaid, since two Americans have offered him 4,000 dollars for his collection, which contains water from 3,211 various rivers and brooks.

Schindler started to collect water eighteen years ago. He gathered water personally from rivers near to Ostmark and obtained, through friends, samples from distant rivers. The result of his efforts is now to be seen in the 3,211 flasks, all neatly labelled and all of different colours.

Strauss sang of the Blue Danube, but the water of this river is blue at no place and in no season. It is

grey, except for one stretch in Ostmark, where it is deep brown. This point is near the city of Melk, where the bed of the Danube is thick mud containing iron. The Rhine is green, the Po sometimes quite black; the waters of the Volga are very pure and their colour is a steel-blue. The Thames, before reaching London, is yellow, but the Yellow River and Yangtse Kiang in China are not at all yellow—merely a dirty grey or an ochre-brown. The bluest river in the world is the Rio Grande, on the borderline of Mexico and the U.S.A., and the greenest is the Colorado. The river Tigris in Iraq is sometimes a lovely sky-blue, because it carries great quantities of copper sulphate into the Persian Gulf. There is a river, the water of which is a dead black. This is the Sacramento, which flows into the sea at San Francisco. The exhibitor had a great quantity of information on the mineral contents which are responsible for the colouring of our streams.

Is it a Grass Snake?

By G. A. VALMORE

RECENTLY in one of our London newspapers there were published a number of letters in which the writers stated that the Grass Snake had been seen to eat birds' eggs and take the young from the nests. I have yet to see a Grass Snake climb a bush to take a bird from the nest or attempt to eat an egg; but I have an open mind on these statements, for a quarter of a century given to the study of snakes has convinced me that an exception to their accepted habits

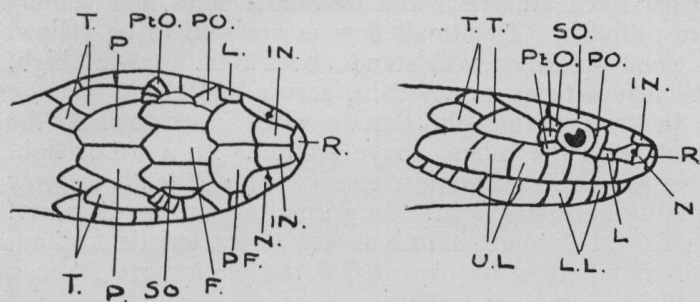
in the same year on Chobham Common. Has the Whip Snake been introduced to this country, and is it really *Zamenis* who raids nests and even takes young part-ridges from the nest?

Many observers of nature will ridicule the suggestion that they were unable to spot our Grass Snake, but I have had brought to me at various times by quite keen observers a Cat Snake, a Dice Snake, and quite a number of Smooth Snakes, and all were called Grass Snakes. The reason for this mistake is not far to seek. We have three snakes common to England, and we do not expect to find anything else. Our Adder is well known, but our Smooth Snake is rare, and when seen to be obviously not an Adder it is called a Grass Snake. The same line of reasoning would be applied to the Whip Snake if seen in the field.

No one acquainted with snakes would be prepared to name a doubtful specimen by colour and marking alone, but head scales are a fair guide. The illustration will help those who are interested in snakes to identify our Grass Snake and Smooth Snake and detect a stranger.

It will be observed that the Grass Snake and Whip Snake both have the nasal shield divided; in the Smooth Snake this shield is whole. The Smooth Snake and Whip Snake have two postoculars, the Grass Snake has three. The Grass Snake and Smooth Snake have one preocular; so has the Whip Snake, but beneath the preocular it has a small shield called the subocular. Other points of difference will also be noticed in the illustration. I must state that there are rare exceptions to the number of scales given in the illustration.

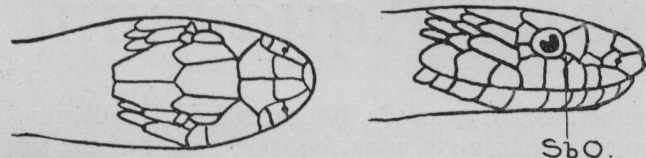
Lastly, if by chance the Whip Snake has been introduced to some of our counties it is a pity, for, apart from the damage it may do to bird life, it will, I am sure, do much greater harm to our reptile life, for I have found that the Whip Snake prefers lizards, slow-worms, and small snakes to mice or birds.



GRASS SNAKE



SMOOTH SNAKE



WHIP SNAKE

F. Frontal; IN. Internasal; L. Loreal; L.L. Lower Labial; N. Nasal; P. Parietal; PO. Preocular; PtO. Postocular; PF. Prefrontal; SO. Supraocular; SbO. Subocular; R. Rostral; T. Temporals; U.L. Upper Labials.

may occur at any moment. However, admitted that a snake here and there does eat eggs and rob nests, is the culprit always the Grass Snake? Although the Grass Snake will climb, it prefers the grass and water's edge.

Once and once only have I seen a Grass Snake eat anything higher in the zoological scale than a frog or toad, and that was a large imported female which on rare occasions would accept a mouse. I cannot say if this snake would eat eggs, but I have never seen anything to approach this happening, and frankly I am somewhat sceptical. The egg-eating and bird-nesting tendencies which have been attributed to the Grass Snake do not suit *Tropidonotus natrix*, but they are the habits of the European Whip Snake, *Zamenis gemonensis*.

In 1936, near Coate in Wilts, I caught a Whip Snake in the act of raiding a nest. In 1938 I caught a Whip Snake near St. Anne's Hill, Chertsey, and yet another

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THIS WEEK'S PLANT

Water Lilies

No pond or lake is really complete without at least one water-lily plant. In addition to their beauty, they provide shelter and shade for the fish and other animal life in the water. Planting may be done at any time between March and October.

So many varieties may now be obtained that it is difficult to know which to choose. Some of the best, suitable for growing in six to twelve inches of water, include Albatross, white with yellow stamens; Escarboucle, vermilion-crimson; Sunrise, pale yellow changing to primrose yellow; and Pink Opal, a deep coral pink. Among those requiring deeper water, up to 3-ft., are Rose Arey, deep rose pink; *Tuberosa Maxima*, white; *Atropurpurea*, crimson; and Colonel A. J. Welch, canary yellow.

J. ST. CLAIR WRIGHT.

Breeding the Spotted Salamander

By T. A. WALDEN, B.Sc.

ALTHOUGH the Spotted Salamander (*Salamandra maculosa*) is common enough in practically the whole of Europe, it is not included in the British fauna. The bright yellow and black livery at once differentiates it from its near ally, the newt, and, indeed, it is far more striking than its British counterpart, the Great Crested Newt. The Spotted Salamander is easily obtainable from dealers, a pair costing between half a crown and five shillings, and its hardiness and readiness to breed in captivity make it a very suitable animal for the vivarium.

In its natural state the Salamander lives under decayed leaves or moss, in the roots of trees, or under stones, and always in damp situations. The vivarium, therefore, must provide adequate cover and must retain the moisture. In practice it has been found advisable to cover the floor of the vivarium with granulated peat and fine gravel. Old and rotten boughs or pieces of bark or moss will provide hiding-places, and ferns and ivy can be planted to give a more natural atmosphere and a decorative effect. The vivarium must be watered frequently, and the salamanders can be relied upon to find the dampest situation.

The Spotted Salamander in captivity has a tendency to hibernate from October to April, but if the vivarium is maintained at a temperature of about 60 deg. F., this tendency can be overcome and the Salamanders persuaded to feed throughout the winter. A convenient method of heating the vivarium during the winter months is to use a 60-watt lamp in a silvered metal reflector placed in an inaccessible position within the vivarium. The artificial light may be screened slightly, but when the vivarium has been planted with ferns and ivy, the extra light will be found to have a beneficial effect on the growth of the plants. If the vivarium is kept in a heated room no artificial heating is usually necessary, although care must be taken to protect the Salamanders from the effects of a sudden frosty night.

Feeding should present no problems; worms, beetles, maggots, and slugs are all taken readily, but the Salamander usually feeds either in the cool of the evening or at night.

The breeding habits and the metamorphosis of the young are exceedingly interesting, and although breeding is restricted to spring and summer, given suitable surroundings, the Spotted Salamander is most prolific, roughly twenty young being born at a time.

Although the species is so common in Europe, the mode of reproduction was not properly understood until the beginning of the present century. Unlike almost all other amphibians, the larvæ are retained within the female for a period of about ten months. The mating takes place practically a year before the birth of the young. The young are usually born from April to June, and are always produced in water, most frequently at night.



The vivarium must therefore contain a small pond or large shallow dish filled with soft water. The young are deposited, each enclosed in an egg-membrane, which immediately bursts and the young tadpole is liberated. These have long external gills, and at birth have both fore and hind legs, developed but very small. The tadpoles are about an inch in length, and black or brown with a metallic lustre. In the first two or three months they become spotted, but do not assume their attractive brilliant yellow and jet-black colouring until they are five or six months old.

The metamorphosis of the Salamander is undergone gradually, and full size, six to eight inches in length, is not attained for about three years.

For the first few weeks the tadpoles feed exclusively on *Daphnia* and to a lesser extent *Cyclops*. At about three or four weeks the tadpoles will readily feed on the freshwater louse (*Asellus aquaticus*). Water lice are easily kept in captivity, and will breed readily. They may be taken in large numbers from almost any pond or canal, where they are usually found clinging to the weeds. They provide good food, not only for the larvæ of the Salamander, but for most of the smaller freshwater fishes, and a stock tank of them will be found exceedingly useful.

It has been found advisable to arrange the vivarium pool with the bottom sloping gradually upwards, and the food is placed in the very shallow water. The young Salamanders at first seem unable to catch live food, and, in fact, seem incredibly stupid. This may be due to their imperfect vision. In a short time, however, they become more skilful, and take the water lice readily. Small maggots and chopped worms can be given until metamorphosis takes place. If the food is always placed in shallow water, the larvæ are continually lured to the

of fanning were interrupted by vigorous onslaughts on snails and floating debris. At this period he refused all food unless it wriggled. The latter type he devoured as the best method of disposing of a potential enemy!

At this period the temperature of the water was maximum 84, minimum 74 deg. F.

April 10 (fourth day).—Seventy-five survivors.

April 11 (fifth day).—The young were still helpless, but the yolk sac appeared to be shrinking.

April 12 (sixth day).—The young were transferred back to their original breeding site on the glass. Many tried to swim, but were hastily seized and spat back on the glass. The male appeared tired, and had lost his colour. He was too busy to eat or even attack snails unless they came close to the young.

April 13 (seventh day).—At dawn the male was discovered in full sail up and down the tank accompanied by sixty-five free swimmers. He had retrieved his colour, his fins were spread, and he looked the real proud father. Alongside him schooled the babies. Any straying outside reasonable bounds were taken in his mouth and blown back into the flock. *Infusoria* were introduced into the tank, and the young were encouraged to feed by father. It might have been a hen scratching and clucking to her chickens. By the evening the young had evaded parental vigilance and assumed an independent existence. It was a pathetic sight to see poor father carefully collecting the five most weakly ones and trying to put them to bed on the original spawning site!

Interesting points arise in connection with these observations:—

(1) Provided other suitable sites are not available, the female will deposit her eggs on the side of the aquarium.

(2) A depth of 18-in. is sufficient for their breeding.

(3) Either parent may turn cannibal at any period of the hatching. Their movements should be carefully watched. When they mouth their young, it should be observed that they return them.

(4) One parent can carry on single-handed and does not seem to miss its partner. The male can be as devoted as in the case of the Fighting Fish, and probably is the better parent to leave with the young, having not been so exhausted by the act of spawning.

(5) Although the eggs show movement in thirty-six hours, they do not develop into free-swimming fry till the seventh day.

(6) Frequent changes of site are essential if the eggs or young are to escape infection by fungus, etc. From this it would appear most unlikely that a reasonable proportion would survive unless at least one parent were present to tend them.

(7) Live food is essential if the parents are not to die of starvation or so lose condition as to be worthless for further breeding for a considerable time to come.

(8) A temperature variation of as much as 10 deg. F. does not appear to have an ill-effect, provided the maximum temperature is above eighty.

Some Notes on the Natterjack Toad

By ERIC HARDY

TOGETHER with Mr. L. G. Payne, Curator of the London Natural History Society, and a well-known contributor to *WATER LIFE*, I have recently been making observations at the great breeding colony of the Natterjack near Ainsdale, West Lancashire. Amongst the interesting facts noted were that these toads spawn much earlier than those in the south; hundreds were spawning on Ainsdale dunes early in April, whereas in Surrey the spawning season is about June. The Natterjacks by far preferred the shallow ponds or "slacks" clear of vegetation, where they exceeded common toads by more than ten to one, to the deeper, heathy slacks and dykes choked with vegetation, where the common toads exceeded them by more than ten to one. The Natterjacks were so numerous that the chorus of their rattling calls was almost deafening—Mr. Payne suggested the possibilities of a gramophone record of their chorus—and many were seen on the exposed sands in the hot midday sun and swimming in the water at midday, a very rare sight in their southern haunts, although they are heard in hiding at that time.

Natterjack spawn is less dense in its gelatinous covering than that of the common toad, which may explain why common toad spawn free from vegetation is more easily wind blown and made derelict; hence the marked difference in their breeding haunts. Numerous examples of a male Natterjack spawning with a female common toad have been found, but not a definite hybrid. Some

fifty dead and partly eaten Natterjacks littered the shores of their breeding slacks, the work of Herons and water fowl.

In Surrey Natterjacks usually lie up in holes under the tussocks of grass or in banks near the water, but this was not noticeable at Ainsdale, where they make much use of the nearby pinewoods outside the breeding season. It is thought that the food of the Natterjack may be more insectivorous than is supposed, and a detailed study of the insect life of the heathy slacks (where common toads are most numerous) and the barren duneland slacks (where Natterjacks are most numerous) may shed light on this fact. The West Lancashire colony is certainly one of the largest, if not the largest, in the country.

* * *

AN EXHIBITION

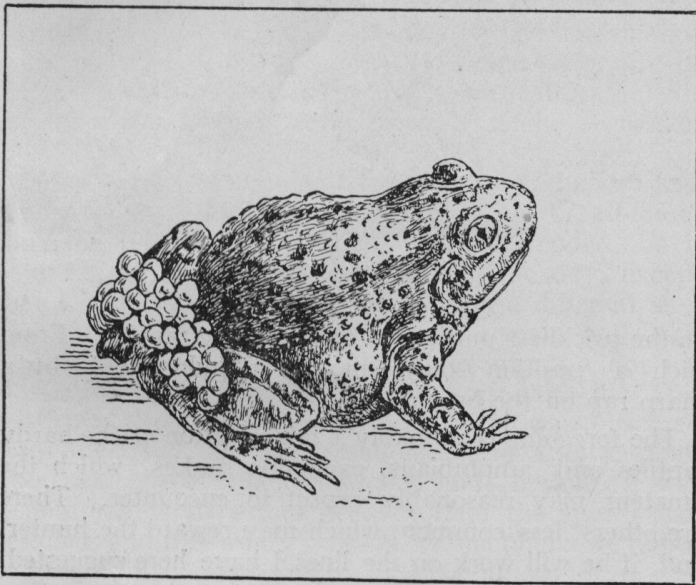
Yet another proof of the rapidly increasing interest in our hobby is given by an interesting and unusual publicity scheme which is being carried out by Messrs. Colliers' Stores, of 37, Walworth-road, London, S.E.17. It consists of an exhibition of seventy-two tanks of fish and twenty-four tanks of reptiles and amphibians. One section is devoted to the development of the Goldfish over a period of 900 years of cultivation. The exhibition will be open for another three weeks, possibly more.

Collecting for the Reptiliary

By L. G. PAYNE

AT this time of the year many amphibians are in evidence during the day, their natural timidity being largely discounted by the urge of the mating instinct. This is therefore undoubtedly the best season to observe these creatures in their natural haunts, and to replenish stock. It is my intention to suggest how this may be done to the best advantage.

In the first place, we must realize that England possesses relatively few species of reptiles and amphibians, and therefore our hunting in this country can only be limited. Let us then decide to take a short



The Midwife Toad

journey across the Channel. In the spring one can stay very comfortably in the north of France for about 5/- a day, and for our purpose almost any part of the hilly districts will be excellent.

Our collecting apparatus consists of (1) a strong net; (2) a handle extending in sections; (3) a few empty chocolate tins; (4) three yards of string; (5) one yard of strong, black cotton. With this modest list we are well equipped for the successful chase of lizards, salamanders, newts, frogs, and toads. The frame of my net is of iron, and it screws into a ferrule. The bag itself is home-made, of coarse netting, and is easily renewed. A 4-ft. 6-in. boy Scout tent pole in three 1-ft. 6-in. sections, with easy-fitting connections, at a cost of 1/-, makes an excellent handle, the short sections being readily accommodated in a rucksack. The string is required for Edible Frogs, and the cotton for lizards.

The most suitable localities for seeking reptiles and amphibians are old quarries of slate, marble, or sandstone, and sandy slopes covered with heather and broom. These abound in Northern France and Belgium.

We have arrived at a disused quarry with a loose debris of boulders and moss-grown stones in the lowest parts. We move some of the smaller boulders, and, if we are fortunate, we find an occasional bright yellow and black salamander up to 8-in. in length. They will make no attempt to escape, and may be picked up and placed in a tin loosely packed with moss. Under the smaller stones we may hope to find immature Midwife Toads. These will be juveniles of 1-3 years which have migrated far from the breeding ponds, and which will not return to the water until attaining the adult stage.

The rarer Parsley Frog should also be seen, but, as he is an active jumper, and has a habit of rapidly creeping down below loose stones, his capture is always problematical.

If we have found these three species in our waterless quarry we have done well, and can now proceed in our search for that best of all sites—the quarry which holds a natural pool. In the springtime the shallower end of this pool may well be covered with the small white flowers of the Water Buttercup, and in the submerged foliage of this, the newts will be spawning and feeding on frog and toad tadpoles. We may now unpack our net and connect the handle sections. Slowly floating through the clear water we see a newt occasionally turning on its back and displaying a bright orange underpart. Newt catching with a large net is easy work, and requires no special skill or knowledge. This one is brought ashore, and proves to be a male Alpine Newt. Newts abound here, and we find in addition Crested, Smooth, and Palmate Newts. I have actually taken these four species in one small pool. Here I would say that it is unnecessary to carry newts in tins of water; they can live quite well for days in tins packed with wet moss, but I would recommend an occasional “bath” if this can be conveniently arranged.

Our attention may now be arrested by a tinkling, high-pitched monotone proceeding apparently from various parts of the quarry. This betrays the presence of Midwife Toads. The males are calling, and, if the month be May, we should find some adults carrying the egg chains tightly wound round their hind legs. Lift these toads carefully, taking care not to let them struggle, for their eggs may become displaced. The toads are olive-grey in colour, and not always conspicuous amongst the grey stones of the quarry. It will be advisable to pack our Midwife Toads in a separate tin with dry moss. We have done well for one day, and can return to our hotel with or without our “catches.” I say this advisedly, for circumstances will decide whether it is more convenient to make a dump of our tins in some cool niche behind a boulder, whence they can be retrieved on a later day, or taken to the hotel, there to be placed in the bedroom cupboard and given a sprinkling of water each night.

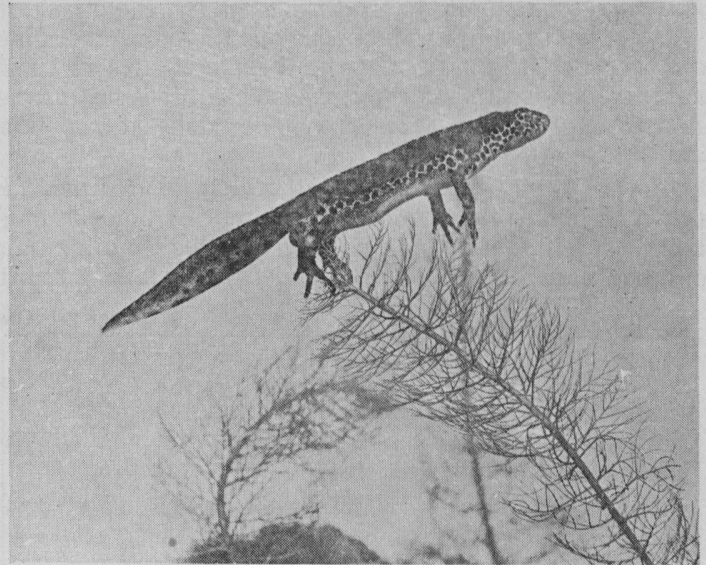
To-morrow we take a different direction—perhaps a short train journey by the coast. Here the land becomes more sandy, and the district less subject to severe frost in winter. If the day is sunny we may look for lizards. To be strictly accurate, however, one does not look for lizards—rather, one becomes aware of their presence. The technique of lizard catching is entirely different from that of frog catching, and is, in my experience, vastly more difficult. Incidentally, it is easier to catch a Green Lizard than a Wall Lizard. Generally speaking, Green Lizards keep to the horizontal surfaces, while Wall Lizards prefer the vertical. In Nature, Green Lizards make short, sharp runs over heather lands and cultivated fields, while the Wall Lizards skim with incredible speed up vertical rock sides, cottage walls, ruins, and even up telegraph poles. I have caught Green Lizards by crawling up to within reach, and then making a swift grab; but perhaps the neatest and most satisfactory method is by use of the cotton noose. This requires a windless day. Connect up the sections of net handle, without the net, and tie your cotton to one end. At the other end of the cotton make a slip noose of about 1½-in. diameter. The stick, with your extended arm, will give a 6-ft. reach, and the lizard will usually permit you to approach this distance. Making all your movements slowly, but continuously, raise the stick high with dangling noose before you get within this distance, then slowly let the noose descend just in front of your intended victim. The lizard will watch the cotton with great curiosity, in no way connecting it with your hand. Then work the noose backwards over the lizard's head. Once over, jerk the cotton sharply backwards again and lift the captive to your feet. Both hands are now required to hold the lizard and loosen the knot. The lizard can then be transferred to a tin loosely packed with grass. The whole process is not easy, and requires practice; but for sheer sport it may well be hard to beat, and the amateur who secures his lizard at the first attempt will have reason to be pleased. All the hardy lizards may be caught in this way.

Our walk over this type of ground may take us to a pond where the Edible Frog gives notice of his presence by swiftly leaping from the water's edge far out into the depths. The nearest frog will give the alarm, but a score may follow him in rapid succession. We may not see one, but the continued "plops" are an infallible sign. Sitting on the bank of the pool, we must now wait a short time until the frogs glide up to the water surface in the middle of the pool. Then, if no danger is feared, they will make for the land in easy stages. Do not make the mistake of waiting until the frogs are on land—it is almost impossible to catch them then. The string should be ready with a worm and small sliver of wood tied on the end, the latter to act as float. This should be flung out to alight on the water a foot or so in front of the intended victim. The wriggling worm will attract the frog, but wait until the bait appears to be well and truly swallowed; then, a quick haul, and the gleaming amphibian is brought to land. A certain amount of adroitness is necessary in finally securing the frog. They should not be closely confined with other species.

In spring, the Natterjack Toad, normally a crepuscular species, is to be seen in broad daylight, the males

sitting in the shallow margins of sandy pools, distending their throats in noisy croaking. It is then quite easy to secure them in the net.

In my experience the Tree Frog is nowhere common in northern latitudes, but single individuals may turn up anywhere. I have found them on the bare margins of sandy pools, very conspicuous in their bright green, on the broad leaves of waterside plants, and high up



Male Alpine Newt

on the prickliest outliers of a blackberry tangle. From such a position they may be dislodged only by a sharp rap on the branch.

The foregoing is probably a fair selection of the hardy reptiles and amphibians, excluding snakes, which the amateur may reasonably expect to encounter. There are others, less common, which may reward the hunter, and, if he will work on the lines I have here suggested, he should have no reason to regret the time thus spent.

* * *

THIS WEEK'S PLANT

Water Dock

Rumex hydrolapathum is a giant among aquatics, often attaining a height of four to six feet. It is most effective when growing in large clumps on the edges of lakes or wide streams, and is naturally not a suitable subject for small pools. The bold, dark-green dock-like leaves turn to bronze and crimson as they age in the autumn, and it is advisable to remove the stout flower spikes in order to prevent them from scattering their seeds about too freely.

Any ordinary soil is suitable, provided it is sufficiently moist, and planting should be carried out during the spring. New plants are easily raised from seeds sown in spring, and the old clumps may be increased by division at planting time.

J. ST. CLAIR WRIGHT.

Tortoises and Terrapins

A WIDE SELECTION AVAILABLE

TORTOISES appear on the market at this time of year in vast numbers. The common species make up the greater part of these, but groups of less usual species are also to be found among the stocks of animal dealers. Most people have at some time kept a tortoise, with varying degrees of success, many would no doubt like to try again, while others will want to own the less common species. The illustrations accompanying these notes cover the species usually available at this time of year, and while others are offered from time to time, the species described will provide adequate interest and the nucleus of a comprehensive collection for the more advanced tyro.

A few words in explanation of the term "terrapin" will not be out of place. The terrapins are those tortoises which have become adapted to an aquatic life. Their shells have become streamlined, their limbs webbed and paddle-like, and their diet carnivorous. The Box Tortoises, of which more later, are aquatic tortoises which are returning to life on land. The Americans speak of all water tortoises as turtles, a term we reserve for the large marine species.

The Mediterranean Tortoise (*Testudo ibera*) is the popular conception of a tortoise, as it is the species that is more or less universally available throughout the spring and summer at remarkably low prices. To house your tortoise comfortably you should supply a sunny enclosure in the garden, with a shelter in the form of an open-ended wooden box with a dry floor of leaves. A vessel of water for drinking purposes is required. Food usually consists in the main of lettuce, but dandelion, clover, banana, orange, peas, etc., are welcome variations.

The Radiated Tortoise (*Testudo radiata*) from Madagascar is an example of the half-hardy land tortoise. The yellow markings on the high domed shell make it an extremely handsome species. It is suited to live out of doors during the three warmest months of the year, but must be kept indoors in a roomy, draught-proof case at a temperature of 70 to 75 deg. F. during the rest of the year. Soft fruit is the most appreciated food of this species.

The European Pond Tortoise or Terrapin (*Emys orbicularis*) is found in almost all pet shops. The black shell and appendages and fine yellow markings are quite characteristic.

The Spanish Terrapin (*Clemmys leprosa*) has a brown shell and similarly coloured head and legs with yellow streaks. Both species are hardy and very active. They need an enclosure with a pool, about 2-ft. deep maximum, if the inhabitants are to winter out of doors. Like the land tortoises, they thoroughly enjoy basking in the hot sunshine.

These terrapins become quite tame, and learn to feed from the fingers quite readily. Small pieces of raw meat and fish, garden worms, etc., form the diet. Better growth will be made if they are fed as often as possible on small live fish. On such a diet much more satisfactory skeletal growth is made.

The Alligator Terrapin (*Chelydra serpentina*) from North America is another hardy species which proves quite attractive in its own way, but, being rather fierce, especially as it grows up, it is really suited only to living with its kind or with other terrapins larger than itself. The shell is small and leathery in texture. The limbs are very fat, giving the appearance, according to one small observer, of being dressed in "plus fours." The head and jaws are extremely strong. Quantities of meat and fish, alive or dead, are the order for this terrapin, and anything that moves is liable to be caught by the amazingly swift and sudden flash of the jaws.

The Box Tortoises, as already explained, are a group of water tortoises which are reverting to life on land. They are characterized by the hinged plastron, or under-shell, which is divided across the middle and is raised or depressed at will, allowing the openings for the head and limbs to be completely closed after these have been retracted.

The Carolina Box Tortoise (*Cistudo carolina*) is the species usually offered, and it thrives on a mixed diet of fruit and meat. The common tortoise is reputed to eat slugs and snails, which, of course, it does not, but the Carolina Box Tortoise really does.

Baur's Box Tortoise (*Cistudo ornata*) is the prettiest of this group, and its dark brown shell is marked by groups of radiating yellow lines.

Importations of large numbers of very small terrapins from the U.S.A. are quite frequent during the summer, and these include a number of species which are not often available as large specimens. They are well suited to life in a small garden enclosure with pool during the summer, but during their first winter in captivity they should be kept indoors in a warm aquarium suitably arranged. Small pieces of meat and fish, freshwater shrimps, bloodworms, etc., are the foods required.

The Elegant Terrapin (*Chrysemys scripta elegans*) is the little bright-green fellow with the red slash along the cheek. This species forms, usually, the bulk of the shipments.

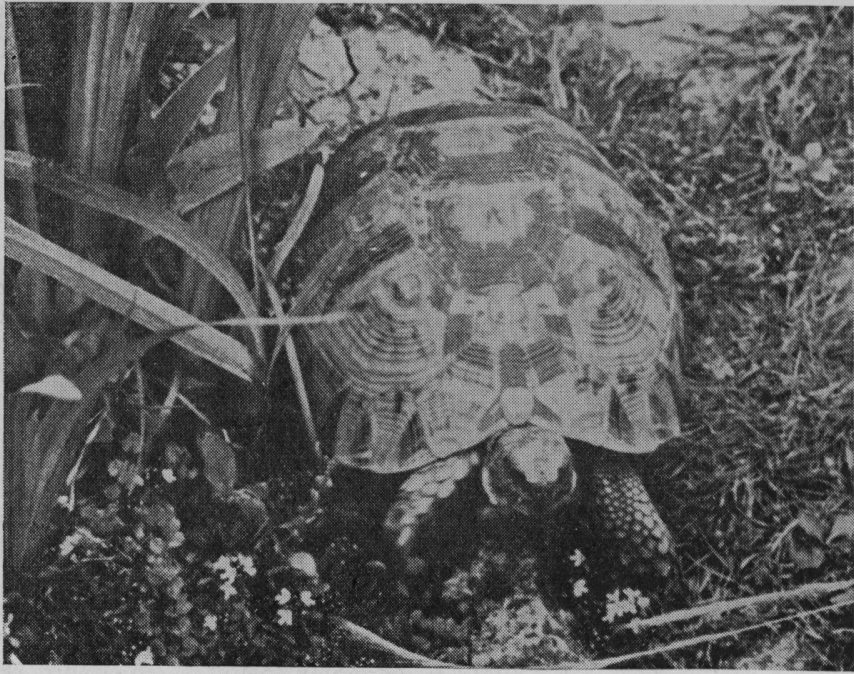
The Painted Terrapin (*Chrysemys picta*) is red underneath and bluish or brown on top, with an orange streak down the middle of the carapace.

The Pseudogeographic Terrapin (*Graptemys pseudogeographica*) is less common. The plastron is a light brown, markedly ridged, and the hind edge is sharply serrated.

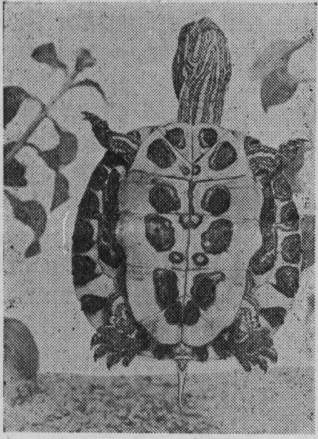
We have attempted to give a short summary of the tortoise in captivity, but more detailed information will be required by those who intend to take up this branch of the hobby seriously. "Land and Water Tortoises" (WATER LIFE Series 3), by "Amphibius," is a unique booklet on the subject, and is full of information resulting from personal experience.

The Tortoises and Terrapins described here are illustrated on the two following pages.

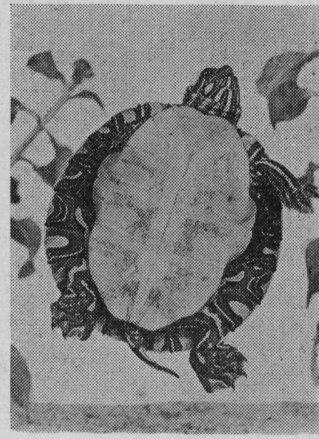
TORTOISES
AND
TERRAPINS



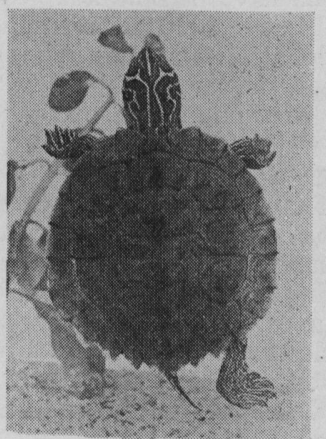
MEDITERRANEAN TORTOISE (*Testudo ibera*)



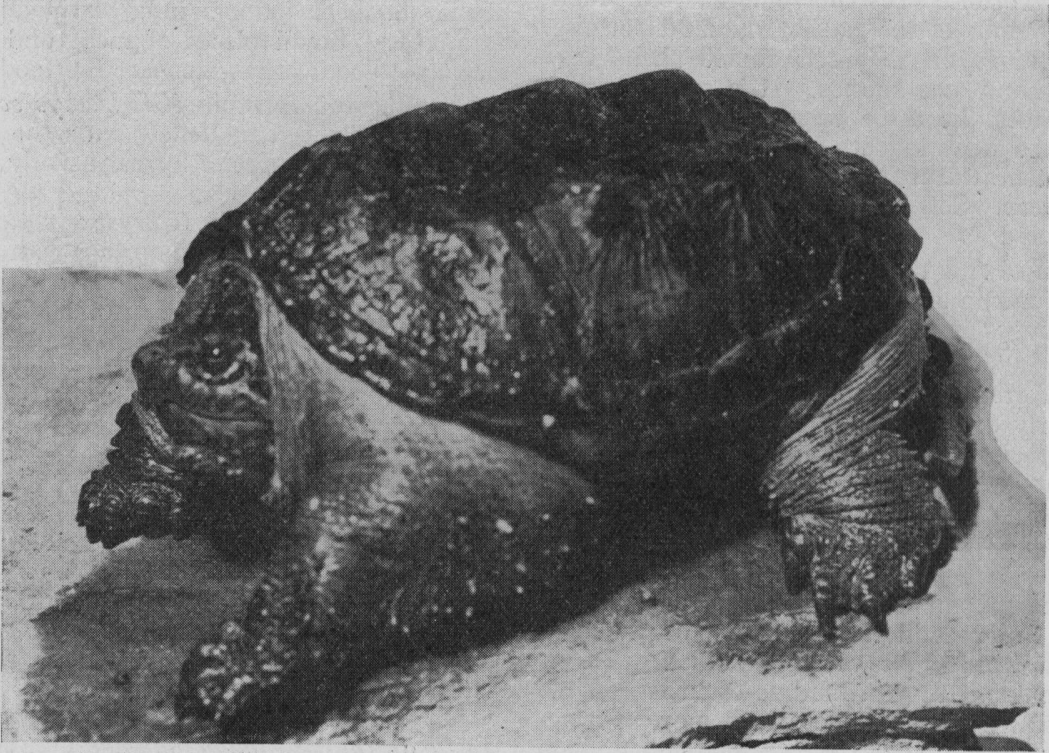
ELEGANT TERRAPIN
(*Chrysemys scripta elegans*)



PAINTED TERRAPIN
(*Chrysemys picta*)

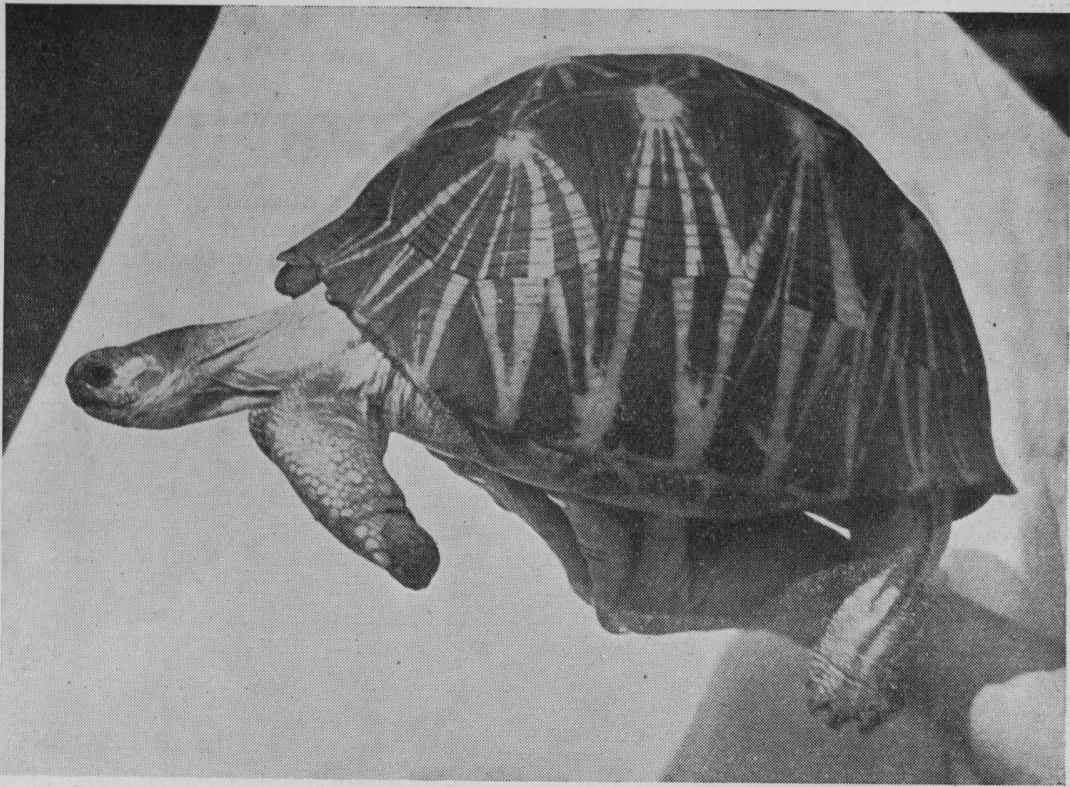


PSEUDOGEOGRAPHIC TERRAPIN
(*Graptemys pseudogeographica*)

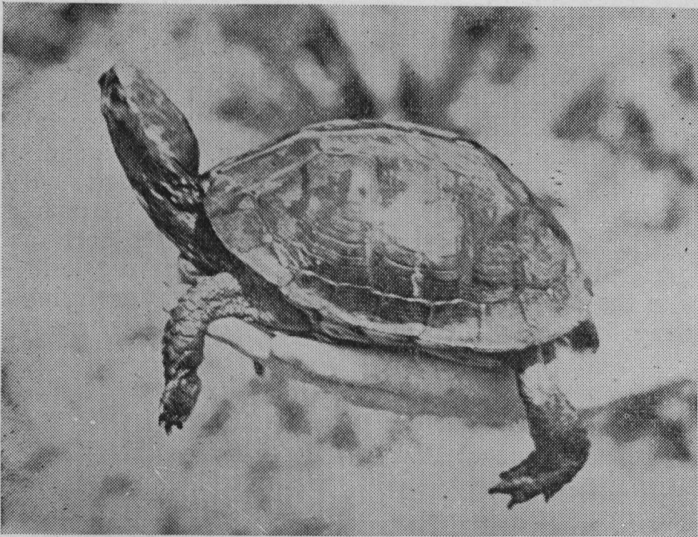


ALLIGATOR TERRAPIN (*Chelydra serpentina*)

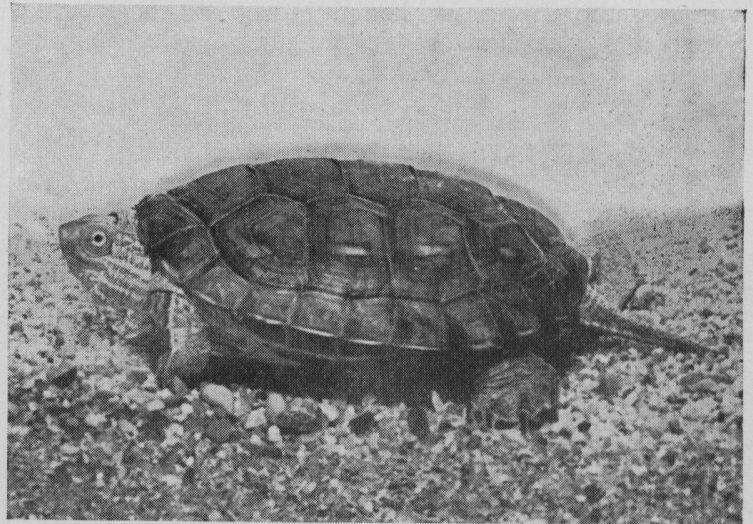
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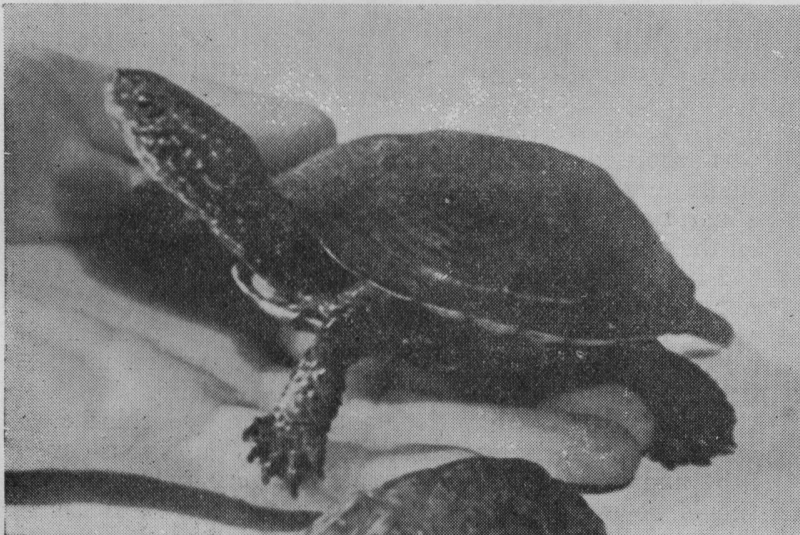
RADIATED TORTOISE (*Testudo radiata*)



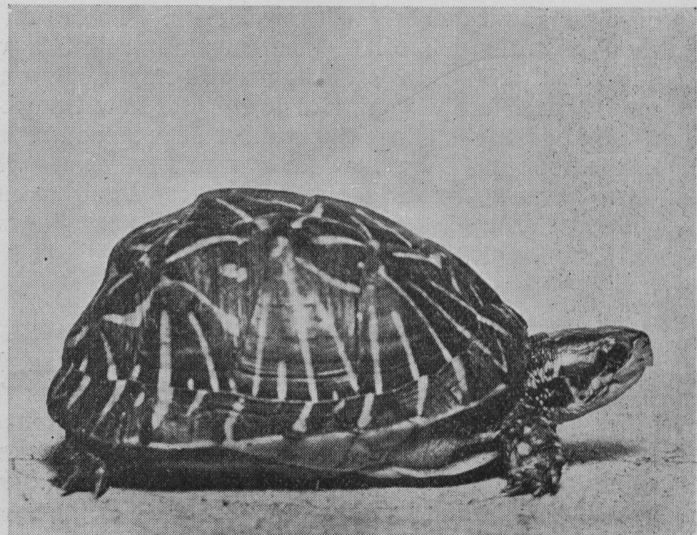
CAROLINA BOX TORTOISE (*Cistudo carolina*)



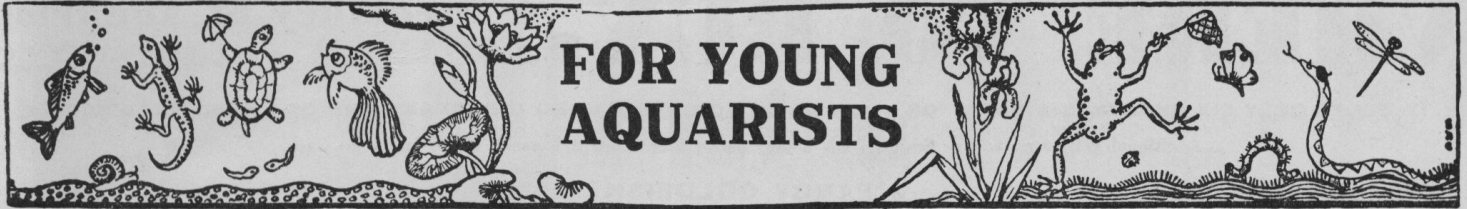
SPANISH TERRAPIN (*Clemmys leprosa*)



EUROPEAN POND TORTOISE (*Emys orbicularis*)



BAURS BOX TORTOISE (*Cistudo ornata*)



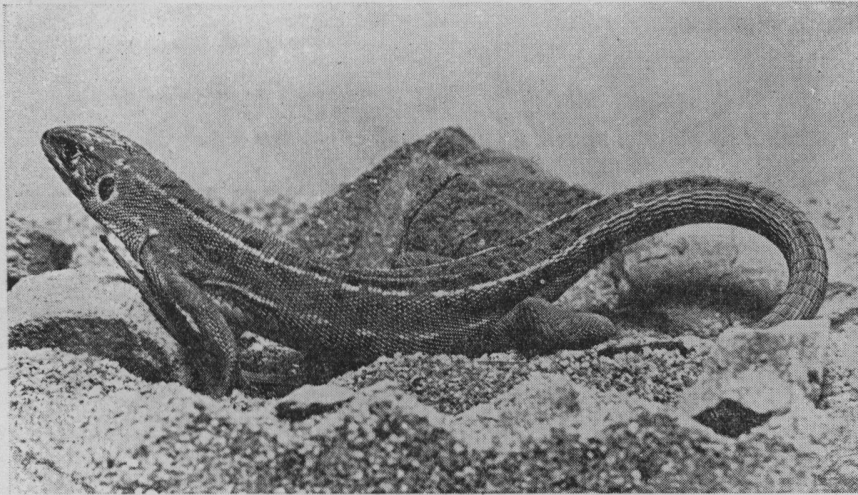
FOR YOUNG AQUARISTS

COMMUNITY VIVARIUMS

By ARTHUR COOPER

Part 2.—Lizards

The community vivarium for lizards should be as large as possible. If it is to contain six lizards, the area of the floor should be at least eight square feet. A layer of sand about an inch deep should be put on the floor, and then rocks, bark, gravel, and moss should be strewn about naturally to form caves. A good sleeping and hibernating retreat can be made from the husks of coconuts. The water trough must be large enough to enable the lizards to bathe.



The Green Lizard

The following lizards will mix quite well: Green, Wall, Sand, and Viviparous Lizards, and also Glass Snakes. The Green and Wall Lizards will thrive on a varied diet of insects, including mealworms. The staple diet of the other three is earthworms and also other insects. If the lizards are large, grasshoppers make a good change from mealworms.

RAISING THE TEMPERATURE FOR COLDWATER FISH

It is a well-known fact, that keeping tropical fishes at a high temperature hastens their life-cycle and makes them reproduce continually. Have you ever imagined if this would happen with coldwater fish?

Go about it like this. Take a few common Sticklebacks and establish them in an aquarium. One day, when the sun has heated the water to about 70 deg. F. or so, instal a heater which should be powerful enough to raise the temperature to about 75 deg. F. Almost immediately a change comes over the fish; they are more active and the male assumes his brightest colours. Young grow very fast, but wait—after a few days the fish fade off for no apparent reason; surely their death was due to their life-cycle being hastened, as in the case of the tropicals. However, try it sometime, as my experience might be exceptional.—B. MEAD (age 14).

FEEDING TIME IN THE REPTILE HOUSE

By RONALD PETRIE

One Friday during the holidays my Uncle Jack took us all to the Zoo, and, without realizing it beforehand, we couldn't have chosen a better day, because the reptiles are all fed on Friday afternoons. We got to the reptile house at half-past five, and saw a keeper walking about with a handful of dead pigeons, rabbits, mice, and rats.

The big boa constrictor had already been given a whole goat, and was getting very excited, uncoiling himself gradually foot by foot all ready to wind himself round the goat. I watched the keeper dangling a dead mouse in front of a baby boa constrictor who seemed to be asleep. Suddenly the boa constrictor woke up, and before I realized what had happened, it had snatched the mouse from the tweezers, and was hugging it, obviously thinking it was alive.

I've often wondered whether the alligators and crocodiles ever move; now I know, they do! They were all lying like logs in their enclosures, then the keepers went in with a bucket full of huge chunks of raw meat. In an instant all the creatures were very much awake and on the alert. With snapping jaws and thrashing tail each animal caught the meat thrown to it, and within three minutes or so of the entry of the keepers each alligator and crocodile was lying like a log again, and

I could hardly believe they had ever moved.

The Komodo Dragons were each given two dead pigeons. They grasped the birds, one at a time, in their mouths, and then stood and gulped hard for several minutes, then suddenly, after an extra hard gulp, the pigeon disappeared from sight, whole.

Walking round the reptile house after feeding time, we saw that all the snakes had enormous bulges in their bodies, and looked very peaceful and happy.

THE DIARY OF A YOUNG AQUARIST

By PETER LIVINGSTONE

I happened to be examining a ditch the other day when I saw one small fish in a very shallow pool. I didn't know what it was, and I hadn't got anything to put it in, so I looked round a bit and found a jam jar in the hedge. I gave it a good washing and then caught the fish and put it in. I got it home and found that it was a Loach (or rather, is a Loach, for it is still alive and happy). It is long and rather tube shaped, with six big whiskers. I have put it in a 6-gall. aquarium, the biggest available, with a drip aerator. I feed it on chopped earthworms and scraped meat. From what I hear Loach are not very common, but can sometimes be found in shallow ponds and streams.

Frogging in Jamaica

By JOHN ARMITAGE

IN the West Indies, there is an extensive genus of diminutive tree-frogs now known as *Eleutherodactylus*, formerly *Hylodes*, in which nearly all the members have returned to life on the ground. They lay large separate eggs on earth among vegetable debris; and in due course miniature frogs appear without passing through a free tadpole stage. Then there are the West Indian Tree-Frogs proper (*Hyla*): goggle-eyed creatures with long hind-legs and lobed toes. Some of them live at considerable heights in trees among parasitic growths known as wild pines, and others pass the daytime in tree cavities and hollow branches.

Among Antillean islands, the British-owned island of Jamaica is outstanding, possessing at least seven different kinds of ground-breeding Frogs, besides one introduced from Martinique; there are four species of *Hyla*, and a big Toad introduced from Central and South America is common and widely distributed. Jamaicans call the little brown frogs "Whistling Frogs"; the arboreal tree-frogs are dubbed "Tree Toads," while the toad—*Bufo marinus*—is known to all as the "Bull Frog"!

When it became known that my wife and I intended to spend a full spring studying and photographing the flora and fauna of this lovely tropic land, fittingly styled "Queen of the Caribbean," it was suggested that we might collect and preserve for the British Museum, certain reptiles and batrachians whose status is only imperfectly mapped out. The suggestion was accepted; and the pursuit of frogs on plains, plantations, forests, and mountains became the main objective through April to the end of June.

Shortly after our arrival at Kingston, two young men,



Jamaican Frog (*Eleutherodactylus luteolus*)

hearing of our desires, told us that there were plenty of Whistling Frogs on their property a few miles out of town. In quick time the place was inspected, and several frogs were located hiding under stones, plant-pots, and garden litter; and late that night many others were seen sitting on low bushes, singing lustily and reminding us of cart-wheels in dire need of oiling.

That day was one of many spent in various parts of the island, hunting for the little brown frogs, learning of their specialized habits, and readily identifying their distinctive calls by night. In Cedar Valley, we met a man who had assisted Mr. E. R. Dunn, the American herpetologist, when collecting and classifying the frogs of Jamaica in 1925. He told us that late one evening, Dunn



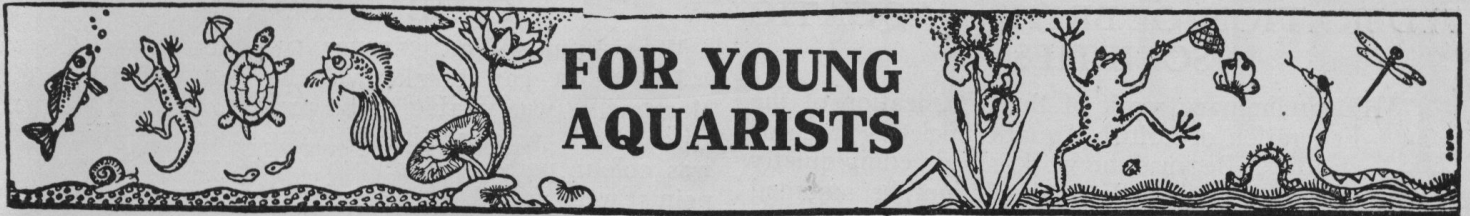
Jamaican Tree-frog (*Hyla brunnea*)

and he were out collecting when suddenly the expert's ear caught the call of a new frog, like the sound of a stick being drawn across a comb. Dunn was crouching on a rock, but he leaped forward, bruising himself badly, but securing the prize. No doubt the frog was the very local *E. junori*, a white-bellied creature that lives about holes in rocks.

Up in the Blue Mountains during the middle of June severe storms hampered our activities considerably, and photographic work was impossible. Frogging and mollusca collecting proceeded smoothly, however. We got in touch with a school inspector who lived on a derelict coffee estate. He was anxious to help us, and proposed a hunt one day before breakfast, stone-turning for ground-haunting frogs and delving among the dripping wild pines for tree-frogs. Rain was falling steadily when he arrived at dawn, hatless, and clad in a jersey, shorts, and football boots. Long past breakfast time, with a fine haul of frogs and soaked to the skin, we tried to take a short cut homewards. On all sides there were creepers, thorns, and rope-like lianas; and frogs were forgotten as we struggled to extricate ourselves.

Our hatless friend was typical of the many Jamaicans who took us in hand. Nothing was too much trouble for them; and the more difficulties they encountered, the better they seemed to enjoy it.

Catching arboreal frogs in the ant-infested trees was exciting work, and exasperating, too, when an intended victim took a tremendous leap and landed in another tree. Once, in the parish of Trelawny, I took some fine examples by accident. We were being entertained and



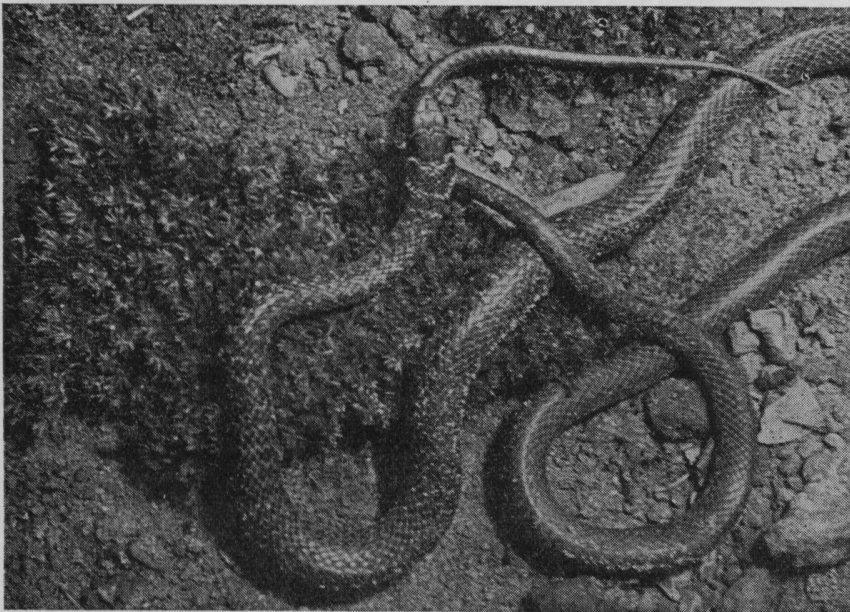
COMMUNITY VIVARIUMS

By ARTHUR COOPER

Part 3.—Snakes

A good rule for keeping snakes is to allow one and a half square feet of room for every foot of snake. Not many species will agree together, but the following mix quite well: Grass, Aesculapian, and Garter Snakes. If the owner wishes he can also include the Glass Snake.

The vivarium should be furnished in the same manner as for lizards, with sand, rocks, bark, and moss. The



Aesculapian Snake

pan of water should be rather large, as Grass and Garter Snakes like swimming. Aesculapian Snakes are semi-arboreal, and Glass Snakes like crawling under stones and in caves. All these reptiles will feed on worms, beetles, small fish, tadpoles, and mealworms.

THE DIARY OF A YOUNG AQUARIST

By PETER LIVINGSTONE

Last Sunday we went to Whipsnade, and we saw a Beaver. It seems to spend most of its time under water, but we were lucky, as it was lying in the water watching the crowd. It is a remarkably intelligent-looking animal, and it seems to use its huge tail chiefly for swimming. There are lots of sticks in the pond, but I could not see any sign of a dam being built. I suppose this was because there was no running water, and they are much too intelligent to build a dam for nothing.

We saw several green lizards in the "Poisonous Snakes" enclosure, but we could not see any snakes.

There is not very much at Whipsnade which you can call really aquatic, and it seems a pity that they have not made either an aquarium or a vivarium. Anyway, the other animals are great fun, and the chimps alone are worth a visit.

"ALICE"

One April, when I was thirteen, I caught a lizard, basking on a plank by a half-built house. She was about seven inches long, half of which was tail. Her back was dull brown, but she was a lovely pale-lemon colour underneath. I took her home in an old tin, and she was christened Alice by my family. She was placed in an old bath, with sand and rocks on the bottom, and several clumps of grass. This was put on the bird-bath, out of the way of the cat.

Every morning the rocks were sprinkled with water, and she drank all she could find. On hot days more water had to be put in in the day-time. She ate spiders, preferring large spiders that took two mouthfuls. Then someone discovered she would eat flies floating in a saucer of water. Everyone was commandeered to swat house flies and put them in Alice's saucer. One day I let her out on a grass bank, and she just walked to the top and stayed there, sun-bathing. After that Alice was let out every fine afternoon, and found half her food for herself.

In the middle of July we suddenly saw two small bronze lizards about half an inch long in a corner of the bath, and Alice on a rock looking very proud of herself. On looking under a mossy piece of bark we found about a dozen eggs, made of something rather like jelly, and the small lizards could be seen inside. In two days the lizards had all hatched out, and just basked in the sun, occasionally darting a few inches over the rocks and then stopping still again. After a few days the young lizards started to eat small spiders, I gave them a piece of rose-tree covered with green-fly, but they took no notice. The babies grew very well for a month or so, and were very lively. Then at the end of August, when I came to look at them one morning, I found five were dead. I could not think what had happened, for the others were perfectly healthy. The next morning another one was dead. I did not know what to do for the remaining seven, so I put them in a box and let them out on the downs, fairly near to the spot at which I caught their mother.

Alice was still eating as many spiders and flies as she could get, and was all right for a fortnight. The day before we went away I fed her in the morning, and came back with some more flies at midday, to find her stretched out on her rock, dead. I just could not believe it. I took her indoors, and put her by my plate throughout lunch, much to my family's disgust. When she did not come to life, I cried until we left for our holiday. I buried her in a quiet corner of the garden, and she now has a monument to the memory of the first lizard I ever kept. I have had others since, but they have never been quite as nice as Alice.

V. M.

were removed. There was also a mass of immature eggs which must have represented another 2,000 at least.

Some years ago a shipwrecked seaman marooned on a Great Barrier Reef island obtained 1940 eggs from a "green" turtle he had captured for food.

The mature eggs are about the shape and size of billiard balls; they are white, with a soft, glutinous shell, which is very tough, but which shrinks up when exposed to the air for any length of time. The eggs are delicious, and can be used in cooking. Usually only the yolks are used, and they can be preserved for long periods; they harden when dipped in boiling water for a few minutes, and in this condition will keep indefinitely.

But it is not always easy to find a nest of eggs, and often visitors to the Great Barrier Reef islands have spent hours in digging up the sand just above high-water mark without finding a trace of a nest. The simplest way of locating a nest is in the age-old manner of the natives; they walk up and down the sand, above the high-water mark, and with every step drive a long spear into the sand to a depth of 2-ft. or so, and then withdraw it to see if the point has punctured an egg.

When she has finished laying her eggs, the female turtle fills in her nest with the sand removed, and she smooths the surface so well that no one seeing the spot afterwards would imagine that it concealed a nest.

The young turtles hatch out in about six weeks, but it has been estimated that not more than two out of every fifty babies reach maturity. Scores of them are taken by birds and crabs when journeying from the nest to the sea, while most of them that do reach the water also perish—as fodder for hungry fish. Despite this heavy mortality, however, there has never been a scarcity of turtles.

When fresh from the nest the babies are about 4-in. long, with their black carapace and flippers prettily outlined in white; at this stage they are not inconvenienced at all by being turned on their backs. They simply wriggle and turn over again as naturally as any other baby. But when a month or so old, and from that time on, the turtle, like the fully-grown adult, is entirely helpless when turned on its back on the sand; it cannot regain its natural position, even though it exhausts itself in its efforts to do so.

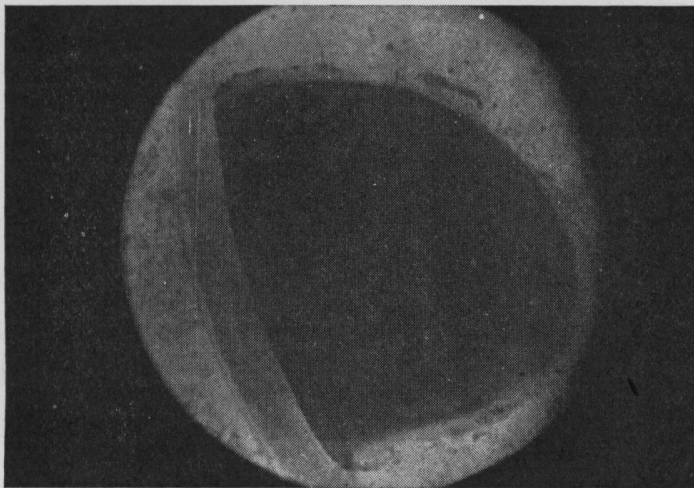
Intestinal Worms in Salamanders

By J. Th. ter Horst, "De Natuurvriend," The Hague

I SHOULD like to quote from my vivarium journal something which I experienced in raising a number of Spotted Salamander larvæ (*Salamandra maculosa*). For many years I have owned, among others, a splendid specimen. In 1933 I was

manifested themselves, and the first deaths among the larvæ took place, in spite of my great care to maintain the purity and level of the water, which I changed regularly. As there was no outward sign as to why the little larvæ had died, I sent a dead one to our fish specialist, Mr. P. H. van Gijn, who made a microscopic examination. According to his communications, the intestine was in several places on the interior infested with what seemed to be the capsule of young intestinal worms. In these capsules lived young larvæ.

The capsule is clearly visible attached to the wall of the intestine in the adjoining photomicrograph made by the above-mentioned gentleman. Not only would the parasite destroy the interior of the animal, but the fairly large capsules in large numbers in such a relatively narrow intestine had also caused constipation. Upon advice the larvæ were fed with white worms (*Enchytræ*) soaked in cod-liver oil, which produced a considerable evacuation, with the chance that the capsules and eventual worms would be expelled with it. Furthermore I had to siphon off the top layer of the ground material and replace it with new sand washed in salt water. The result was that the deaths ceased. It is true that in the beginning I still lost a few larvæ, evidently because I had fed them with too many *Enchytræ* (so that an oily film floated on the top); however, after this defect was also overcome there were no further deaths. The rest of the specimens prospered during the remaining summer months, and in the middle of September they took to land, and the metamorphosis was completed. When the time for their hibernation arrived, there were seventeen left out of the nest of forty-four—all at least 2-in. or 3-in. in size. My intentions are to help the readers of this periodical by describing the appearance and method of combating this parasitic disease.



(Photomicrograph by P. H. v. Gijn)
Capsule of Intestinal Worms

pleasantly surprised with a number of little ones, altogether no fewer than forty-four! The first days of these yellow and black friends passed normally. The aquarium in which I was keeping them measured 12 x 9 x 8½, and was planted with common water weed (*Elodea canadensis*), pond weed (*Potamogeton natans*), and Hornwort (*Ceratophyllum demersum*), and the water level stood at 4½-in. *Daphnia* and earthworms cut into small pieces were furnished for food.

When the warm season began, the first difficulties

The Sand Lizard (*Lacerta agilis*)

By ALFRED LEUTSCHER

THE Sand Lizard, a British species, is not so well known to reptile enthusiasts as other lizards because it seldom finds its way into the animal market. Financially, it would not be profitable to collect in this country owing to its very local distribution. It prefers sandy localities in a wild state, and to-day is chiefly found in dune areas, such as those in parts of Hampshire, Dorset, and Lancashire. This distribution seems to tally with that of the rare Smooth Snake, which feeds on this lizard. Along the Atlantic seaboard on the Continent, however, it is exceedingly common, and I have frequently come across it whilst walking through the sand dunes along the coast of Holland.

The sand of these dunes is bound together by numerous plants, such as the marram grass, *Psamma*, the dune sedge, *Carex*, and other deep-rooted species. In the dune slacks, which pass between each ridge parallel to the sea one comes across areas of lush vegetation where grow various grasses and reeds and damp-loving plants, such as the sundew and the mosses. These patches form as a result of a heavy moisture content of the soil, brought about by underground seepage of rain water. Among the low-lying briars and bog myrtles of these "wet" areas live the Sand Lizards. They are to be found on sunny days basking on the sand or heather, but at one's approach will beat a hasty retreat into the undergrowth. A rabbit burrow may even be used for this purpose. With a little patience one can approach close enough to catch one.

They are, however, exceedingly nimble, and may continually elude one's efforts to capture them. A method I have adopted with success is to use a small trap with a spring door, inside which is placed a tempting bait. Something alive is preferable, such as a wriggling worm or small beetle. Sand Lizards, I have noticed, are very alert at noticing a likely meal, and very soon one should become attracted to the spot. At the crucial moment the catch can then be released by a length of thin cord, held in the hand and connected with the door.

In this way the lizard hunter can wander through the dunes and pick out likely spots for setting the trap. I do not advocate the net-catching method of the entomologist, as a net, more likely than not, is liable to catch in some bush or other, and give the quarry time to escape.

At a superficial glance the Sand Lizard might easily be confused with the Common or Viviparous Lizard. In parts of Dorset, for example, the two species intermingle freely. The general colouring of the former, however, is of a more yellowish-brown, which is broken with longitudinal bands of a darker shade. Rows of brown and white patches along the flanks give the impression of stripes. The darker markings in the bands often have white centres and form a typical character in this Lizard.

An adult male measures about eight inches, of which the tail contributes a good half. The head is rather short, and has a somewhat blunt snout. In contrast with the Common Lizard, it possesses extra rows of teeth, the vomerines, in the upper jaw.

In the spring the male puts on a courtship dress in which a bright green predominates. As a result it is often mistaken for the Green Lizard, which is really a native of the Channel Islands and parts of Southern Europe, but may be met with in England as an escapee from captivity. The Sand Lizard lays eggs, and the female, usually larger than the male and coloured a more sombre shade of brown, may be induced to lay in captivity. She should be given a suitable medium in which to lay, such as a good supply of dry silver-sand mixed with a little soft loam. This should be spread on the floor of the reptiliary or vivarium, and to imitate natural surrounds groups of stones and xerophytic plants, such as bits of heather, dwarf furze, and even cacti, may be planted. The female will lay her eggs in the sand, and with reasonable luck these should hatch out in about a month. The eggs, about twelve in number, are of the size of a Wren's egg, grey in colour, and soft to the touch. The spot in which they are resting should be kept moist to prevent their drying up. The young, about an inch and a half in length, are pale brown in colour with cream underparts.

Feeding should present no difficulties. Globe fly-traps, to be purchased at most hardware stores, will ensure a plentiful supply of natural food. To vary the diet, an occasional worm, caterpillar, or small piece of raw meat may be given. Garden spiders are greatly relished. The much overrated mealworm, though a good standby, is, I find, not too popular with Sand Lizards, as they seem to prefer something smaller and more tasty to satisfy their keen appetites.

This Lizard appears to be more hardy than most other species, and can stand greater temperature extremes. If fed regularly and frequently it will become exceedingly tame and intelligent. Care should be taken in handling it, however, as it possesses the habit, in common with many lizards, of shedding its tail if treated roughly.

As this lizard is the rarest and most locally distributed of the three English species, discretion should be used as to the number collected in this country, and visitors to the Continent might try to introduce fresh numbers into the English sand dunes. In this way I have successfully liberated Sand Lizards from Holland which were collected there on holiday.

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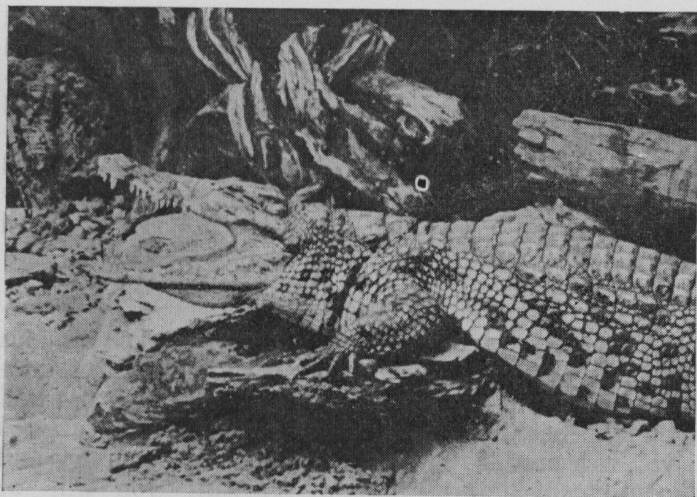
"A popular hobby which aquarists could adopt is 'Grangerizing,' named after its best-known practitioner. This hobby consists of collecting newspaper and magazine clippings and photographs, and pasting them in one's books, in appropriate volumes. In this way I have added interesting appendices to my aquarium library, consisting of cigarette cards, odd items from newspapers and photographs. I recently got some magnificent goldfish photographs from a popular weekly, which now serve as admirable end-papers to Volume 5 of WATER LIFE."

The Berlin Aquarium

By HANSJOACHIM MITSCH (Translated by Margery G. Elwin)

THE Berlin Aquarium is one of the largest and most comprehensive of the public aquariums. It was opened in 1913, and cost £50,000. The three-storeyed building is 170-ft long by 115-ft. wide. On the ground floor are housed the freshwater and marine tanks, of which there are twenty-five, each about 10-ft. long, 7-ft. wide, and 5-ft. deep. There are also twenty-five smaller aquariums. On the next floor are the reptiles and amphibians, with nineteen very large exhibition compartments and sixty-nine smaller vivariums. On the same floor is the spacious Crocodile Hall, 90-ft. long by 30-ft. Finally, the top floor is given over to insects.

In the cellars are air compressors producing 18 cu. ft. per minute, of which three-quarters is available for



aerating the aquariums. The marine section has a water reserve of 300 tons of water, which circulates through the tanks.

From the exhibition tanks the water runs over an enormous sand filter, whence it passes to collecting vessels, and is then pumped up into the water tower incorporated in the building. From this it runs under pressure into the aquariums. Where necessary there are additional filters containing activated charcoal.

When the aquarium was opened, 300 tons of sea water were brought by boat up the Elbe from the North Sea to Berlin and pumped, with the aid of a 1,000-ft. hose and the fire brigade, into the aquariums. To-day artificial sea water is used, with excellent results.

There are many auxiliary motors in reserve in the event of a breakdown, and the Aquarium has its own printing press. So much for a general survey.

Entering the building via a small hall, we pass up a broad outside staircase to a large hall. To the right of this is the horseshoe-shaped exhibition gallery. The first half is devoted almost entirely to freshwater specimens. First we notice numerous very beautiful Angel Fish and *Symphysodon discus* in a well-planted and attractively set-out aquarium. Then in the next aquarium there are, strangely, gigantic specimens of the N. Ameri-

can and African Soft-shelled Turtles. Amongst these giants bustle shoals of Cichlids, mostly mouthbreeders of various species. Passing on, we see tanks of Ide, Bleak, Catfish, Sterlet, Crucial Carp, Roach, Pike, and Pike-Perch. Finally, we reach an aquarium, nearly 20-ft. long, inhabited by the various types of Carp—Mirror Carp, Leather Carp, etc. Some of these are 33-lb. in weight! Here also is a 6-ft. long Catfish which was caught in a lake near Berlin. In order to combat fish-lice in this tank, a strainer is fixed near the bottom of the tank attached to a long rubber tube. Built into the strainer is a small electric light, and after dark the lice, attracted by the light, wander into the sieve and are sucked up the tube by a current of water into a collecting basin.

Our round now brings us to a large aquarium in which a miniature "mountain stream" cascades over rocks and stones. Here, in the cool, highly aerated water, noble specimens of Trout disport themselves. As a contrast is seen in a dark rocky "cave" near by a Japanese Giant Salamander, 4-ft. long and 35-lb. in weight. Near it dwells a close relation, the North American Mud Puppy.

On the inner side of the gallery, which receives plenty of daylight, are many small tanks containing native and North American fishes.

On the way to the marine section we pass along a corridor, each wall of which is an enormous aquarium, the glass being strengthened by a great iron frame in six pieces. From here one can see into the water of the Crocodile pool, situated on the first floor, and one can occasionally observe the way in which the armoured reptiles swim.

The marine section contains in the outer wall great tanks housing the coastal forms of Istria, Heligoland, etc. The rocks have been taken from the original site to Berlin and artistically reassembled. There are also to be seen tanks containing the incomparably beautiful Coral Fish, which are unfortunately so short-lived in captivity. The Edible Turtle is also present.

Next follow tanks containing the Rays and Flatfish—Plaice, Flounders, Soles, Turbot, etc. In one tank, representing a part of the Istrian coast, after every importation are to be seen Cuttlefish and Octopuses. There is also on this side an 18-ft. long double tank containing deep-sea fishes.

Still more aquariums follow, with interesting inhabitants. I must mention here that Herrings have been successfully kept in this aquarium for over fourteen weeks, a record for an inland aquarium. Young jellyfish only 2-cms. across have also developed in captivity to full-sized adults and lived for over seventeen weeks.

Reaching once more the large hall, we pass up the main staircase to the reptile and amphibian department. Here are the giant and other land tortoises, and vivariums containing tropical tree frogs, native reptiles, and various terrapins. Now we come to the great exhibition gallery. First we notice forest vivariums, with luxuriant vegetation, then we pass terrariums with ever-decreasing vegetation, until finally we reach those of the desert.

The Berlin Aquarium is famous for its very fine collection of poisonous snakes, many of which are very rare. In between are vivariums containing Chameleons, Iguanas, Mediterranean Lizards, Basilisks, Giant Lizards, etc. There is also a fair sprinkling of Puff Adders, Spectacled, and Rattle Snakes.

Well worth seeing is the large vivarium containing the very rare Komodo Dragon. This 9-ft. specimen is very tame, and is allowed to wander freely, when the house is shut, along the passages.

The giant snakes compartment is heavily barred. In it are two Reticulated Pythons 22-ft. long, Anacondas, and Boa Constrictors.

In two niches are forty aquariums containing fish of especial interest to the fancier. In over 130 species are

collected all the fishes that the heart desires. On the inner side of the corridor we see well-laid-out vivariums containing poisonous snakes, Mud Skippers, and Giant Toads, and also aquariums containing Electric Catfish, Electric Eels, Knife Fish, and Archer Fish.

Finally we come to the Crocodile Hall. We set foot on a bamboo bridge, and see below us a primeval forest river with a sandbank, and, in the background, a native hut. Round us grows thickly a jungle of tropical plants, where moist, warm forest air prevails. In the water and on the sandbank swim the Alligators and Crocodiles.

It is impossible even to name all the creatures which are on show, and this short account can describe only a small section of the Berlin Aquarium.

Encyclopaedia Aquatica

(HINTS AND TIPS FOR BEGINNERS)

Slimy Algae

Slimy algae troubles us all from time to time, but usually where the aquarium is not over-populated with heavily feeding fishes the problem cures itself as soon as the decorative plants become well established. A suggested measure for combating this unpleasant algae was mentioned recently in a continental aquarium paper. It was to paint the light side of the aquarium with a thin layer of brown paint. This can easily be removed with a razor blade when the pest is finally cured. We have not tried this idea, but pass it on; perhaps someone who is troubled this way may care to experiment.

Snails and Dead Fish

A fish dies in the aquarium while we are away during the day, and when we come home we find the corpse is the site of a snail picnic, and it is surprising how quickly they will pick a small fish clean. A correspondent asked us if snails ever attack live fish, and we can answer quite definitely that the species of snails kept in aquaria will not. Other fish, especially tropicals, will nibble to pieces a dead companion, and we have several times been amused to see young *Mollienisia*, the vegetarians of vegetarians, heartily consuming a defunct brother or sister. To return to snails for a moment. In the aquarium we usually stick to the red varieties of *Isadorella* and *Planorbis*, and the reddest specimens of *Isadorella* we have ever seen lived in the tropical aquarium of a fancier who every week gave his fish a large meal of finely chopped beef or heart. The many snails in each aquarium adequately and to advantage dealt with the leftovers.

Egg Yolk for Fry

In spite of best intentions and efforts, the supply of *Infusoria* sometimes fails when we have a large batch of fry on hand, and we are thrown back on artificial foods. Yolk of egg properly prepared and used is an excellent substitute, and is extensively used by many breeders. An egg is boiled absolutely hard, opened, and the yolk extracted. A piece of this is placed in the centre of a piece of fine silk or organdie: this latter is

the stuff we have previously recommended for small nets. The yolk is screwed up tightly in the silk, and the little bag is then swirled round in a tumbler or jam-jar of water. A fine suspension of egg yolk results, and small quantities of this should be fed to the fish at frequent intervals. The suspension will keep quite well in a cool larder or the refrigerator, and needs thoroughly agitating before use. Do not use if it becomes at all odorous.

Forcing Growth

Abnormally high average temperature, continuous light, and aeration, and bloating with food will produce startlingly rapid growth among fry. But such fish will not make healthy and long-lived adults. Be satisfied if you can produce natural conditions for your fry and a consequent natural rate of growth; you will be rewarded with robust and healthy adults, which will be valued later by all who are lucky enough to receive specimens of them.

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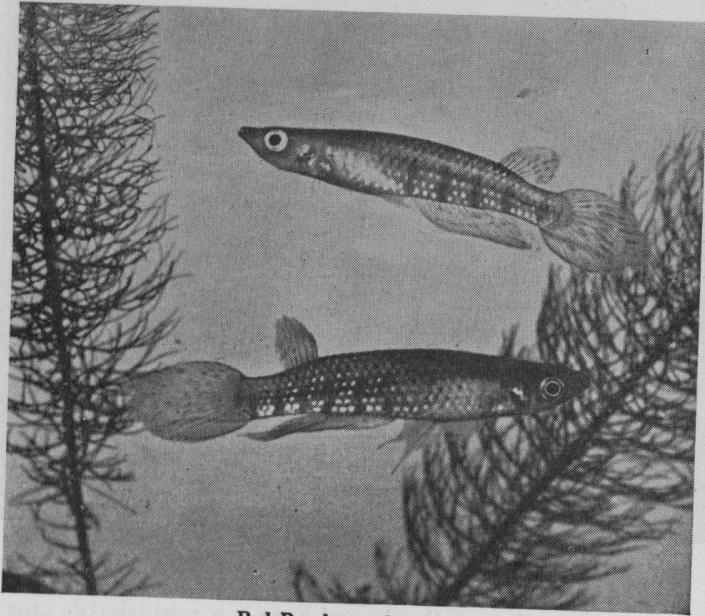
DAPHNIA COLLECTING

It is, of course, a good plan to breed *Daphnia* in any spare aquarium one may have lying about; but the bother is collecting the rather thin "concentrations" which result. This may be easily done with an air-lift. The inlet should be fixed about 2-in. from the bottom of the tank, so as to avoid collecting sediment, and the air-pipe should be connected to an air-pump. Under the outlet a wire-mesh tea-strainer is placed so that it dips into the water. When the current is switched on, a continual stream of water is running into the strainer, and any *Daphnia* carried with it are retained. Experiment will determine the length of time required to amass sufficient numbers, after which the cold water can be got rid of simply by taking the strainer out of the aquarium. *Daphnia* can then be served "neat" to the fishes. Of course, a special pump need not be kept for this tank; the aerator motor may be temporarily disconnected each day for the short time required.—A. E. SPICER.

A New Panchax Species

By LOUIS C. MANDEVILLE

RECENT importations of tropicals have included specimens of a *Panchax* species new to the aquarist and, as far as can be gathered, to science, for there is no record of a catalogued description of such a fish. Apparently it hails from



Red Panchax: 2 males

India and beyond that its origin is at present not known.

It is not a large fish; the illustration is life size of breeding fish. On seeing the fish for the first time one is immediately struck by its resemblance to *P. lineatus*, but closer inspection reveals to the practised eye that it is quite definitely very different.

The olive-coloured body of the male is marked by five or six dark bars in its hinder half. There are also a few irregular red spots about the body, and in reflected light there is a pale green iridescence of the scales. The lips are a full red and a reddish suffusion spreads over the head, the throat being a golden yellow. The fins are perhaps the prettiest part of the fish. The dorsal, anal, and caudal fins are a clear yellow and are flecked and edged with red, and a clear bow of red marks the lower half of the tail. In *P. lineatus* the female is quite a colourful fish, but the female of the new species is plain, even plainer than a female *P. blockii*. German aquarists have christened this new species the Red Panchax, and those aquarists who have seen it will agree that the name is quite appropriate.

The requirements of this species are the same as those of its relations. A well-lit aquarium, clear, old water, and plenty of floating plants. It is, in my experience to date, rather a slow feeder and liable to be late at table in a community tank. It eats dried food, but not with pleasure, and while enjoying *Daphnia*, prefers white worms, bloodworms, and new-born Guppies, etc., in which it is like most of its relations.

It spawns readily and the fry hatch after the usual incubation period of fifteen to eighteen days. It has forcibly reminded me of the jumping powers of the *Panchax* fishes, for I have lost my females through an absurdly small gap in the cover glasses—probably during some pre-nuptial gambols. Nevertheless the fry will eventually make good the deficiency.

This should prove a fairly popular species, for it has considerable colour, is not too large, and though slow to feed is quite active for a fish of its kind.

Zoo Aquarium Notes

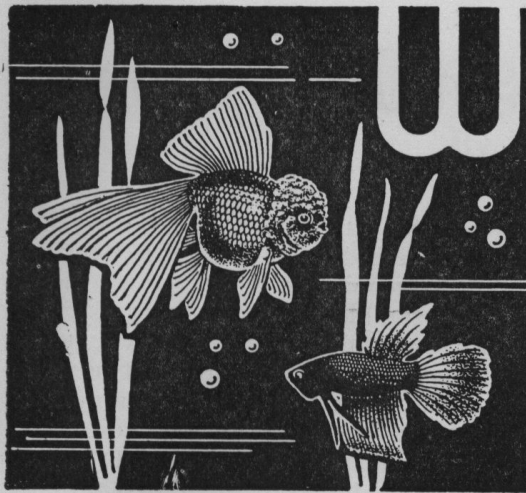
By E. G. BOULENGER

THE Reptile House has recently received from Ceylon a specimen of that aberrant relative of the frogs, newts, and salamanders, the limbless, burrowing amphibian *Ichthyophis glutinosa*. It belongs to the amphibian order *Apoda*. These worm-like creatures possess neither ear opening nor tympanum, but are provided with a short, retractile tentacle, a sensory organ situated between the eye and the tip of the snout. The eyes are minute and in most species covered with skin, and as a consequence are completely blind. These animals may measure up to 1-ft. in length, and are found under damp earth in the proximity of ponds and rivers. Most forms are oviparous, and the eggs, which are very large, adhere together, forming a mass round which the female coils herself for their protection. The embryos are provided with three long, external gills, and in most of these amphibians the metamorphosis takes place within the egg. In the embryonic form the eyes are well developed

and the tail, though short, is crested above and below as in the case of newts.

The Zoo Aquarium recently celebrated its fifteenth birthday, and a certain number of inhabitants which were on exhibition on the opening day are still on show. Amongst these are many turtles and a number of Sea Bass; the latter, as youngsters fifteen years ago, weighed about half a pound each; now they turn the scale at 12-lb.

The Zoo Aquarium is the direct descendant of the first aquarium in this country, founded in 1850 by the famous naturalist Gosse. This was just a glass-fronted house with a few tanks containing some sea creatures and fish, and aerated by hand by means of bellows. These were worked by the keepers, but the Dublin Zoo were ingenious enough to improve on this by providing foot bellows outside their aquarium which were worked by the public themselves.



WATER LIFE

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The Terrapins

By S. W. WOLFF

EVERY spring our aquarium shops contain examples of the European Pond Tortoise (*Emys orbicularis*). This is the largest terrapin commonly offered for sale, being usually about 8-in. from nose to tail. It is often accompanied by the Caspian Terrapin, and the Chinese or Reeves' Terrapin (*Damonie reevesii*). All these are hardy species; that is to say, they thrive in a temperate climate, and hibernate during winter. There are many other species of terrapins, some of which, such as the "Alligator" and Australian Long-necked Terrapins, are quaintly grotesque in appearance; but in this article we will deal only with these three.

When buying a terrapin, the head, limbs, and eyes should be examined for possible injuries. It is best to secure a pair, and males can be distinguished from females by the fact that the rear portion of the plastron, or under-shell, is more or less concave instead of flat or convex, and—a surer guide—that the tail is thicker at the base and somewhat longer.

On arriving home, the specimens should immediately be placed in water, so that they can take a long drink and soak their dry bodies.

These hardy terrapins will do quite well in an open, out-door enclosure, the essentials of which are an unclimbable fence or wall, a small basking ground, a pond at least 6-in. deep. Maximum sunshine and shelter from cold winds is also desirable.

The fence may consist of wire-netting, with a 3-in. overhang at a height of 8-in., but this is rather unsightly. A fence made from boards painted a harmonious shade of green is more pleasing, while a really permanent one is best built of brick, stone, or concrete; but in each case there must be an overhang, as, where there is any grip for its claws, a terrapin can hoist its light body upwards quite easily. The pond need only be a few feet long, and a few inches of earth all round, or some flat rockery is sufficient, as terrapins show little desire to wander round their enclosure, and spend most of their time squatting in the sun.

The pond may be constructed in concrete, with a central island, or a discarded sink, or even a galvanized iron bath may be used. Provision should be made

for the animals to enter and leave easily. A cave-like retreat on land will be appreciated at night.

Food consists first and foremost of common earth-worms. Raw meat and strips of raw liver, though useful foods, take second place, as terrapins will only readily take food which is moving. Terrapins will also eat maggots, but they prove indigestible owing to the tough skins. Minnows are taken with relish, but these are a more expensive food than worms. They should first be dispatched by quickly crushing the head with a pair of pincers. Water snails provide a supplementary food—the terrapins will pull them from the shells themselves.

Since terrapins will only feed in water, and may overlook morsels that drop below their line of vision when they are being fed, the bottom of the pond should be clear of obstacles such as stones and sand, and should be cleaned with a siphon tube from time to time, this being necessary if the water is to be kept clear and unpolluted. It is a good plan to construct a soak-away of loose stones with a foot or so of lead piping embedded in the earth and leading to the surface near the pond. The end of the siphon-tube can then be easily pushed down the piping during cleaning operations. Cleanliness, it may be mentioned, is only called for on the score of appearance, since these creatures do not appear to suffer any ill-effects from living in foul water.

Terrapins are less stolid than land tortoises, and should not be lifted suddenly or startled in any way, or they may become timid in taking food from the hand.

If feeding well, the animals will store up a supply of fat in their bodies for the long winter sleep. They will hibernate either at the bottom of their pond—in which case it should be at least 9-in. deep to guard against their being frozen—or on land in the hole, mentioned above, or in a box containing damp earth or moss, which should be placed in a cold place away from frost. Little or no ventilation is necessary. They will remain in a torpid condition through the winter.

They should be brought out when the first reasonable spell of warmth appears. Any suppurating of the eyes should be treated by letting them swim in a solution of boracic powder.

Mainly for Coldwater Fans

By L. C. BETTS

Disaster in the Breeding Tank!

AS an aquarist of some experience, I have long since realized that rules are not made for fun, but are the result of bitter experience. The scourge of blanket weed had played havoc with my *Myriophyllum* in the ponds, and as the breeding season had arrived I was compelled to supplement my supply from outside sources. I had suffered somewhat from various epidemics five years before as the result of introducing outside plants and fish, and I had sworn that once my tanks and ponds were clear I would not introduce any more, but would rely solely upon what I already had. For reasons already stated I was compelled to break my oath, and bought a quantity of *Myriophyllum*. So far so good, but it was here that I made the fatal mistake. Instead of buying nice aquarium-grown plants, I economized and bought cheap pond-grown Milfoil. Now, the rules state that all plants should be sterilized, and through sheer slackness I failed to do so.

The nice green Milfoil was placed in my breeding-tanks, and in due course my Goldfish spawn was deposited upon it and the fry hatched out.

The little hair-like fry soon took on a horizontal position, and I could see that whilst the spawnings were not good, they were certainly not bad. After a time, however, I became aware that whilst the fry were making good growth they appeared to be diminishing in numbers. My wife and small daughter were called in for consultation, and the former confirmed my worst fear that the numbers were certainly getting less. In the meantime, I took out the Milfoil and planted it in the ponds for a supply for next year. (It is surprising how we breeders are always working for next year!) For some days I was at a loss to account for my diminishing numbers until one day I saw a sizeable fry start up from the bottom of the tank as if it had been shot. Now, fry will often dart about, particularly if they have caught a larger *Daphnia* than they can swallow, but this fellow moved like lightning, and then remained stationary at the surface. In a flash it came to me—*Hydra*.

Feverishly I emptied the tank to a third of its depth, for by this time I was unable to see through the water clearly, as it had turned green. There on the back panel of the tank, all gorged up with fry and *Daphnia*, was a colony of anything up to a hundred *Hydra*. And so, for what will be the last time I hope, I have once again learned the elementary rule which says, "Never introduce new plants and fish to old-established tanks until they have first been quarantined and sterilized."

For the benefit of those readers who have not so far come across *Hydra*, perhaps a few notes will not be out of place. Greek mythology says that *Hydra* had a hundred heads and infested Lake Perna in the Peloponnesus. As soon as one head was cut off another grew in its place until Hercules eventually slew the monster. This he did with the assistance of Iolaus, who applied burning irons to the wound as soon as the head was cut off.

The *Hydra* we get in our tanks has much in common with its mythical prototype, for if perchance it is cut in half, each half becomes a separate being, and the trouble

is doubled. The books say that it belongs to a group of animals called the *Cœlenterata*, to which the Sea Anemone belongs. There are two species, *Hydra viridis* (green) and *Hydra fusca* (brown), and adult specimens are between $\frac{3}{8}$ -in. and $\frac{1}{2}$ -in. in length. Nature enables them to cling to anything handy by means of a sucker, and from the other end of the body it has six or eight tentacles which wave about in the water and by means of special cells in the form of fine threads, injects poison into its prey, which, in the case of small fry and *Daphnia*, proves fatal. There is no proper alimentary canal, and the food is just taken into the trunk, where it is digested, and the waste products ejected at the same aperture. Oxygen is absorbed through the soft body, and, generally speaking, it takes a very low place in the animal kingdom. Reproduction is maintained by two methods. The first is by budding, and it is easy to see with the naked eye young *Hydra* breaking away from the parent. The second method is by egg cells which lie dormant until suitably warm conditions obtain for the young to hatch out. I rather think my *Hydra* were introduced by egg cells, which had the best of conditions in my heated breeding-tank to hatch out, and certainly the best of conditions to thrive once they had hatched out.

Now, what is the remedy for *Hydra*? The best that I know is the introduction of the *Limnea stagnalis* snail. It has a partiality for *Hydra*, and will ultimately clear them up. But the *Hydra* has great powers of survival, and I say with great feeling that prevention is far, far better than cure.

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BURROWING TORTOISES

AMONG the new arrivals at the Reptile House of the London Zoo are some Gopher Tortoises from the southern United States. This tortoise, sometimes also known as the Mungofa, is so named because of its digging propensities, in which it resembles the rodent called the Gopher.

The Gopher Tortoise (*Testudo polyphemus*) is said to be the only representative of the land tortoises (*Testudo*) in North America. The carapace is 12-in. to 18-in. long, and of a dark brown colour. The front section of the plastron, or under-shell, is extended forward and upturned. It is with the aid of this shovel-shaped shell and the very strong claws that the tortoise digs so effectively.

A tunnel is dug which may be several yards long, and gradually fall over its length to a depth of three or four feet below the surface. This tortoise is a nocturnal animal, and it spends most of the daytime in its warm retreat, coming forth only at night to feed. It is chiefly found in forests and woods, and it feeds on the resinous exudations of various trees, but also enjoys similar green food and fruit to its more common cousins. It is said to do especial damage to the potato crops, on which it delights to feed; but the Gopher Tortoise is itself considered quite good eating locally, so it is not advisable for it to show itself too freely.