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The Natterjack Toad for the Outdoor Vivarium

By L. G. PAYNE

IT is now many years since fate and good fortune led me to that heathy hollow in a southern county where I found my first Natterjack Toad. It was more than an interesting incident—it was an event which directly fanned to a flame a desire to know more about the lives and habits of the small amphibians that has not diminished with the passing of time.

The Natterjack is a native of this country and a most worthy occupant of our vivaria. The name itself invites etymological research, and we find that in Anglo-Saxon days the word "nadder," meaning "nether" or "lower," was commonly applied to the snake tribe, and to-day is perpetuated in the name "adder." The suffix "jack" is possibly a term of contempt, or a diminutive, though one writer quotes the old German "jager," "one who runs."

Perhaps the most striking characteristic of the Natterjack is the narrow yellow vertebral line which extends from the snout to the vent. This stripe and the prominent cutaneous glands are best observed in a specimen taken from the water. Then it is that the beautiful greenish-yellow and olive markings become conspicious, and we realize that here we have a creature, which for its natural attractiveness of colour and form is equalled by few other hardy amphibians and excelled by none.

Photo] [*L. G. Payne*

The Natterjack Toad

In the photograph the parotid gland lying behind the eye as a raised brownish patch will be noticed. This and other glands occurring as prominent warts along the dorsal surface secrete an offensive and poisonous fluid which is the Toad's only protection against its enemies. Even so, the poison cannot be expelled at will, and its expulsion is induced only under rough external pressure, as when the creature is seized by a dog. For this reason the prospective purchaser of Natterjack Toads need not fear that he will have any unpleasant experiences in this way, for in the course of many years' observations and much handling of specimens I have yet to witness personally the actual nature and effect of this means of defence.

Numerous smaller glands are also dotted over the skin surface. These conserve the skin in the moist condition necessary for the normal functioning of cutaneous respiration. Experiments have proved that this "breathing" through the skin is auxiliary to pulmonary respiration, and that the latter is insufficient in itself to support life.

The Natterjack is distinctly gregarious, and on this point contrasts with the Common Toad, which, except at breeding times, is usually satisfied with his own company. The distribution of this Toad in England is decidedly local, and is confined to certain areas of well-drained sandy soils which it would perhaps not be desirable to specify too exactly. Where they occur, however, it is not uncommon to find a dozen or more in the daytime sheltering under the same tuft of heather.

A unique characteristic of our Natterjack is that it does not jump; its method of progression is very definitely by running. It can, on occasion, run as fast as a mouse, and as its maximum length is about two and a half inches, it is quite easy to mistake the Toad for a mouse in the gathering dusk of a summer evening.

The photograph shows the sturdiness of the front legs and the comparatively short rear limbs. The whole aspect of the Toad is one of greater alertness than in the common species, and this power of more rapid movement may be a real necessity for a creature whose principal food in the wild state probably consists of fast-moving crepuscular beetles.

In captivity the Natterjack will readily eat worms, and flies; in fact, as with all Toads, any moving creature small enough. Wasps and bees are also taken, but it is interesting to note the Toad's reactions to this form of food. If the wasp passes beyond the mouth before a sting is inflicted there is no apparent sensation of pain or harm, and another similar insect will be accepted; but if the wasp's poison is injected immediately this is seized, it will be instantly rejected with every appearance of discomfort, and the Natterjack will have sufficient instinct to refuse another wasp for days afterwards.

(*To be continued.*)

The Natterjack Toad

By L. G. PAYNE (*Continued from page* 6.)

THE outdoor vivarium is very suitable for the Natterjack, but he will do well indoors provided always sufficient moisture is present in the actual cage or enclosure to prevent the drying up of the skin. Ideally, I recommend an outside open vivarium as a permanent home, and a small enclosed indoor cage of wood, with glass front, for the purpose of watching the captive at very close range in feeding, skin-casting, etc., and generally in making those unhurried observations which should be a large part of the owner's pleasure in keeping amphibians. A Natterjack kept indoors in this way should be frequently returned to the outdoor vivarium, and another substituted.

Let me describe a practical open-air vivarium for Natterjack Toads. It must be remembered that though this Toad is a good climber, yet he cannot jump, therefore quite a low vertical obstacle will be sufficient to impede his progress, provided it be made of a smooth material such as zinc. If a corner of a yard or garden can be allotted to this vivarium it will repay the owner in permanent interest. A small pool of water should be included in the enclosure; there should also be a few large stones embedded amongst some moist sand; this makes for those cool conditions necessary for the good health of the Natterjack which your captives will be quick to appreciate.

It is interesting to observe the speed with which the Natterjack digs into loose sand. In a very few seconds he can press below the surface, deftly kicking the sand over himself with the hind legs. In firmer sand he digs away with his fore legs, throwing the excavated soil below and behind him in the manner of a terrier scenting a rabbit.

The Natterjack does not breed in this country until about the end of May, when the male may be heard uttering his harsh monotone. The throat is then considerably distended, and the observer will be surprised at the difference this makes to the Toad's appearance. At mating time also the inner, second, and third fingers of the male are adorned with pads of minute crenulated excrescences—sexual characteristics which in the Natterjack frequently persist throughout the year. The eggs are laid in long strings wound amongst aquatic plants, or these strings may be simply deposited in the shallow end of a pond. Evolution of the Tadpole is rapid, and the young usually leave the water about six to eight weeks after the spawn is deposited. They are then very lively and interesting little creatures, and appear more intelligent perhaps than many other species owing to the alert body movements and quick elevation of the head which always precede a run.

In common with other amphibians the Natterjack occasionally changes its skin, and, if you are fortunate, you may watch this event for yourself. The outer layer of skin will be seen to shrink away from the body, and shrivel up. The process is often accelerated by friction of the leg, and the popular belief that Toads eat their skin can certainly be confirmed to the extent that fragments of skin within reach of the forelegs are frequently pushed into the mouth and swallowed. The whole event may occupy half a day, and, in my experience, its occurrence seems to bear a definite relation to weather conditions. The short rainy spells which usually recur during the summer months appear to be much favoured by all batrachians for this transformation. When the operation is completed the new skin glistens with unusual lustre for several hours.

Now is the time for the intending owner to prepare a home for the Natterjacks. By purchasing in spring or early summer your Toads will have the warmer months to get thoroughly acclimatized to their new surroundings, and their chances of passing next winter satisfactorily will be almost assured.

My Fish

By Master ROSS (age 9 years)

IN a pond at the end of our garden we keep twenty-four Roach. They were caught at Winsor by my Father, and they live well. I am put in charge of the pond, and I make it my duty to see that the rocks, the pond and the fish are clean, and well kept.

We clean the pond by means of a run-away, after the water has gone down I scrub, and sweep, and hose the pond, making it quite spotless.

Roach are hardy fish and thrive well. They cannot live long in still water, but are very lively indeed. You must have some fairly big rocks in your pond to offer shelter from the sun in the summer. Big concrete bricks or rocks as they are called will be ample.

The three main ways of keeping fish for a long time are: one, clean water and clean pond, two, some big rocks, three, change water. After knowing this you can keep fish for a long time.

Letter to the Editor

Sirs,—I have to-day received the report on water analysis sent to you on May 27. I am very grateful indeed for the most valuable information contained therein, and will most certainly take advantage of the advice of the analyst, and send samples for examination twice yearly.

The trace of iron in the water is no doubt due to local conditions, as all the water locally is from ironstone beds.

Yours faithfully,

Scunthorpe, Lincs. HAROLD FLETCHER.

(*See page* 23.)

* * *

Do not buy young fancy Goldfish raised in running water, unless you can provide them with similar quarters. You will pay more for fish acclimatised to still water, but your losses will be low and eventually you will be in pocket

WHERE TO BUY

A Directory of Aquarists and Allied Traders

This Directory will be published at regular monthly intervals. Traders interested should write to "Aquaria Directory," 7, Milford Lane, Strand, W.C.2

ACCESSORIES (a)

MANUFACTURERS

The Ryder' (R. R. Sidwell, Ltd.), 68, Brunswick Place, N. 1.

WHOLESALERS

Artistic Aquaria Co., 15, Foxbourne Road, S.W.17.
Philip Castang, 91, Haverstock Hill, N.W.3.
L. Cura & Sons, Bath Court, Rosebery Avenue, E.C.1.
De Von & Co., 127, King's Cross Road, W.C.1.
Wigmore Tropical Fisheries, Jason Court, Wigmore St., W.1.

RETAILERS

Artistic Aquaria Co., 15, Foxbourne Road, S.W.17.
Philip Castang, 91, Haverstock Hill, N.W.3.
Frank Crocker, Paignton Livestock, 26, Hyde Rd., Paignton
L.P.F.S., 1352, London Rd., Leigh-on-Sea.
Wigmore Tropical Fisheries, Jason Court, Wigmore St., W.1.

AERATORS (b)

MANUFACTURERS

Artistic Aquaria Co., 15, Foxbourne Road, S.W.17.
'The Ryder' (R. R. Sidwell, Ltd.), 68, Brunswick Place, N.1.

WHOLESALERS

Artistic Aquaria Co. ("AWO."), 15, Foxbourne Rd., S.W.17.
Derham Fish Farm, 23, Queen's Av., Watford, Herts.
L. Cura & Sons ("Marco"), Bath Court, Rosebery Ave., E.C.1.

RETAILERS

Artistic Aquaria Co., 15, Foxbourne Road, S.W.17.
Derham Fish Farm, 23, Queen's Av., Watford, Herts.
Philip Castang, 91, Haverstock Hill, N.W.3.
Wigmore Tropical Fisheries, Jason Court, Wigmore St., W.1.

AMPHIBIA AND REPTILES (c)

WHOLESALERS

Philip Castang, 91, Haverstock Hill, N.W.3.
L. Cura & Sons, Bath Court, Rosebery Ave, E.C.1.

RETAILERS

Frank Crocker, Paignton Livestock, 26, Hyde Rd., Paignton.
L. Haig, 10, Featherstone Buildings, High Holborn, W.C.1.

AQUARIUMS (d)

MANUFACTURERS

Artistic Aquaria Co.("AAC" brand), 15 Foxbourne Rd.S.W.17
"The Ryder" (R. R. Sidwell, Ltd.), 68, Brunswick Place, N.1.
W. A. Smith, 117, Great Hampton Street, Birmingham, 18.
H. S. Townsend, 154, South Avenue, Southend-on-Sea.
Wigmore Tropical Fisheries, Jason Court, Wigmore St., W.1.

WHOLESALERS

L. Cura & Sons, Bath Court, Rosebery Ave., E.C.1.
De Von & Co., 127, King's Cross Road, W.C.1.
Wigmore Tropical Fisheries, Jason Court, Wigmore St., W.1.

RETAILERS

Artistic Aquaria Co., 15, Foxbourne Road, S.W.17.
Philip Castang, 91, Haverstock Hill, N.W.3.
L.P.F.S., 1352, London Rd., Leigh-on-Sea
Wigmore Tropical Fisheries, Jason Court, Wigmore St., W.1.

COLDWATER FISH (e)

WHOLESALERS

L. Cura & Sons, Bath Court, Rosebery Avenue, E.C.1.
De Von & Co., 127, King's Cross Road, W.C.1.
H. Gould, Long Sutton, Taunton.
Chas. Palmer & Sons Sclater Street, Shoreditch, E.1.

RETAILERS

Frank Crocker, Paignton Livestock, 26, Hyde Rd., Paignton
H. Gould, Long Sutton, Taunton.
L. Haig, 10, Featherstone Buildings, High Holborn, W.C.1.
L.P.F.S., 1352, London Rd., Leigh-on-Sea.
Perry Inman, Northgate, Devizes, Wilts.

FANCY GOLDFISH (f)

WHOLESALERS

L. Cura & Sons, Bath Court, Rosebery Avenue, E.C.1.
De Von & Co., 127, King's Cross Road, W.C.1.
Marshall's Goldfish Hatchery, Harlow, Essex.

RETAILERS

Philip Castang, 91, Haverstock Hill, N.W.3.
Frank Crocker, Paignton Livestock, 26, Hyde Rd., Paignton.
Marshall's Goldfish Hatchery, Harlow, Essex.
Perry Inman, Northgate, Devizes, Wilts.

TROPICAL FISH (g)

WHOLESALERS

Artistic Aquaria Co., 15, Foxbourne Road, S.W.17.
Philip Castang, 91, Haverstock Hill, N.W.3.
L. Cura & Sons, Bath Court, Rosebery Avenue, E.C.1.
Chas. Palmer & Sons, 351, Upper Street, Islington, N.1.
S. Robinson, 40, Lordship Park, Stoke Newington, N.16.
Wigmore Tropical Fisheries, Jason Court, Wigmore St., W.1.

RETAILERS

Artistic Aquaria Co., 15, Foxbourne Road, S.W.17.
Philip Castang, 91, Haverstock Hill, N.W.3.
Derham Fish Farm, 23, Queen's Avenue, Watford, Herts.
Chas. Palmer & Sons, 351, Upper Street, Islington, N.1.
H. S. Townsend, 154, South Avenue, Southend-on-Sea.
Wigmore Tropical Fisheries, Jason Court, Wigmore St., W.1.

DRIED FOODS (h)

WHOLESALE MANUFACTURERS

Caperns, Ltd., Lewins Mead, Bristol.
F. Ditchfield, 65, Albert Street, N.W.1.
Songstar Products, Ltd., Upper Dawson Street, Liverpool.
Spratts Patent, Ltd., 58, Mark Lane, E.C.2.
Trower & Co., Tremadoc Road, Clapham, S.W.4.

WHOLESALERS

Artistic Aquaria Co. ("Bartmanns"),15 Foxbourne Rd. S.W.17
L. Cura & Sons, Bath Court, Rosebery Avenue, E.C.1.
De Von & Co., 127, King's Cross Road, W.C.1.
Lexcoy Products Co. ("Reliance," "2-in-1," "Hy-Grade," Broad St. Ho., E.C.2.
Chas. Palmer & Sons ("Aquafood"), 351, Upper St., Islington.
Wigmore Tropical Fisheries, Jason Court, Wigmore St., W.1.

RETAILERS

Artistic Aquaria Co., 15, Foxbourne Road, S.W.17.
Philip Castang, 91, Haverstock Hill, N.W.3.
L. Haig, 10, Featherstone Buildings, High Holborn, W.C.1.
L.P.F.S., 1352, London Rd., Leigh-on-Sea.
Chas. Palmer & Sons, 351, Upper Street, Islington, N.1.
Wigmore Tropical Fisheries, Jason Court, Wigmore St., W.1.

LIVE FOODS (k)

RETAILERS

L. Cura & Sons, Bath Court, Rosebery Avenue, E.C.1.
L. Haig, 10, Featherstone Buildings, High Holborn, W.C.1.

HEATING APPARATUS (l)

MANUFACTURERS

Artistic Aquaria Co. ("AAC" Thermostats), 15 Foxbourne Rd.
Putnams Depend. Serv., (Lit. Putnam Stove), Northam, Dev
Dowler Electrical Engineering Co, 37, Barrington Rd., S.W.9
"The Ryder" (R. R. Sidwell, Ltd.), 68, Brunswick Place, N.1.

WHOLESALERS

Artistic Aquaria Co. ("Regular" and "SR"), 15 Foxbourne Rd
Philip Castang, 91, Haverstock Hill, N.W.3.
Chas. Palmer & Sons, 351, Upper Street, Islington, N.1.

RETAILERS

Artistic Aquaria Co., 15, Foxbourne Road, S.W.17.
Derham Fish Farm, 23, Queen's Avenue, Watford, Herts.
Philip Castang, 91 Haverstock Hill, N.W.3.
L. Cura & Sons, Bath Court, Rosebery Avenue, E.C.1.
Maryland Engineering Co., 23, Leadenhall Street, E.C.3.
"The Ryder" (R. R. Sidwell, Ltd.), 68, Brunswick Place, N.1.
Wigmore Tropical Fisheries, Jason Court, Wigmore St., W.1.

PLANTS—Pond (m)

WHOLESALERS

L. Cura & Sons, Bath Court, Rosebery Avenue, E.C.1.
Derham Fish Farm, 23, Queen's Avenue, Watford Herts.
De Von & Co., 127, King's Cross Road, W.C.1.

RETAILERS

Frank Crocker, Paignton Livestock, 26, Hyde Road, Paignton.
Derham Fish Farm, 23, Queen's Avenue, Watford, Herts.
H. Gould, Long Sutton, Taunton.
L. Haig, 10, Featherstone Buildings, High Holborn, W.C.1.
Perry Inman, Northgate, Devizes, Wilts.
Kenneth A. Isaacs, F.R.H.S., 13, Mercers Road, N.19.
L.P.F.S., 1352, London Rd., Leigh-on-Sea.

PLANTS—Aquarium (n)

WHOLESALERS

Artistic Aquaria Co., 15, Foxbourne Road, S.W.17.
Philip Castang, 91, Haverstock Hill, N.W.3.
L. Cura & Sons, Bath Court, Rosebery Avenue, E.C.1.
Wigmore Tropical Fisheries, Jason Court, Wigmore St., W.1.

RETAILERS

Artistic Aquaria Co., 15, Foxbourne Road, S.W.17.
Frank Crocker, Paignton Livestock, 26, Hyde Road, Paignton
Derham Fish Farm, 23, Queen's Avenue, Watford, Herts.
L. Haig, 10, Featherstone Buildings, High Holborn, W.C.1.
L.P.F.S., 1352, London Rd., Leigh-on-Sea.
Wigmore Tropical Fisheries, Jason Court, Wigmore St. W.1.

SAND, ETC., FOR AQUARIUMS AND PONDS (o)

Artistic Aquaria Co. (Filter Sand,) 15, Foxbourne Rd., S.W.17
D. S. & L. Co., Ltd. (Sea Shells, Pearl Chips), Shore, Perth
Spratts Patent, Ltd. (Pond Compost), 58, Mark Lane, E.C.2

MEDICINES (p)

WHOLESALERS

F. Ditchfield, 65, Albert Street, N.W.1.

A Directory of Aquarists Arranged in Districts

LONDON (Central)

L. Cura & Sons, Bath Ct., Rosebery Av., E.C.1. **a,b,c,d,e,f,g,h, k, l, m, n,**
De Von & Co., 127, King's Cross Rd., W.C.1. **a, d, e, f, h, m,**
L. Haig, 10 Featherstone Bldgs., Holborn, W.C.1. **c,e,h,k,m,n,**
Lexcoy Products Co., Broad St. Ho., E.C.2. **h,**
Maryland Engineering Co., 23, Leadenhall St., E.C.3. **l,**
Spratts Patent Ltd., 58, Mark Lane, E.C.2. **h, o.**

LONDON (South)

Artistic Aquaria Co., 15, Foxbourne Rd., S.W.17. **a,b,d,g,h,l,n**
Dowler Electrical Engineering Co., 37 Barrington Rd., S.W.9.1
Trower & Co., Tremadoc Road, Clapham, S.W.4. **h.**
Gay's Fisheries, 96 Waterloo Rd., S.E.1. **R.P.S.**

LONDON (West)

Wigmore Tropical Fisheries, Jason Ct., Wigmore St., W.1. **a, d, g, h, l, n.**

LONDON (North)

Philip Castang, 91, Haverstock Hill, N.W.3. **a,b,c,d,f,g,h,l,n**
F. Ditchfield, 65, Albert Street, N.W.1. **h, p.**
Fentnum, 76, Hoppers Rd., Winchmore Hill, N.21. **R, P, S.**
Kenneth A. Isaacs, F.R.H.S., 13, Mercers Road, N.19. **m.**
Chas. Palmer & Sons, 351, Upper St., Islington, N.1. **g, h, l.**
S. Robinson, 40, Lordship Park, Stoke Newington, N.16.
"The Ryder" (R. R. Sidwell, Ltd.) 68, Brunswick Pl., N.1. **a, g, b, d l.**

LONDON (East)

Chas. Palmer & Sons, Sclater St., Shoreditch, E.1. **e.**
D. A. Wood, 682, High Road, Leyton, E.10. **R, P, S.**

PROVINCES

BIRMINGHAM—W. A. Smith, 117, Gt. Hampton St. B'ham. **18d**
BRISTOL—Caperns, Ltd., Lewins Mead, **h.**
DEVIZES, WILTS.—Perry Inman, Northgate, **e, f, m.**
HARLOW, ESSEX—Marshall's Goldfish Hatchery, f.
ILFORD, ESSEX—C. Wright, 327, Ilford Lane, **R, P, S.**
LIVERPOOL—Songstar Products, Ltd., Upper Dawson St. **h**
NORTHAM, DEVON—Putnam's Dependable Service.
PAIGNTON—Frank Crocker, 26, Hyde Rd. **a, c, e, f, m, n.**
SOUTHEND-ON-SEA—H. S. Townsend, 154 South Av. **d, g.**
L.P.F.S.:—1352, London Rd., Leigh-on-Sea. **a, d, e, h, m, n.**
TAUNTON, SOM.—H. Gould, Long Sutton. **e, m.**
WATFORD—Derham Fish Fm., 23 Queen's Av. **b. g, l, m, n**
SHORE, PERTH—D. S. & L. Co., Ltd. o

NOTE.—Letters thus:—(a, b, c) after address refer to headings under which traders appear in "Where to Buy." R.P.S.—Retail Pet Stores.

Keep a Grass Snake

By IAN HARMAN

EVERY spring finds the glass cases in the dealers' shops well filled with specimens of the common but elegant Grass Snake. The snakes have just awakened from their long winter sleep in some secluded hollow, and are once more on the prowl. Not all of them escape the attention of zoological collectors, who find a ready sale for both English and continental Grass Snakes at the sum of a shilling or two. Of course, it is the schoolboy who mostly is attracted by the somewhat doubtful charms of this pretty snake, though we have heard it said that members of the fair sex in society have of late taken to keeping Grass Snakes as companions. They have even been known to carry them about in their handbags! All this shows one thing: there must be something in the nature of the Grass Snake to allow himself to be thus treated. And it is quite true that the reptile is most adaptable, and shows a very high degree of intelligence—high, that is, when we speak of the reptile community.

A wild Grass Snake will emit from the cloaca a most horrible-smelling fluid on being handled, and the smell is very hard to get off. But in time, if properly treated, the reptile never makes use of this method—its only method—of defence. The pet Grass Snake will become very tame, and soon learns to distinguish between different people—a display of intelligence shown in hardly any other reptile except the tortoise. It will, in time, allow itself to be handled without showing any annoyance, and will often crawl up the arm or sleeve, and curl itself up like a contented cat. The Grass Snake is perfectly harmless, and though wild specimens will hiss and strike out furiously with the head, they never bite. In the vivarium they should be given milk to drink fresh daily, being thirsty creatures, and mealworms, beetles, and cockroaches to eat, but they prefer small frogs to any other diet.

The usual ground colour of the Grass Snake, which is called the Ringed Snake by the older writers, is greenish. Behind the head is a collar of golden yellow, and immediately behind this another collar of black. Along the back run two rows of small dark spots, and a row of large, oblong spots is arranged down each side. The colour and shade of the spots are very variable. There are several varieties which may be picked out of continental consignments in the dealer's shop. A pronounced variety which is quite common in Spain and Portugal has a white, yellow, or orange colour, usually divided in the middle, behind which is the black collar, the latter only sometimes being present. A second variety, prevalent in the south of Europe, has no collar at all, and is often uniform grey-green above. A third well-defined form, mostly found in south-east Europe and Asia Minor, has a strongly marked collar, but this is divided in the middle, and there is a yellowish streak along each side of the back. Very rarely indeed one meets with an almost black variety.

The usual length of a full-grown Grass Snake is 3-ft., but there are occasional records of specimens reaching 6-ft. In all cases the males are smaller than the females, and are of a more slender build. The range extends over the whole of middle Europe, Algeria, West and Central Asia. It is, however, quite absent from Ireland and Scotland, as well as the north of Sweden. In England the Grass Snake is still quite common, though it does not appear to be nearly so abundant as once was the case. It may be found in suitable places in woods, heaths, and open parts of the country. Most often they are met with in moist, grassy meadows in the vicinity of rivers and ponds. Here they find the greatest abundance of their favourite food, frogs. Toads are eaten occasionally, but not mice or furred creatures. It is remarkable to see one of these snakes chasing a frog in the wild state. The amphibian seems to be unable to get away, and instead of hopping quickly and strongly out of the way of its enemy, it crawls slowly, sluggishly, as if doped. Sometimes the victim, on seeing the snake, stands rooted to the spot, paralysed, and may give a shrill cry such as is never made at other times.

The frog is usually seized by the hind leg, and gradually swallowed by the snake without its position being changed. Regarding this, Bell writes: "When a frog is in the process of being swallowed in this manner, as soon as the snake's jaws have reached the body, the other hind leg becomes turned forwards, and as the body gradually disappears, the three limbs and head are seen sticking forwards out of the snake's mouth in a very singular manner. Should the snake, however, have taken the frog by the middle of the body, it invariably turns it by several movements of the jaws, until the head is directed towards the throat of the snake, and it is then swallowed head foremost." I am sorry to relate that as a rule the frog remains alive during the swallowing process, and sometimes you may hear the unfortunate departed amphibian croaking in the snake's stomach! Frogs have been known to return, Jonah-like, after being "eaten."

The Grass Snake is an accomplished swimmer, its motions while in the water being peculiarly graceful. It frequently goes fishing, seizing the fish by the belly and returning to land to complete the process of swallowing them. When swimming, the head and neck are kept raised above the surface. The snake can dive and remain at the bottom for some time. It can climb, too, but does not make its way up in spiral manner as is so often shown in drawings, but by pressing itself firmly against the tree, and crawling up by the movement of the large banded scales of the belly, the body being as straight and rigid as a stick, and ascending in a manner that seems almost inexplicable Once a year the skin is shed, and this is drawn off, turning inside out during the process so that the lenses covering the eye appear concave instead of convex. Previous to changing its coat, the reptile becomes evidently ill at

(*Continued on page* 38.)

The Colourful Shubunkin

By F. L. VANDERPLANK, F.Z.S.

OF all the cold-water fancy fish, what could be prettier or more graceful than the Shubunkin? The Shubunkin is a variety of scaleless Goldfish, and can be bought for a few pence upwards according to size and quality of the fish. I never recommend a beginner to purchase expensive fish to commence with, but rather young and medium quality fish, then when he has become accustomed to aquarium management to go in for something larger and better. Whenever possible it is best to choose any fish carefully before purchasing. There are several important points to watch. First of all, one should observe the condition of the fish; one's eye soon becomes expert at this. A healthy fish will be swimming about with brisk movements and erect fins, the surfaces of the fish's body will be clean without any milky or hazy appearance. Should the fish appear sluggish, with drooping fins, or a woolly appearance, it should be at once considered out of the question, especially for a beginner. Secondly, there is colour, shape, and size to consider. A Shubunkin should not have any visible scales, and it should be multi-coloured, with a bluish background mottled with red, orange, and yellow, and splashed with blue, black, and brown spots. Flat or whitish-coloured fish are not really first-class, but often with careful treatment they may be brought up to scratch. The shape should, according to the Bristol Standard, be of even contour above and below, the deepest part to be at the dorsal fin. This fin should be broad and erect, in height about two-thirds of the depth of the body, slanting back, but not touching the base of the tail. The first ray of the fin should be slightly convex. The tail should be single, about three-fifths of the body in length, very broad and rounded, and carried expanded; in other words, not drooping or trailing like a veil. The eyes should be normal—like an ordinary Goldfish, and not telescopic. In judging these fish the maximum number of points awarded to the body is 15, tail 15, fins 15, colour 45, style 10; total 100. From these figures one can see at a glance that colour is the main factor when considering a fish with a view to purchase. Lastly, there is size, and, as suggested above, a beginner will be well advised to purchase young fish to start with. Fish with damaged fins, fungus, or some peculiarity are of very little value, and generally not worth purchasing.

Once the fish have been obtained they should be placed in a prepared aquarium. I do not wish to give hints on this, since detailed articles on this subject are published in WATER LIFE from time to time. They should be fed on a variety of foods, and given living *Daphnia* when this is in season. Chopped and washed worms should be given when preparing the fish for breeding, which should be from four to five months previous to spawning time.

Two-year-old fish are suitable for breeding purposes. Driving or chasing by the male is noticed prior to spawning, and other fish should be removed from the tank, since they will readily devour the eggs as they are laid. It is advisable to move the parents directly after spawning, since they also will eat the eggs. It is best gently to remove the weeds on which the spawn has been laid to another tank of the same temperature, replacing it with fresh, since the fish may not have finished, but be just resting. Milfoil (*Myriophyllum* species), or the hanging roots of the Water Hyacinth (*Eichornis speciosa*), are best for the reception of the spawn. *Elodea* and *Utricularia* are not suitable, and should not be used in breeding tanks. Willow Moss (*Fontinalis*), tied into bunches, makes a fine mass of weed for spawning purposes.

The male Shubunkin can be recognized by small tubercles that appear on its cheeks in the breeding season, but these sometimes, although rarely, appear on a female; in any case, it is difficult for the beginner to spot them, and it is safer to have several fish in one tank and wait till a pair " chase " each other.

The eggs hatch between six and twelve days, according to temperature; the alevin or newly hatched fry should be fed on infusoria, *Paramœcium* if possible, or very fine egg or prepared fish food rubbed together through muslin by one's fingers.

In a later article I will tell you how to make your fish spawn and how to treat and rear the fry.

Keep a Grass Snake

(*Continued from page* 34.)

ease. The change is accomplished by the old skin bursting at the neck, and being pulled off by the snake wriggling between the thickly matted undergrowth. Sometimes you may find these cast sloughs in hedgesides, and the country people believe that, tied round the forehead, they will cure a headache.

Pairing takes place in May in this country, usually on hot, sunny mornings. In July and August the female lays her eggs, which number from a dozen or so to thirty, or even more. The older the reptile becomes, the more prolific she is in the production of eggs. The situation chosen for the clutch varies. In some cases the eggs are laid in sunny places, where they can only be hatched by the warmth of the sun, and at others in heaps of weeds, manure, or the like, where the heat generated by the decomposition of the material greatly assists in incubation. The eggs are soft, shell-less, with a parchment-like covering, and whitish in colour. They stick together so that you can often pick up the whole batch together. The baby Grass Snakes hatch out in the autumn, and feed on insects and worms. They cannot swim at this stage, and are unable to eat small frogs until several weeks old. During the winter the Grass Snakes, young and old, retire to sheltered spots, where they remain until the warm days of spring awaken them again. In some places they will congregate for hibernation in large numbers, a hundred or so having on occasions been found snuggling together in one hole.

Snakes

By KENNETH CHARNOCK

DURING the present months many thousands of reptiles are being shipped over from the Continent, and I am writing this article in the hope that my readers will be tempted to obtain some of these extremely interesting creatures. My object is to deal with the common species of snake that usually find their way into dealers' establishments, *viz.*, the Grass, Dice, and Æsculapian Snakes.

The Grass or Ring Snake (*Tropidonotus natrix*) is a native of Europe, including Great Britain. Grass Snakes seen in dealers' windows are Italian, and I have found these more aquatic than the English Grass Snakes. The maximum length of British specimens is about 4-ft., although continental specimens sometimes reach a length of 6-ft. They will hibernate quite safely in captivity, if provided with a pile of hay and moss, under which they will burrow until March. This species is distinguished from others by the yellow or orange "collar," just behind the neck, and the row of dark brown spots down the back. Actually the Grass Snake can bite, but it is so feeble a bite that it is doubtful whether it could puncture the most tender of skins. They are generally found near water, where frogs and newts abound, these being their favourite prey, although young specimens will partake of insects and tadpoles.

Many Snakes, when purchased, go on hunger-strike, and I suggest exchanging the specimen rather than feeding it forcibly with a ramrod and raw meat, a procedure which is rather apt to damage their teeth. A bacterial disease called canker is sometimes found on Snakes, due to tight shipments. It is in the form of a cheesy substance between the jaws. My advice is not to purchase Snakes with this ailment, however cheap they may seem, it is not very easy to cure.

The place to keep a snake is called a vivarium, or terrarium; this is like an aquarium in general form, but the water is restricted to a shallow dish for drinking and bathing purposes. Be sure that you put plenty of vegetation in the vivarium: it will make the inhabitants feel more at home.

Another Snake of the genus *Tropidonotus* is the Dice or Tessellated Snake (*T. tessellatus*) inhabiting Central and Southern Europe. It is quite a small Snake, being about 3-ft. long, with a very narrow head and eyes situated at the top to enable it to see above the surface of the water. It is semi-aquatic, its favourite food being small fish; and it will be readily seen that it cannot be kept with any hope of success unless it is given a big bowl for swimming purposes. Olive grey is its colour, with the under-parts red or orange, marbled with black. Its habits are very similar to the Grass Snake, and it is frequently offered for sale as such.

The third and last Snake which is commonly seen in dealers is the Æsculapian Snake (*Coluber longissimus*). This large Snake is a constrictor, and is found in Italy, Greece, Spain, and locally in Central Europe. Its favourite food consists of small mammals, Sparrows, and Lizards, which it crushes to death and then swallows.

Newly imported specimens are rather savage, and I well remember a large 4-ft. 6-in. specimen that I had. It used to dart at my hand whenever I approached it. and, as it would not partake of mice, I exchanged it for a couple of Slow-worms (*Lacerta fragilis*).

The Æsculapian Snake is distinguished by the network pattern of the skin, and its pale yellow underparts. There is frequently a yellow line stretching from the eye to the nose. As it is prone to bite, and generally hard to feed, it can be understood that it is not as popular with reptile fans as the foregoing.

Rambling

"Tropical" enthusiasts should not fail to pay a visit this week to both the Wigmore Fisheries and S. Robinson's establishment at Stoke Newington. At the former they will see some extremely large and beautifully coloured Medakas. These little fish are golden in colour and have bright green eyes. They will also see there a large number of Pink Kissing Gourami, those queer fishes that swim around kissing the glass, the plants, and each other!

Mr. S. Robinson, 40, Lordship-park, Stoke Newington, has just received a large and varied collection of very fine fish from South America. These include a number of species which have never been imported before, and which are, at present, unidentified. Catfish lovers should pay Mr. S. Robinson a visit *at once*, since this shipment includes several new species which will soon be snapped up.

Messrs. Charles Palmer & Sons are marketing an excellent dried food under the name of Aquafood. This contains practically no biscuit meal, but consists almost entirely of a good variety of dried natural foods. Aquarists would be very well advised to buy a tin—fish deserve a little treat now and then!

Charcoal forms an essential part of any aquarium filter and serves to remove undesirable, dissolved organic matter in the water, but the charcoal needs regular changing if your filter is to perform with the highest efficiency. The specially prepared and activated charcoals, such as Hydraffin, are much more absorbent than ordinary commercial types, and though a little more expensive, Hydraffin will last longer. Aquarists interested in filtration should write to the Tropical Aquaria Co., 17, Oxford - road, Manchester, or Wigmore Fisheries, Jason-court, Wigmore-street, W.1. Both of these firms issue interesting pamphlets on the problem of filtration.

Newt Communities

IN the Spring Newts appear in shallow ponds, where they breed, and after quite a short time they disappear again and are seen no more until the next year. We all know what handsome creatures they are during the breeding season—the males, with their fine dorsal crests, veritable water-dragons. But then they are gone, and apart from occasionally finding a dried-up looking adult hiding beneath some old bank or stones, they have apparently ceased to exist. Would it not be entertaining if one could keep an aquarium containing Newts which are active and colourful the whole year round? This can be done and, what is more, the animals will breed under such conditions.

An ordinary indoor aquarium, about 24-in. by 15-in. by 12-in. deep, planted with the usual plants, *Ludwigia, Myriophyllum,* and *Vallisneria,* is quite suitable. The water should not exceed about 8-in. and some rocks, granite or sandstone, should be arranged at one end and covered with patches of moss, so that the amphibians can get out of the water if they so wish. The English species of Newts will not be suited to this tank as they are only aquatic for part of the year, whereas many of the foreign species live in the water the whole year through, only leaving it for short spells. There are a number of Newts available, and they are all very beautiful, so that one might be tempted to acquire specimens of them all and to put the whole collection into the tank. This would result in a rapid dwindling of the population as almost invariably the larger species eat the smaller. Two communities will be described, one of small species and one of large.

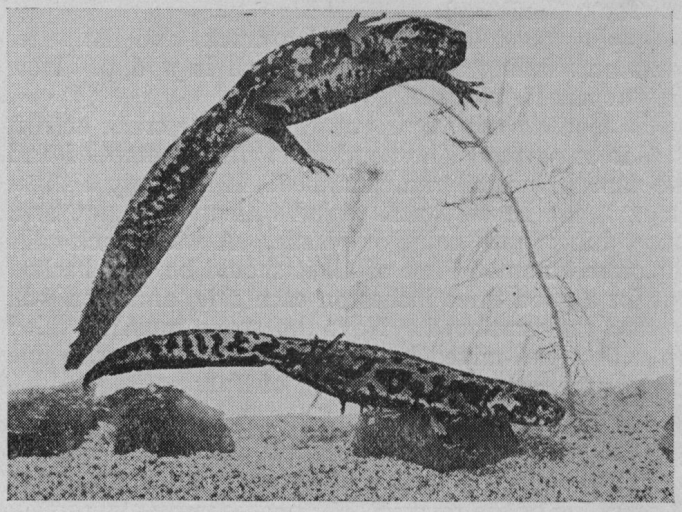
Molge alpestris, the Alpine Newt, from Switzerland and South Germany, is one of the most inoffensive and gentle of the Newts. The females, slightly larger than the males, do not much exceed 4-in. from tip of nose to tip of tail. The back is a bluish-black and the belly a delicate pale orange. This species breeds quite readily in the aquarium. Mating takes place in May and the eggs are laid singly on the leaves of plants like *Anacharis, Aponogeton,* and *Ludwigia.* As each egg is laid the female wraps the edges of the leaf over it with her hind feet, thus cunningly protecting and disguising it.

M. pyrrhogastra, the Japanese Newt, is one of the most beautiful. The dorsal parts are black and granular, and the belly is a brilliant, smooth carmine. The males of this species develop no crest at breeding time, but both sexes have a bony ridge along the top of the back. This species is fairly small, about the same size as *M. alpestris,* and it also breeds quite readily in the aquarium, but about a month later.

M. viridiscens, the American Newt, is the third species of small Newts recommended. In size it is about the same as the above. The dorsal parts are deep greenish-brown and there is a lateral line of red flecks. The ventral parts are pale orange with small black dots. This is a handsome species, but does not breed very readily in aquariums. It is less often available than either of the above, but specimens are well worth obtaining.

The Alpine, Japanese, and American Newts are three species well suited to life together. The other species to be described are larger and should not be associated with the smaller ones.

M. cristata var. *karelinii,* the Crested Newt. This is a variety of the Great Crested Newt of England, but is distinguished by the fact that the black spots on the orange belly are larger, and also this variety is much more aquatic. In the writer's experience these Newts,



The origin of the English name is plainly shown by this beautifully marked pair of Marbled Newts

which are usually imported from Italy, are much fiercer than the English specimens. This species breeds quite readily in May or June.

M. torosa, the Californian Newt, is another large species, but not so fierce as the above. The back is a fine full brown and the belly a delicate shade of orange. *M. torosa* is seldom bred in the aquarium but is a long lived and handsome species which is well worth procuring.

All the species, both small and large, so far described are characterized by rather subdued dorsal and gaudy ventral coloration. Presumably in fighting when the protagonists meet face to face they rear up and try to intimidate one another with their fearsome, warning coloration. There is one handsome species of Newt from Southern France and Spain which is most beautifully marked all over and in a colour not found in the other species. This is the Marbled Newt (*M. marmorata*), and it is charmingly mottled, green and black, with occasional smaller white marks. The under parts are pale yellowish-brown, speckled with white. This really is an extremely handsome and unusual species. It breeds quite readily in the aquarium and will hybridize fairly readily with the Crested Newt both in the domestic and wild states; this latter is rather unusual, as cross-mating does not often occur in Nature.

Other large Newts are the Spanish Ribbed Triton and the Pleurodele Newt, but in the opinion of the writer these are not quite so desirable.

The feeding of these creatures is quite simple—earth worms *ad lib.* They quickly become quite tame and will feed from the fingers, and the diet should be varied with

strips of meat and fish; even small live fish, such as Minnows, will be greatly appreciated. A. E. Hodge likens the effect of introducing worms into the "newtarium" to putting a penny into an automatic working model. Where there was leisurely inactivity there is now a writhing mass of lashing tails and snapping jaws. The idea seems to be to bite that which wriggles most with the result that the same worm will be held by two or even more Newts, and they think nothing of seizing one another by the tail, leg, and even jaws. You will well see the need for keeping the community to specimens of similar size! The writer has had adult Alpine Newts and young Salamanders, consumed by Marbled and Great Crested Newts.

If your Newts breed in a small aquarium it will be best to remove the adults before the larvæ hatch out. The larvæ appear in about one month to six weeks, according to the species and temperature. They are quite easy to raise and should be fed on small *Daphnia* at first, but they are very soon able to take *Enchytræ* and *Tubifex*, then blood worms, and before the end of the autumn small earth worms.

Though it is rather late to think of breeding Newts, it is not too late to buy specimens and to acclimatize them to aquarium life ready for breeding next spring. Incidentally the "newtarium" should not be kept in an unheated room during the winter or it may be necessary to provide proper hibernating facilities for the inmates.

Peculiar Fishes (6)

The Thunderfish

By NORMAN BAKER

THE Thunder or Weatherfish, *Misgurnis fossilis*, is one of the most strangely formed and behaved fishes, as well as being one of the most adaptable, since he lives quite satisfactorily in either cold or tropical aquariums. This species has a wide distribution through Europe and Asia, and there are several varieties. The one usually imported is that known to the Germans as the "Schlammbeisser," or Stone Biter, and to the Japanese as the "Shimadojo," or Striped Loach. The Japanese word "dojo" corresponds to the German "wels," which is becoming almost anglicized, and is frequently used instead of Loach.

The imported specimens are usually about 3" or 4" long. The body is elongate and cylindrical, marked by longitudinal brown and sandy-yellow stripes. The head and eyes are small, as is also the mouth, which latter, however, is adorned by no less than ten whiskers, six on the upper lip and four on the lower.

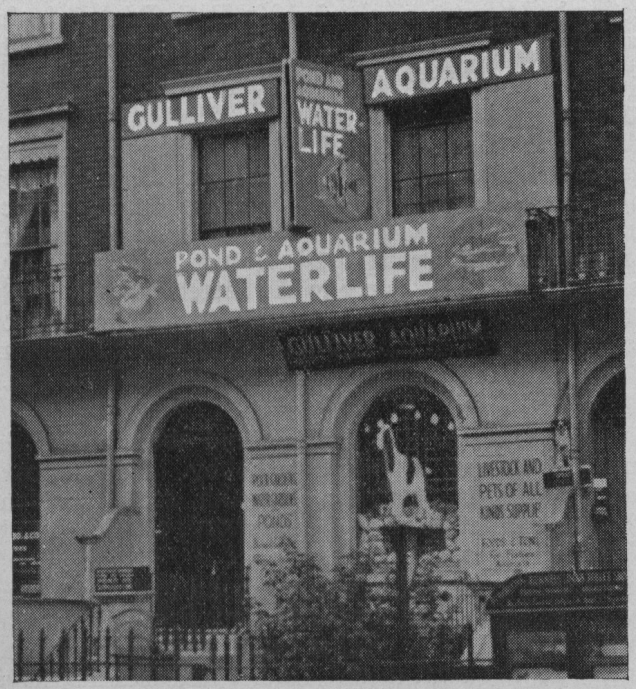
This fish is essentially a scavenger, and his systematic searching through the sand for waste scraps of food leaves little for any roving snails, and in fact the "Thunderer" is particularly useful in aquariums where snails cannot be kept owing to the inmates' habit of killing them off. The "Thunderer" has himself been accused of molesting other fishes, particularly biting the tails of Fancy Goldfish. Well, there is no place for any other species with such fancy fish, and probably the damage was caused, not by biting, but by the boisterous movements of the Loach. The writer has never known this scavenger to molest any other fish, however small.

Why the "Thunderfish"? you say. It is said that when the weather is thundery and the atmosphere is tense before the approaching storm, this fish becomes particularly active, and careers around the tank in a wild, aimless manner. Perhaps he does, but the thunder cannot have been heavy enough in the writer's vicinity.

In small tropical aquariums this fish grows slowly, but lives well, and, apart from a greater frequency in the trips made to the surface to gulp down air, life proceeds much as in a cold-water tank. In a large temperate aquarium or in a frost-protected pool, growth is astounding, and in a year the fish will increase their length four or five times, so that they are just short of 2-ft. This is the size at which they particularly appeal to the Japanese housewife, who uses them to prepare a stew which is highly palatable and regarded as a great delicacy.

* * *

It is often desired to make small notes about a particular aquarium, and it is a great advantage if that note can be affixed to the aquarium in question to avoid subsequent confusion. China and glass marking pencils in red and blue can be obtained from artists' dealers, and these enable notes to be made direct on to the glass. It has been suggested that the feminine lipstick would serve well for this purpose. Kiss-proof varieties are not essential!



No, we have not started a pet shop! In fact Messrs. Gulliver, we find, thought of the words before we did. Our sub-title also would be no less appropriate, for at the Gulliver Aquarium (opposite Whiteley's) you can buy anything which lives in or near the water. They do a considerable business also in designing and carrying out water gardens, aquariums for interior decoration, etc., etc.

A Reptiliary for the Garden

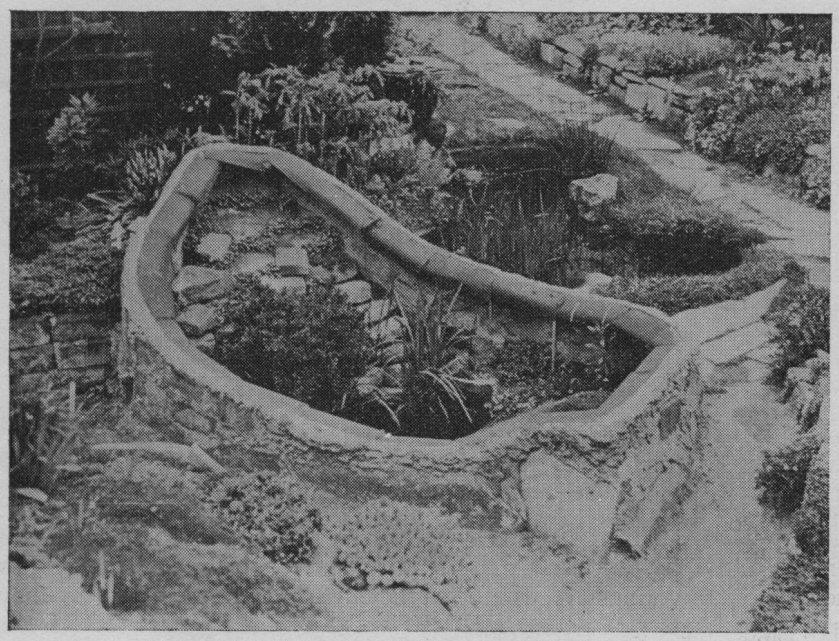
By L. G. PAYNE

PERHAPS the most satisfactory method of keeping hardy batrachians, and some of the smaller reptiles, is in the open outdoor enclosure. This may seem at first to be a contradiction of terms, but the reptiliary is " enclosed " by a continuous wall, and " open " to wind, rain, and sun.

The reptiliary illustrated was made about five years ago and forms a natural home for Midwife Toads, Natterjack Toads, and Yellow-bellied Toads. Two or three slow worms sunning themselves on a Saxifrage-covered rock make a pleasing contrast in form to the other occupants.

Let me describe in some detail how this " enclosure " may be constructed satisfactorily to owner and inmate. First of all, it is advisable to choose a site in the garden neither wholly shaded nor wholly sunburnt, and if the two ends of the enclosure are higher than the centre, this will add to the naturalness of the finished article. If soil is removed from the centre to form a shallow pool and this soil is slightly heaped at each end the desired result will be achieved. The reptiliary photographed is about 9-ft. long by 5-ft. wide and the small pool 2½-ft. by 2-ft. by 1-ft. deep. The continuous wall is 18-in. high. This latter was made of odd bricks and granite slabs cemented together—the whole washed over with cement and sand solution. This very soon tones down and appears weathered. The distinctive and peculiar feature of a reptiliary is, of course, the inward horizontal ledge designed to prevent escape of the inmates, many of which will be expert climbers. In constructing the reptiliary it is important to notice that this ledge should be the last item of all. It should be done after the planting and filling of the pool, the reason being that the inturned downcurved ridge has an amazing tendency to catch in one's clothes and otherwise hamper free movement. The small pool is made of sand and cement in the ordinary way, a thickness of 2-in. to 3-in. being ample. This pool should not extend the entire width of the enclosure, thus cutting the area into two parts, but a narrow border of the natural earth should be left on either side—if only to ensure that the occupants are not forced to swim in order to have access to any part.

Having thus far completed the hard work, the backbone as it were of the reptiliary, the enthusiastic owner now comes to the really joyous part—the constructive and artistic details wherein his sense of fitness and natural design should combine to result in a harmonious and pleasing whole. Between the pool and the farthest end of the enclosure it will be well to remove soil to a depth of 18-in. or more. This cavity should then be filled in very loosely with old bricks, broken flower pots, or stones, and these may be of any shape or colour for they will not be exposed to view. This stratum is important and serves the double purpose of draining the overlying surface, and forming a frost-proof refuge in winter. Next obtain, if possible, some pieces of porous sandstone of pleasing shape. I think this stone should be ideal, though the stones seen in the illustration are small granite setts. These latter, while not porous, certainly have the merit of lying nicely and squarely in position. The placing of the stones should be done carefully. These should rise from below the surface of the water, and each stone may well be placed slightly at the back of, and above, the preceding. This stonework can be built up to within about 9-in. of the top of the wall, but try to avoid any appearance of regularity or studied orderliness in the final arrangement. Many of the stones will, of course, rest on the drainage " crocks " previously described, but the whole should be pressed firmly into position. It is quite possible to do this and yet leave runways and bolt-holes below. Now sprinkle sand amongst the crevices and plant with some dwarf but free-growing plant. I use the white-flowered form of *Linaria cymbalaria*. By the pool plant a small evergreen—I suggest a slow-growing shrub such as Berberis. For the pool itself I know nothing better than the water grass *Poa aquatica*, which is delightfully green and easily kept within bounds. It makes a satisfactory foil to the apparent hardness of the stone colour. *Elodea canadensis* completes the pool flora. We now come to the furnishing of the ground on the other side of the pool. Here the natural earth may be left as it is, and on this built up a low covering of dead leaves, moss and bark. A short thick piece of tree trunk will add to the studied carelessness of your reptiliary and will form a useful breeding ground for woodlice and worms, and these in turn will feed your pets. A few low-growing



Mr. Payne's Reptiliary

(*Continued on page* 106.)

WATER LIFE was present, and the Editor assisted the club members in giving information to the public, who were full of questions.

Members are to be congratulated on a very fine show and excellent team work, and they have proved the contention that aquarists will set up an interesting and instructive exhibition even when there are no prizes available. Other clubs who think of indulging in activities similar to this may be interested in the following. The clubs supplied the centre of interest at the Horticultural Show; for this service they had to pay all their own expenses, including the hire of a tent, which leaked like a sieve, and further, they received no proportion whatsoever of the "gate-money," visitors paying sixpence entrance fee. This I consider grossly unjust, and aquarium clubs should think twice before letting themselves into a similar bargain. We want to spread our hobby, just as others do theirs, but we have expenses just as others have, and aquarium clubs must make a firm stand for the proper recognition of the value of their exhibits at flower shows and the like, or they may find their enthusiasm abused.

Hearty congratulations to all the "Ditchers."

L. C. MANDEVILLE.

Hints to Pet Stores

By A DEALER

IN last week's issue there was again published the "Where to buy," and I notice the increased number of advertisers compared with the previous issue. I have no doubt that those who have had their names and addresses inserted are reaping the benefit of this economical form of publicity, and I hope that many more pet stores will see that their names and addresses are before the public in the next issue of this trade directory.

While on this subject I feel bound to draw your attention to the Classified Small Advertisements. Amateurs who read this paper, that is I should imagine the majority of aquarists in this country, never fail to read these small advertisements (am I right, amateurs?). The temptation to look for a bargain, or for some opportunity of purchase which might not be repeated later, is one that the aquarist cannot resist. Therefore, if you have anything out of the way or something for clearance, there is the place to announce it.

No, I have no other interest in this paper than that of a contributor. I have made the above suggestions because I believe it to be advice worth your while to follow, quite apart from any benefit to this paper if you do so.

On the subject of periodicals "The Aquarium Trade Guild Gazette," Number 2, has disappointed me. I was told it would have twenty pages, and I looked forward to seeing how it managed to provide this quantity of matter on aquarium subjects. Well it has twenty pages, but I now find that instead of keeping solely to the aquarium business it is also dealing with puppies, cats, and other livestock; so that with the articles on aquarium subjects in addition and the lists of wholesale prices, the publication of a twenty-page issue was not so miraculous after all.

From periodicals to live food. Be careful where your live Daphnia comes from. It is possible to introduce disease, white spot included, if your Daphnia comes from pools contaminated with rabbit or deer manure. If you do not collect this food yourself, you should at least get an undertaking from your supplier that no rabbits or deer inhabit the region where they get the Daphnia. Cow manure is harmless, likewise duck manure.

One must also be careful with blood worms during the summer. When you receive any you should put them through a strainer, or separate in some other way the living from the dead. During hot weather many may die in transit, and though fish will eat dead blood worms, they are unhealthy food unless fresh.

White worms are good food and a profitable line to cultivate. If you have a cellar that is suitable, it would be worth your while running a number of worm boxes. They are always in demand and cost nothing to raise, except more work!

From live food to dried food. Many aquarists to-day like to give their fish a different brand of food each day. Therefore, keep a diversity of brands in stock, excluding ants' eggs and dried flies, which form an excellent dried food for bacteria, but are not bought by the aquarist who knows anything.

* * *

A Reptiliary for the Garden

(*Continued from page* 102.)

ferns such as *Cystopteric fragilis* will be ornamental and useful amongst the leaves and moss.

Finally, we have to consider the horizontal "shelf" which confines the inmates to the reptiliary. Theoretically at least this may be made of any substance which is sufficiently smooth to prevent a foothold. I used sheet zinc 6-in. wide cut into 12-in. lengths, though this is not necessarily ideal. It possesses, however, the merits of cheapness and pliability. These strips were cemented lengthways, and slightly overlapping, on to the top of the continuous wall, but before fixing into position each piece had the inside edge turned downwards—this being intended as a further check on the climbing propensities of the Frogs and Toads as well as adding to the appearance of the reptiliary. The zinc should then be painted green or brown.

An enclosure constructed on these lines may, of course, be of any size or shape—the ideal arrangement being perhaps separate enclosures furnished to suit the special requirements of separate species—but whatever form the reptiliary takes, I would stress the importance of time and trouble being taken with stone placing and with planting. Care in this direction will go a long way to providing the maximum of satisfaction over many years.

The Land Tortoise

By IAN HARMAN

FOR hundreds of years the common Land Tortoise has been a popular pet, particularly with the very young. In stern Victorian days, when parents were apt to show strong objections to the keeping of pets, the tortoise, being quiet, unexciting, and clean, was often allowed when less circumspect animals were forbidden. To-day thousands of them are imported every year, and find a ready sale in this country.

The street tortoise-seller seems to have disappeared. At one time he was in every market place with the organ grinder and the Punch and Judy man. He would offer them as "marvellous pets for the children: eat all the slugs in the garden," and as many other virtues as his fertile brain could invent. The Land Tortoise will *not* eat the slugs in the garden, nor destroy any pests. It is a pure vegetarian, and likes nothing better than nice, juicy lettuces.

This one unfortunate element, however in the character of the tortoise need not deter us from keeping it as a pet. It will, of course, be necessary to make arrangements for its accommodation in the garden, so that it will not be able to wander into the vegetable patch. It is best to keep such creatures out of doors, for they seem to be more lively and interesting under open-air conditions. In a flower garden, provided it is small and has no openings from which it could escape, the creature can do no harm, and if there is an expanse of green lawn on which it can roam and forage, it will live happily enough.

The chief objection to keeping a tortoise loose in the garden is that sooner or later it is likely to disappear. In any case, it will have to be caught up and confined towards the autumn, or it will bury itself in the ground for hibernation, and may not be seen again. They need very little space, and the best plan is to enclose a corner of the garden with a fence of wire-netting. A cool greenhouse makes an excellent home.

One of the main difficulties in keeping a tortoise is to feed it. That seems rather absurd, but few people realize that they cannot find enough food for their needs even when given the freedom of a whole garden. They are surprisingly hungry creatures, and in the way of diet will appreciate the softer leaves of cabbage and other greens, lettuce, sow thistle, tomato (of which they are very fond) strawberries, and even succulent garden weeds. Do not overlook water; a shallow dish or saucer of this must always be accessible.

It is not altogether a good plan to keep a solitary tortoise, for these creatures are sociable in disposition, and it is much better to have two, a true pair being ideal. The sex may be determined by inspecting the breastplate, that of the male being concave, and that of the female flat. A pair is much more likely to remain in the garden than a solitary one, which would become very anxious to wander away in spring.

With regard to intelligence, this is comparatively high for reptiles. These creatures become very tame, and soon learn to recognize their keeper. Their eyesight is pretty keen, but their hearing is very poor indeed. The Land Tortoise is a purely diurnal creature, unlike the Water Tortoise, which is active only at night. When kept loose in a garden, they should be fed at the same spot every day, and they will soon get into the habit of coming there regularly.

Where a pair is kept, it is not by any means an uncommon thing for the female to lay eggs; always in a hole 4" to 6" deep, scraped in the soil with her powerful forefeet. After depositing the clutch, she carefully covers them over, and then levels the top soil so neatly that it is practically impossible to find the "nest," unless she has been carefully watched. In the Mediterranean region, where the Land Tortoise is found wild, the heat of the sun is sufficient to incubate the eggs; but this is not the case in this country.

If you wish to hatch out the eggs as an experiment, remove them very carefully indeed, keeping them the same way up as they were laid, and rebury them exactly in the position as they were laid in some fine, damp sand. This should be placed in some warm place as in a garden frame or greenhouse, where a temperature of 80 deg. can be maintained during the day. They will hatch if you are lucky, but it depends to a large extent on the weather: the hotter the better, of course. The period of incubation is from four to eight weeks.

The young tortoises should be kept in a vivarium or fern case, with a saucer of water sunk in one corner. They should not be removed from the hothouse or frame until they have got into the way of feeding regularly, and then they must be brought gradually into a cooler temperature. The food should be the tenderest, small leaves of lettuce, given fresh every day. Bread and milk is quite unsuitable fare for tortoises, and not necessary. They are soft, like putty, and about the size of a two-shilling piece, but very pretty little creatures.

In winter the tortoise hibernates. This it does by burying itself in the ground; and as ordinary garden earth is too hard for it, as well as too cold in winter, it is advisable to lodge it in more suitable winter quarters. The earliest signs of approaching hibernation are sluggishness, torpidity, and refusing to eat. The best plan is to store the creature in a box of friable earth, leaf, and sand mixture. A garden frame containing a heap of leaf mould would make a satisfactory dormitory if covered with sacking from November onwards to exclude frost. A popular way of hibernating them is in a box of soil in a cellar or garage.

There is much misinformation concerning the age which tortoises attain. The Land Tortoises—the Greek, Hermann's, and Iberian—live for about twenty-five years as a rule. Much higher ages have, of course, been known, and the famous tortoise immortalized by Gilbert White lived fifty-four years in this country. Those which attain the tremendous ages about which we sometimes read—200 years and so on—are of the giant Galapagos variety. The age is estimated by counting the concentric rings on the shields of the carapace. Each ring represents a year's growth.

The Salamander

By IAN HARMAN

THE Common or Spotted Salamander is one of the most distinctive and strikingly coloured of amphibians. Its constant presence on the market testifies to the popularity of this bizarre, yet strangely beautiful, creature. It could not possibly be mistaken for any other amphibian, as its remarkable colour scheme is unique.

The creature, which is related to the newts, and is of similar form, though crestless, has a smooth and shiny skin, full of pores. When adult it is purely terrestrial, and large specimens measure up to 8-in.

The coloration of the Salamander is jet-black, strongly contrasted with brilliant orange patches on the back and limbs, and is an example of what are called " warning colours," given to a few poisonous creatures to protect both themselves and their enemies from the disastrous results of an attack. Birds, animals and reptiles, which would normally eat a soft-fleshed amphibian, baulk at the vividly hued Salamander—and fortunately, too, for the creature is poisonous when subjected to considerable pain.

At ordinary times it is harmless enough, but if violently attacked by a dog, for instance, a milky-white liquid exudes from the glands and may even be squirted out to a distance of a foot or so. When injected with some of this liquid, small animals have died very quickly. That warning colours are liable to be ignored by creatures coming from another country is borne out by an experiment carried out by Gadow. He put two American Bull Frogs in the same outdoor enclosure with a number of Salamanders. The following morning he found the frogs dead, each having swallowed a Salamander, with which they were not acquainted.

The poisonous nature of the Salamander has given rise to a great deal of superstition, and the country folks of its haunts go in great dread of it. A very popular belief is that it can thrive when thrown into a furnace! On this account one often hears it called the Fire Salamander. Possibly the idea arose from the fact that it can absorb a lot of water, which keeps its skin moist even during long, hot and dry periods.

The Salamander is widely distributed over the whole of Central, Southern and Western Europe, except the British Isles. It also occurs in Algeria, Asia Minor, and Syria. In those places where it does occur it is generally very plentiful, but it seems restricted in distribution. The favoured haunts are moist and shady places, particularly in mountainous and hilly districts.

The creature is remarkably clever at hiding itself during dry and hot periods, and at such times collectors may spend weeks in its known localities searching under rocks and stones without coming across a single specimen, or at best unearth only a dry, listless emaciated one here and there. Yet after a heavy thunderstorm the same place will be swarming with sleek, lively Salamanders in search of worms brought out by the recent rains. They move abroad mostly at dusk though some are out and about on dull rainy days. It is a strong swimmer, but if unable to get out of the water it soon drowns, for the Salamander only becomes aquatic during the breeding season.

Its food in the wild state consists of slugs, snails, beetles, earth worms, and the like. It often consumes a large amount of food during favourable wet periods, which enables it to undergo the long fasts which are so often a necessity during the summer months, when the ground is baked hard, and dry. It can fast for as long as a month at a stretch.

The breeding habits of the Salamander have been properly investigated only of recent years. Briefly, they are as follows:—During the breeding season, both sexes take to the water, where the females collect the sperm deposited by the males, in the same way as does the ordinary newt. The young Salamanders do not make their appearance until nearly a year later. Thus they appear to be born before their parents have paired.

When about to give birth, the mother Salamander crawls half into the water, mostly at night, and produces from half a dozen to as many as fifty young. These are born alive, but they are surrounded by an egg-like membrane, which usually breaks away before birth. Sometimes it happens that eggs are laid by the female, from which the young Salamanders immediately make their escape.

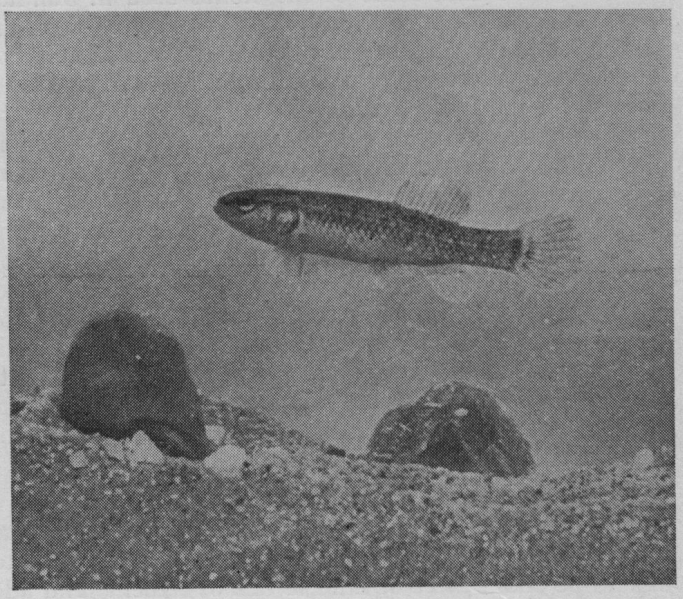
(*To be continued*)

The Fresh-Water Dogfish in the Aquarium

By R. FEAKINS

A TANK of cold-water fish is usually thought of in terms of Goldfish, Orfe, Shubunkins, or something else that presents a display of colour. Far more attractive, in my experience, is a fish of sober hue but entertaining habits, such as the European Dogfish (*Umbra krameri*). This little chap is of ideal aquarium size. The males, of two to three inches, have a slightly more elongated shape than the three to four-inch females. It seems hardly credible that the fishermen of its native waters in Austria and Hungary were wont to attribute misfortune to the capture of the mild-looking little "Hundsfisch." Why Dogfish? Seen swimming slowly with pectoral fins paddling alternately, its movements irresistibly remind one of a dog in the water. The rear four or five rays of its ever-erect dorsal wave in time.

In shape *Umbra* is by no means graceful, though definitely attractive. The head is covered with scales which merge without a break into the body. Its colour is a pale reddish-brown, blotched irregularly with dark brown. These blotches become more prominent in the dark, and it is laughable to see the pale fish which retired to a shady corner suddenly emerge looking as though it had donned an overcoat.



An overhanging rock is greatly appreciated, though the fish is not at all shy. It does not appear distressed by lack of oxygen, but a normal habit is that of occasionally mounting the water—I can think of no other term. The fish literally seems to climb to the surface, where a gulp of air is taken. The gill plates move slowly and deliberately. Compared with the method of the Goldfish of giving a vague suck at anything which looks like food, the feeding of the Dogfish is a joy to watch. A cautious examination, sometimes from two or three angles, is followed by slight curving of the body into a horizontal S, then—snap! the fish is straight again and the food has disappeared. Ordinary dried foods are readily taken, but Bloodworms and Ghost Larvæ are especially liked. The introduction of some of the latter into a tank of Dogfish gives rise to a whirl of *staccato* confusion as the fish dash and snap. A real entertainment.

A characteristic habit is that of remaining in one position for several minutes at a time. Often the position is almost vertical, a light ripple of fins and a steady motion of the gill-plates being the only perceptible movements.

I was surprised and amused when I first saw Fido, my favourite, poised on a rock ledge. He rested on a slant with his ventral fins lightly touching the edge, remaining thus for nearly half an hour. Now, when I see Fido perching, I am not surprised—but still amused.

The Salamander

(*Continued from page* 129.)

THE young Salamanders are fitted with three pairs of external gills, and they have a long tail furnished with broad fins. The four limbs are very small. In colour they are blackish, with a pretty metallic-green and golden lustre. They are quite active little creatures, and begin to feed at once on both animal and vegetable matter. They are somewhat prone to nibble bits of each other's fins if too many are confined in an aquarium of small size. The change into the adult state is very gradual and slow, taking about four or five months.

If you happen to have a female Salamander who gives birth to young, it is not hard to rear them, and it is well worth the trouble. They should be fed well and regularly, and lodged in pure, well aerated water. Guard against overcrowding. Provision for leaving the water must not be overlooked.

With regard to the adults, these are easily kept in a cool vivarium. It should be fitted up with damp soil and moss, not forgetting some concave pieces of virgin cork under which they can hide when they desire to do so. Keep the vivarium containing Salamanders out of the sun at all times.

Encyclopaedia Aquatica

(HINTS AND TIPS FOR BEGINNERS)

"Doping" Water

IT is very unwise to start tinkering with the mineral content of your aquarium water unless you know what you are doing. The majority of beginners add rectifiers, sea salt, Epsom salt, etc., in indiscriminate quantities, until the aquarium becomes what has been aptly described as a veritable chemist's shop. Most water is greatly improved by the addition of small quantities of mineral matter when the tank is set up. We suggest about a teaspoonful of sea salt to five gallons of water, or the amount suggested on the packet of any reliable rectifier, if you use one. We do not agree with the frequent addition of extra quantities of any of these preparations. A much more natural and beneficial state is arrived at by regularly, about fortnightly, removing about a quarter of the aquarium water and replacing this by fresh water prepared as the original.

House Flies

Though there are fewer house flies than usual this year there are still enough around to make them worth catching, for they are greatly relished by fishes big enough to take them. Large Goldfish, Bass, Cichlids, and Barbs all greatly enjoy nice juicy flies, and, of course, to the vivarium keeper they are almost indispensable food for Lizards, Frogs, Toads, Newts, etc. A fly trap or a light fly swatter is a necessary part of the hobbyists' equipment these days.

Mosquito Larvae

The wet summer has resulted in many little patches of casual water appearing where in a normal summer would be sun-parched grass. These "pools," if they can be called such, are most pleasing breeding grounds for the mosquito, as therein lurk no enemies of the little larvæ. This is an advantage to the "live food hunter," who can net the larvæ wholesale with the certainty that there will be no undesirable creatures in with the "skitters." They are collected by sweeping with a large fine net, and may be packed on trays or very thickly in a small can, as long as there is room to come up for an occasional breath of air.

Discussion

MR. C. PERCIVAL STAPLES, in his article, "An Amateur Considers," July 28 issue, claims that he can obtain satisfactory heating of a tank 14-in. x 8-in. x 8-in., using two 5-watt lamps placed in a wooden tray under the tank. He does not say, however, what the temperature of the surrounding atmosphere is, nor whether the tank is located in a normally heated room or in an outhouse.

It is interesting to note in this connection that since one unit of electricity is equivalent to 3,440 British thermal units, a consumption of 10 watts can only provide 34.4 British thermal units in one hour. Assuming that the tank is made of $\frac{1}{4}$-in. plate glass with a conductivity and radiation loss of .5 B.Th.U. per sq. ft. per degree difference in temperature into surrounding still air on five of its six sides, it will lose heat at the rate of approximately 1.75 B.Th.U. per hour per degree difference in temperature from the surrounding atmosphere. This means that even if the system of heating advocated in the article has an efficiency as high as 60 per cent., which is doubtful, it is only possible to maintain such a tank by this means at a temperature some twelve degrees higher than that of the room. Whilst in summer weather this may be found adequate in a substantially insulated building, its unsuitability under winter conditions is apparent.

It is, however, a fact that consumption of some of the cheap electric lamps on the market does not agree with the rating, so that your correspondent may be using more current than he is aware of.—J. N. BERNARD.

Reading Mr. Ian Harman's article on the Grass Snake reminds me of an experience I had a few years ago.

Several dead specimens (3-ft. 6-in. to 4-ft. in length) were brought to me one summer with the complaint that they were responsible for the death of several very valuable dogs at various times and a request for a method of exterminating them. After the departure of my visitors I examined the dead bodies they had left with me and discovered two of them contained eggs.

A shallow box was made and the floor of it covered to a depth of 3-in. with moist peat. The eggs were just buried in this, and after providing a perforated zinc cover to the box the whole was placed in a warm greenhouse. In about three months the eggs began to show a change as a small hole appeared on the top surface towards one end. The interior appeared to be filled with a pale straw-coloured liquid and if one watched quietly for a little while a little reptilian-like head would venture to peep out and then to disappear quickly at the slightest disturbance. The embryo remained thus for a week, then gradually the baby Snakes left the shells.

A shallow pan of water was now placed in the box, the top cage level with the surface of the peat. Into the water were introduced *Daphnia*, frog tadpoles, baby *Lebistes*, and the like. At the same time the temperature was gradually lowered slightly. The youngsters thrived greatly, frequently shedding their skins.

It was interesting to notice the protective behaviour of these baby Snakes. Whether curled up or lying outstretched, on the slightest interference they would erect their heads and hiss in a threatening manner. Bring your finger close to them while in this attitude and they would make a sudden dart at the offending digit and immediately go to earth. Their actions were so much in keeping with the Adder's method of defence that one might be excused for forgetting that the Adder was really a viviparous reptile, and that these were the babies of the oviparous Grass Snake. H. R. STERRETT.

The Curious Axolotl

By IAN HARMAN

THE Mexican Axolotl is surely the ugliest of all aquarium inhabitants, but its very ugliness has a kind of charm, and for sheer interest there is no other water creature which can compare with it.

The Axolotl refuses to grow up. It is one of the very few creatures which is able to remain all its life in an immature or actually larval state, and yet breed freely. It is indeed a veritable Peter Pan of amphibians, spending its life in an eternally youthful state.

This ugly creature belongs to the Salamander family, being a pretty close relation to the newts. In appearance it may be roughly described as resembling a gigantic tadpole in the " leggy " stage, with an enormous head and tiny brown eyes. It has four legs, and the tail is provided both above and below with a very broad fin which, on the upper side, is continued along the back to the head. Its skin is smooth and shiny, normally being black, though sometimes variegated with yellowish blotches. The head carries three pairs of gills.

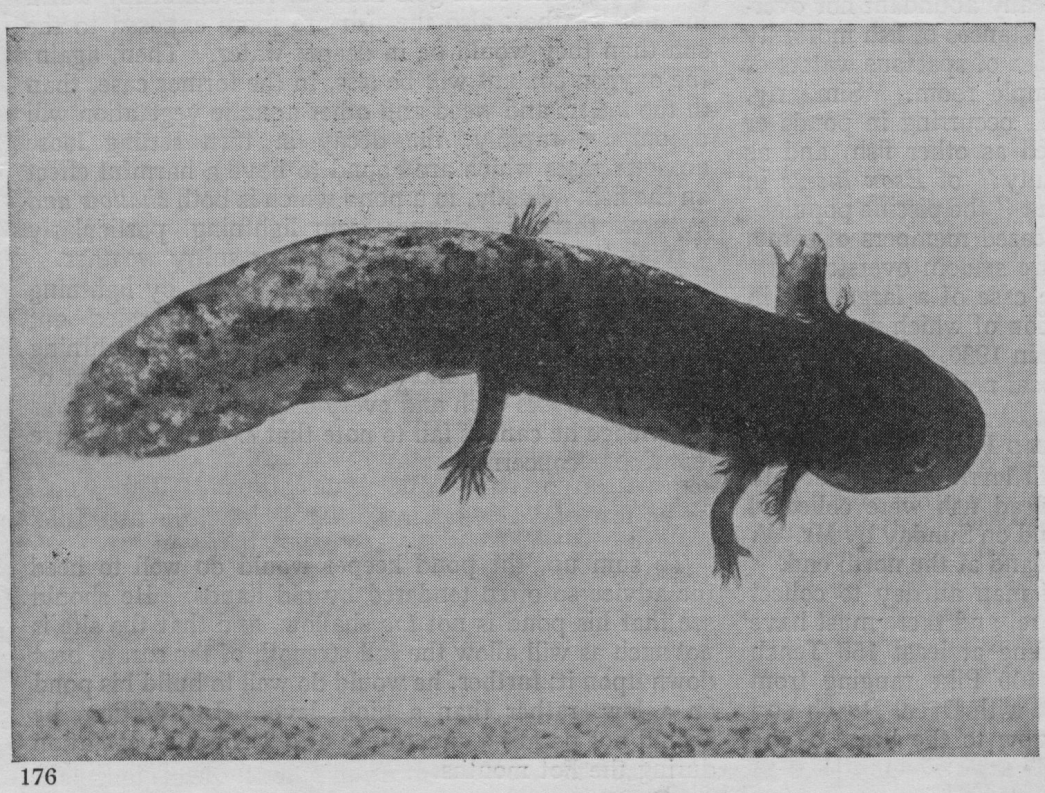
The Axolotl was, for a long time after its discovery, a great puzzle to naturalists. At first it was thought to belong to a family of amphibians armed with perpetual external gills; this classification was disproved in 1865, when some of these creatures surprised French scientists by beginning to breed in the Paris Museum. Eggs were laid, and some of the resulting progeny grew into the true adult state—the black Land Salamander (*Amblystoma mexicana*). The eggs began to hatch out in January, and by the end of the summer the young Axolotls were about as big as their parents. In the beginning of September one of them began to undergo the change into the adult.

In the course of a few weeks, the conspicuous branched gills became absorbed, the gill-openings closed up, the large dorsal fin disappeared, the tail became rounded like that of an ordinary Salamander, and the yellow spots appeared on the body. Eventually the creature began to breathe by means of lungs, and then left the water. In the early part of October, the other young Axolotls changed in the same way, and out of several hundreds about thirty became perfect Salamanders—or Amblystomes, as this species is called in the adult state. But the parent Axolotls did not undergo any change.

This interesting series of transformations was widely published, and caused many interested persons to secure Axolotls and attempt to rear them to the adult stage. Few were successful for it is a very tricky and slow task to induce the change to take place.

One of the early experiments which was successful was carried out by a German lady, who procured specimens between the ages of six and nine months, which she placed in a vessel of water, with a small island upon which they could rest. In the Axolotl state, of course, the creature will never leave the water, any more than would an ordinary frog or newt tadpole until the change to adult has set in.

Every day a quantity of the water—a very small amount—was taken from the aquariums, and in a few weeks the branched gills became smaller, until eventually after living for a while surrounded by damp moss, most of the Axolotls became perfect adults. The experiment may be repeated by any reader who cares to do so. The Axolotls should be secured at the age of about six months, and before they have bred. These should be placed in an aquarium containing sand, gravel, and an island in the centre gradually sloping into the water, which should be about 4" deep at the greatest depth. The best plan is simply to let the water evaporate naturally until only about ½" remains and then put in some wet moss.



It is now known that if Axolotls are bred in a limited supply of water, and the water gradually reduced, the young will become Salamanders quite readily. A German experiment consisted of placing a number of young Axolotls in an aquarium containing so little water depth that at one spot only could they dive quite under, while everywhere else they came into contact with

the air. The water was then gradually reduced, and within a few weeks the change took place.

The typical Mexican Axolotl (*Amblystoma mexicana*) is a native of the extensive lakes in the vicinity of Mexico City. It is, apparently, only the Axolotls from this district that stay in the larval stage, and in other parts of America the creatures habitually develop into the Salamander. It is not known why the Mexican Axolotls stay immature, but it is supposed that the very hot and dry desert country about the lakes of Mexico City may be too dry for the adult.

The Axolotl is a popular and easily obtained aquarium inhabitant. It is easily kept in either aquarium or garden pond, having been bred successfully in both. When not given the opportunity to leave the water, it can be kept indefinitely in the larval stage. They will live in an aquarium and breed regularly for many years.

Sexing Axolotls is difficult. Though a scientist can determine the sex of these creatures from certain external characteristics, there is no way in which an ordinary amateur aquarist can with certainty determine the difference. Unlike newts, no crest or other prominent characteristics appear in spring, nor is there any appreciable difference in size. In full-grown specimens the female may, however, be found slightly bigger and more bulky than the male. Dealers can often tell a pair by comparative examination, but many " pairs" prove of the same sex. The surest way of knowing if you possess a truly sexed pair is to watch for the deposition of eggs. The Axolotl always breeds freely, and if a couple were kept under proper conditions for some time without any eggs being laid, they would most certainly not be a pair.

The Axolotl is an easy subject to cater for, and will feed readily on tadpoles, worms, small fish, newts, small pieces of chopped-up meat, and so forth. When well fed they will breed every year. The eggs are laid amongst water plants or on stones and rockwork. When noticed, the eggs must be removed from the reach of the parent Axolotls, and placed in a separate tank. They are generally laid in spring and autumn, and in batches of about 100 or so. They hatch out in from ten to twenty days, according to the temperature of the water. The young should at first be given *Daphnia,* and later small earth worms. They are adult when a year old.

[*Editor's Note.*—At University College, London, Axolotls have frequently been bred and large numbers of the young have been reared. Some of these have metamorphosed to the adult Amblystoma stage; these also have been induced to breed and the tadpoles have been successfully raised—a really remarkable achievement.]

The Tropical Fish Trade

By VAN RYSSEN

I HAVE read with great interest Mr. "Ariel's " article in your issue of June 16. This was of particular interest to me on my return to England after a residence in Holland for the past thirteen years and a close acquaintance with and experience of the development touched on by Mr. Ariel.

As a keen cold and tropical fish amateur fancier for years, I have been privileged to witness the development in Holland both of the " hobby " and of the tropical fish " trade "; and it is deplorable that this trade, so absorbingly interesting, has gradually declined. Several firms, originally good going concerns, have had to close or trade at a loss. Owing to the advent of so many novice " mushroom " dealers, with no real experience or knowledge of the business, a ruinous price-cutting ensued, to the detriment of the trade and without lasting benefit either to buyer or seller. Mr. Ariel says that when he came to England ten years ago the tropical fish dealers were accustomed to sell at " very high prices," and that they made " not only a good living, but enough to save money." I hope I am interpreting Mr. Ariel's statement correctly to mean that this is not abnormal, but should be quite a normal state of affairs. One is in business to make a profit and a sufficient one to be a fair reward for work and experience. A successful concern would naturally be conducted in this way. The trade was carried on so in Holland. Similarly, in Holland the amateur dealer embarked on a headlong price-cutting policy with disastrous consequences to seller and client. Quality of specimens deteriorated, and many experienced and reliable firms had perforce to close in face of an unremunerative trade.

I certainly agree with Mr. Ariel's advice to the private buyer that he should go to his own dealer " in the neighbourhood," even to the extent of " paying seven times" the price that the fishes are offered him on the Continent. It is cheaper to do so in the long run. One cannot make a " mailing business " of the tropical fish trade as one can, for instance, with bulbs, where there are not quite the same difficulties in selection and risk of transport. " Select your fish on the spot." That should be the buyers' slogan, and it is ultimately the satisfactory and paying procedure.

As to the dealers, I think guild organization should be promoted also by the Dutch traders, for, if they fail in combating " price-cutters " there is no hope for the tropical fish trade. Part of the solution of the problem might be curtailment of supplies. Dealers in spices, for instance, make good profits because the sources of supply are limited and controlled. Similarly, dog breeders get a price here for their dogs which, on the Continent, would be considered abnormally high. English breeds are admittedly better, but probably this would not suffice were it not a fact that dogs are only admitted into England with much difficulty, trouble, and expense on the part of the sender abroad. There would be no fear of degeneration of the species of the fish, since well-planned replenishment of the best specimens of the different species could easily be provided. On the other hand, importations of unhealthy and puny fish would cease, resulting in strong and well-preserved breeds of fish in England, whilst Nature would ensure multiplication sufficient to provide for a popular hobby. At the same time, legitimate and responsible dealers would be sure of a reasonable and adequate profit in their calling.

The Mystery of the Ardennes

By L. G. PAYNE

NO! this is not a murder story, not even a thriller, in the accepted sense of that term—and, it is about toads—so now you know the worst. It possesses, however, the merit of being true and up to date—for it happened last month.

" 25 from near Dinant "—thus wrote an eminent herpetologist, in a standard work on amphibians, many years ago. That phrase related to the little Yellow-bellied Toad, and as I had long wished to study these creatures in their native surroundings I decided that a few days might well be spent in June with this end in view.

Do you know the little Diesel-driven train that follows the winding Meuse from Namur to Dinant? As each gay little flower-decked station approaches, the country people in the train are standing ready at the door, and the train has hardly stopped before it starts again. One scarcely expects this quiet efficiency, perhaps, until one reads a notice, conspicuously displayed, requesting the traveller to be ready to alight before the train stops, and giving a list of the stations in order of arrival.

The tourist season had not commenced and Monsieur was very welcome in the more-than-half-empty hotel. Lunch—" and now Henri, please, a bottle of something good, and some biscuits, for my knapsack, and I'll be back for dîner at 8 p.m."

And so across the Meuse by its handsome bridge, and down the narrow street to Anseremme. To-day, as I pass down, the way is strewn with flowers, the houses decked with branches of the Mountain Ash, the radiant children clothed in white, as the procession, symbolic of its country's religion, passes slowly by. But the road to Anseremme can tell another story. Along this winding street in 1914 advanced the invader, and the peace of to-day is tempered by the grief of an almost contemporary yesterday, the bitter evidence of which lies in simple scroll on every side.

Now, up the hill and along the high plateau where rolling cornfields alternate with pasture, and so to Furfooz —hamlet of stone-built cottages—where the joy of the antiquarian and artist will mingle with the prosaic and utilitarian, for is there not a motor bus service daily, and an electric iron in every cottage? And now, turning down a narrow lane where the slaty mossy rock outcrops. Hark! A tinkling bell-like note, a Midwife Toad is calling from its retreat amongst the scree, and then another until the lane echoes faintly with the sound. Lower down, where a little brook is born, an old man is watering his two cows, and here I wait impatiently until he moves away, for the stream temporarily widens into a shallow grass-fringed pool. Eagerly the net is brought into use and scores of Midwife Toad tadpoles exposed to view—many in their second year.

It was here I hoped to find my real quarry, the Yellow-bellied Toads, through vague memories of a visit years before when amphibians were not the prime objective. These were not to be seen, however, so passing on through rocky woods—a paradise of Lily of the Valley, Solomon's Seal, Delphinium, and rare ferns, I came suddenly upon the Lesse—that delightful Kingfisher-haunted tributary of the Meuse. You cannot row up the Lesse because of the shallows and the rapids, but it is a delightful experience to take one of the flat-bottomed boats at Honyet, upstream, and drift down under expert guidance to the confluence at Anseremme.

The meadows by the Lesse were redolent of all the scented growths that go to make a hayfield, while the big coarse leaves of Saffron, the so-called Autumn Crocus, gave promise of a wonderful display in later summer. Occasionally, a large Edible Frog would glide swiftly into the shallows.

By the following morning, however, I realized that haphazard methods might not be the best way of finding my little friends, so, bolstering up my courage, and armed only with a coloured picture, and a limited knowledge of the French language, I approached the commissionaire at the town museum. I gathered here that the principal idea was to foster in its visitors a love of the painted picture, and that beyond a doubtless valuable and meritorious collection of artists' work there was little to see—certainly nothing which would help me.

My next move, therefore, was to enter a stationer's shop, and ask the location of the principal school in the town. Here the head master was interested and sympathetic, but explained that as he had not been in Dinant very long his knowledge of the district was limited—he would, however, see what he could find out, so, taking me across a playground, bordered with bush and standard roses, we entered a room where a master was instructing a class of boys of about fifteen years. There followed a rapid dialogue which I was unable to understand, then the coloured picture was shown to the boys, but unfortunately to no purpose, and the head master informed me that he had drawn a blank. Nevertheless, inspiration followed, and we went upstairs. Appeared then a science master who announced that he had actually seen the Yellow-bellied Toad, the object of my visit. Eureka! Now things looked rosy indeed. I produced a large-scale map and asked him to mark the exact place thereon. This he did, at the same time informing me that the precise locality consisted of two small lakes on a preserved estate about 25 kilometres distant. I promptly said that I had a whole week in front of me, and that the distance was immaterial. " Then," he said, " I will give you a letter of introduction to the ' garde particulier ' "—a gentleman analogous to our head gamekeeper. I thanked him sincerely and felt I had done a good morning's work.

The early afternoon found me at Beauraing—a wayside station near the French border, where, after one or two inquiries, I was able to deliver my letter of introduction.

" And can I go where I like on the estate? " I said. " Certainly, Monsieur." And so with a cigarette and a handshake another friend was made. Soon now I was leaving the roadway, and plunging through low bracken and heather, passing various " warning " notices with

that luxurious disdain which can only be truly appreciated by those who usually slink by such warnings in fear and trembling. Glimmering through the trees were the two ponds, and the end of my journey. These were at different levels and joined by a stony brook. I noted an abundance of coarse fish, while Edible Frogs in hundreds hunted amongst the bordering rushes. Midwife Toads were also in evidence, but despite a three hours' search no sign of Yellow-bellied Toad was found.

This was very disappointing, and I was quite at a loss to account for my bad fortune; however, the brilliant evening sun, the tonic air, and the distant wooded hills of France proved an efficient antidote to undue pessimism.

Two days later in the Grand Place a hand was laid on my shoulder, and turning, I beheld my friend the science master, when the following conversation ensued:—

"Well, Monsieur, did you find what you wanted?"

"No, I'm afraid not, but I'm very glad to see you again."

"I think you ought to go there in the evening, towards dusk; that was when I saw them a few weeks ago."

"Indeed! But surely the Yellow-bellied Toad should be out in the daytime, plainly visible in the water."

"No, Monsieur, in the daytime they hide under stones, and tufts, and come out only in the evening."

"But that is quite contrary to the behaviour of specimens in captivity, and to what I read in books. Perhaps you and I are thinking of different species."

"No, these are yellow and black underneath the body."

"Well, thank you very much, cher ami. I will try again."

And so I did, with no better success, but came away with the strong belief that my friend was confusing the Midwife Toad with the Yellow-bellied Toad.

Now it seems to me there are various conclusions which may be drawn from this true story, none of which are satisfactory to the writer.

In the first place, assuming that both the master and the gamekeeper really knew the species, then I was either incredibly unfortunate, or could not see what was there to be seen. Secondly, although anyone with the slightest working knowledge of European amphibia could hardly confuse the species, I certainly believe that even an intelligent and observant man, such as my informant undoubtedly was, might easily make this mistake—provided he was familiar with the one, but knew not the other. To offset this, however, why did he send me so far if the Midwife Toad was the creature he had in mind, when, to my certain knowledge, it occurs plentifully in several localities much nearer? Following the latter hypothesis we must believe he was quite unaware of these nearer localities—a difficult conclusion.

Again, we have the conversation reported above, the trend of which definitely points to the known habits of the Midwife Toad.

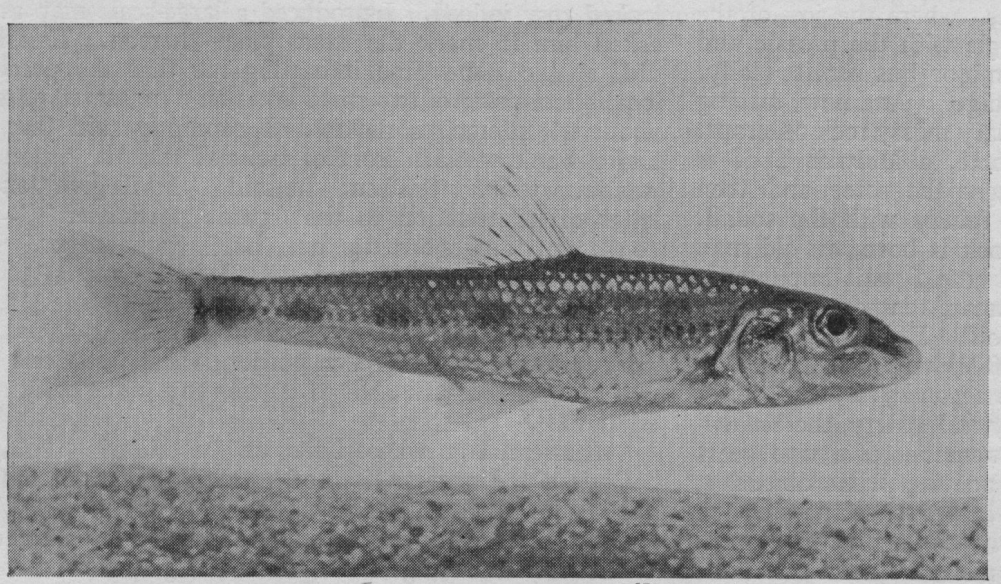
And, finally, I received a letter a few days ago from a most authoritative source which at least does nothing to confirm my own conclusions. My correspondent states that the Yellow-bellied Toad was, until recently, plentiful at ——, which place is only some ten miles from the science master's locality.

Yes! I think there is a mystery to be solved in the Ardennes.

The Gudgeon

THIS is a rather small fish, usually measuring 5-in. or 6-in. in length when fully grown. It is typically a bottom-haunting fish, as may be seen on examining the mouth, which is placed low in the head in order that the fish may feed comfortably on the river bed. It resembles only the Barbel amongst British fishes, but may at once be told from that species by the fact that it has only one lip appendage (barbel) whereas the Barbel has two of these.

The coloration of the Gudgeon is practically impossible to describe. The back is generally a sort of yellowish grey, with tints of blue and green. This colour fades into a greyish white on the underside. Young individuals are not so clearly marked. The scales of this fish are rather large, and the fins are marked with a number of deep brown dots.



[Photographed by kind permission of Messrs. L. Haig

The Gudgeon is hardy and lives well in an aquarium. Being a bottom-haunting fish, it is, as is to be expected, a scavenger and will eat practically anything. Most of all, however, it likes small wriggling earth worms.

Under natural conditions the female lays several thousands of blue adhesive eggs which are deposited in clumps. This species is, however, rarely induced to breed in an aquarium.

Take Care of Your Tortoise

By "AMPHIBIUS"

WHAT happens to the enormous number of Tortoises that are sent over here every year? If they all survived, I am sure that by this time land Tortoises would be almost the commonest form of animal life in the country. Nobody expects his cat, dog, or canary to live for only a few weeks during the summer, and yet there is no reason at all why one's Tortoise should not long outlive cat, dog and canary, and even owner himself. Any natural history will relate tales of Tortoises' longevity, and certain specimens, those of Peterborough Cathedral and Gilbert White, are quite famous personalities.

It is a very regrettable fact that some pet shop owners in their ignorance tell buyers that Land Tortoises are carnivorous and will maintain themselves happily in any cellar or garden that is overrun by beetles, spiders, slugs, or snails. This misrepresentation is the more reprehensible since many people buy Tortoises purposely as pesticides and take no further interest in them whatever. It is little wonder then that at the onset of winter, the neglected animal dies and it is amazing how many otherwise quite well-informed people consider a brief summer to be the normal span of a Tortoise's life, bury its corpse in September with equanimity and buy another in May. Still I do think that often during its short life the Tortoise arouses such interest that the owner would willingly take pains to keep it alive if he only knew how.

Buy your Tortoise as early in the year as you can, this is rather late advice now! They start coming over in March every year and are then not so debilitated by confinement in parrot cages and poultry pens in little shops as they are likely to be later in the season. Fence in any bit of the garden that you can spare for him, and if it is grassed, so much the better. No doubt they like the free run of the garden better, but among the reasons against this is a strong penchant for peas and pansies. I have found, however, that when fed every morning and subsequently let out of their enclosure for the day, they do very little, if, indeed any damage in the garden at all. I have Tortoises of from a pound or so up to thirty pounds weight, perambulating about and yet I manage to grow all the flowers I want without any trouble.

The pea guards sold by nurserymen, wire-netting a foot high, or, best of all, croquet fencing make good Land Tortoise pens, the two former, of course, needing sticks erected at intervals to strengthen them. Make the enclosure interesting. Tortoises like climbing about rockwork, although nobody would think so to look at them. In a garden, the Tortoises can follow the sun round if they want to, but an enclosure should be so situated that it gets plenty of whatever sun there may be. A clump or two of Michaelmas daises or rhubarb will provide a shady retreat, and in a pen a house is absolutely necessary.

Photo [*Brian Stanford*

Make your Tortoise's Home Interesting

A Tate sugar box can rapidly be converted into a Tortoise house, though a box much smaller will do nicely if only one Tortoise is kept. Set it on one long side and three-quarters board up the front. The top, sides and bottom should be covered with roofing-felt to make it waterproof and to cut out the knife-edged draughts that would otherwise get in. It should be stuffed fairly tightly with clean hay, renewed when necessary and should face the east. If he is put in his house for the first few nights, it is surprising how soon he will form the habit of going to bed on his own every night. Tortoises are creatures of habit and have far more intelligence than almost anybody realizes.

Just outside the door of my "Tortoise houses" I have buried a red earthenware flower pot saucer level with the surface of the ground. This is kept filled with clean water, for Tortoises drink deeply but not often. Their daily food also is placed here consisting of lettuce, endive (when in season), young cabbage leaves and occasionally spinach. Clover leaves are relished and grass sometimes eaten. Such extras as banana, overripe gooseberries, strawberries, currants and raspberries are provided according to season.

(*Continued on page 233*)

Curious Names for Familiar Fishes

By ARTHUR SHARP (*Continued from page* 208)

THERE is a small fresh-water fish that inhabits our small, clear brooks and hides much beneath the stones, named " Miller's Thumb " (*Cottus gobio*). It is said to derive its familiar name from a more or less fancied resemblance to the thumb of a miller, the flattened shape of the latter digit, caused by its constant use in testing the evenness of the flour as it falls from the mill-spout, being similar to the flattened head of this little fish. The "Miller's Thumb" grows to a length of from 3-in. to 5-in., and is identified by its broad, flat head with outstanding gills, which in breadth equals about one-fourth of the entire body. It is, we fancy, the ugliest of all our river fishes. Its curious shape has given it not one, but many names. Hence, we may recognize it by such titles as " Bull-head," " Cull," " Tom Cull," " Tommy Logge," and " Bighead."

That beautiful member of the game-fish family the Sea Trout (*Salmo trutta*) is known by a large number of names. It is the " Mort " in Cumberland, the " Scurf " on Tees, the " Whitling " on Tweed, and the " Finnock " in other parts of Scotland. Small Sea Trout are variously known in the North Country as " Herling," "Blacktails," "Orange-tails," and "Lammasmen," the latter from their annual appearance at Lammastide at the beginning of August. Smolts of Sea Trout are known as " Orange-fins," " Silver-white," " Black-fin," etc. " Sprod," in some parts of the North of England, also indicate a Sea Trout in the smolt stage, and sometimes the Sea Trout in its grilse stage of growth. In Ireland Sea Trout are usually known as " White " Trout to identify them from the Brown or Yellow Trout (*Salmo fario*). Again, if we go to Devonshire we shall hear the anglers refer to a fish they know as " Peal " or " Salmon-peal "—this, again, is the Sea Trout. And should we travel to Wales, then we shall hear talk of the " Sewin," which is just the Sea Trout under another local name. A Highland name is " Finnock "—*i.e., Fionach,* the white fellow.

Among familiar coarse fishes with two or three names is the Roach, also known as " Red-fin "; the Rudd, which is spoken of as the " red-eye " from its possessing a beautiful red iris, while the " Finscale " is another local name, and on the Broads it is sometimes known as the " Shallow," probably on account of its frequenting shallow water in summer.

The little silvery Bleak is also called " Whitling " on the Trent, and we have also heard it referred to as the " Willow Blade." (When a Bleak turns on its side in the water it glints just like a willow blade or leaf fallen from a riverside tree and whirled along with the eddying current.) This fish is also known as the " Blick," a corruption of Bleak. Izaak Walton tells us that this fish is known as the " River Swallow ":—" for just as you observe the Swallow to be, most evenings in summer, ever in motion, making short and quick turns when he flies to catch flies in the air, by which he lives, so does the Bleak at the top of the water."

The Loach, a little fish found beneath stones in ponds, ditches and brooks, is also the " Beardie "—a name suggested by the presence of the half-dozen tiny barbules that hang from his upper lip—and in some parts he is the " Colley." The White Bream or Silver Bream (*Blicca bjoernka*) is also called the " Tin-plate " and the " Bream-flat," probably owing to its shape and colour. The Tench is the " Physician " of the fishes, according to ancient belief, and the Carp is the " Water Fox " on account of its cunning and wariness. The Lampern is identified by various other names—" Grig," " Snig," " Nine-eyes," " Seven-eyes," " June-ba," and " Stone-grig." The common Eel is also known as the " Grig " and the " Snig " by many anglers.

Take Care of Your Tortoise—(*Continued*)

When winter comes, there are two alternatives open to the Tortoise keeper. Either he can allow it to hibernate or he can bring it indoors and try to keep it going through the lean months. With many years' experience of all kinds of reptiles behind me, I unhesitatingly recommend the former. It is their natural mode of life and is less trouble, none in actual fact, to their owner.

Tortoises at liberty in the garden will attend to themselves. It is as well perhaps to introduce them helpfully to a specially placed heap of dry leaves and soil in a spot which will not be overlooked while the garden has its winter "doing-out," but a little observation and a stick to mark the spot will keep him in mind wherever he chooses to go. In any case, if the soil is clayey, the Tortoise must not be allowed to bury himself where there is any likelihood of water collecting.

Where it is not possible or desirable for the beast to bury himself, at about the end of September he should be packed into his house with much more hay than usual, and either the house can be left in situ or moved into the tool shed, or any other unheated outbuilding, in which, however, there must be absolutely no risk of penetration by frost. Here the winter will be slept away and during the first or second week in March, the house should be moved back to its accustomed position in the enclosure, and he will then wake up in his own good time to start another summer's life.

* * *

CARDIFF AQUARISTS.—A meeting will be held on Wednesday, September 23, at 7.30 p.m., at " Clevelands," 34, Windway-avenue, Victoria Park, Cardiff, by kind permission of Mr. R. J. King, with a view to forming an aquarists' club. It is hoped that everybody who can will attend this meeting, which should prove of great benefit to all Cardiff aquarists.

The Gigantic Salamander

By "AMPHIBIUS"

THOSE of my visitors who share my "queer tastes" always envy me my Salamanders. They always tell me that they are far rarer than I know them to be, "frightfully" difficult to obtain, etc., etc., and generally say all those things that a collector—in however small a way—loves to hear and pretends he does not.

In actual fact, the subject of this article is tolerably common in China and Japan. They are eaten in the latter country, and I expect the somewhat omnivorous Chinese finds a place for them in his dietary. Once one does manage to get hold of them, however, they prove most satisfactory animals to keep and are tolerant of conditions, which theoretically, one would expect to kill them off with great rapidity.

My own are small specimens measuring twenty and twenty-one inches in length respectively. They are very dissimilar in build, the one which has a linear superiority of one inch exceeding his companion in weight by just over a pound. The maximum size attained by the species is known to be at least sixty-three inches (there is a magnificent specimen approaching this size in Bristol Zoo Aquarium), and a weight of fifty pounds, but I do not expect mine to reach such a size in my lifetime. One has recently died in a continental zoo, after living there for sixty-five years.

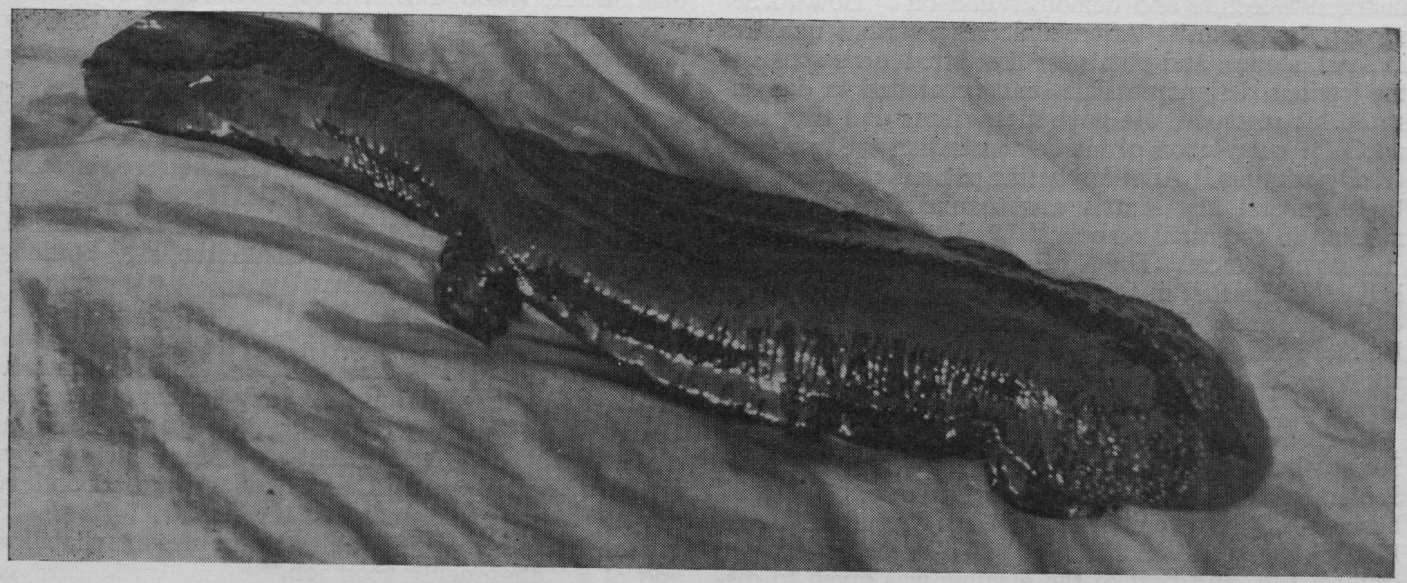
When of small size, their accommodation is not much of a problem. Mine seem very happy and comfortable in their six-foot aquarium, which holds 120 gallons. The suitable furnishing of the tank is, as with all similarly big beasts, an awful job. The range of plants available to the tropical and cold-water fish culturist is enormous, but the horticulturists do not seem to be able to produce a nice, lusty plant that will grow in a tank of the dimensions named, and which can stand a bit of knocking about by anything over a pound in weight. I am not concerned, of course, with "shop-windowing" my tanks for people to look at—that can be done easily enough—but with the desire to reproduce in them something approaching the creatures' natural habitat—in this case a rocky but well planted stream.

Of all my efforts in this direction, only a big pot of Iris sunk in the sand has been able to flourish: a clump of *Sparganium* will keep going for a month or two in the summer, and an extra-selected *Nuphar* is slowly giving way after trying its best. The disadvantage of masses of *Elodea* is that while adding to the occupants' comfort, they effectively stop anyone from seeing what goes on in the water. Fortunately, the Salamanders' favourite resting place is among the rocks with which one end of the tank is furnished, which is a good thing as I am sure there are no more plants left for me to try.

As I cannot provide running water (which is very desirable for them), I have to give them fresh water every two or three weeks in the summer, and once every six weeks during the winter. I propose, however, to instal a filter of sufficient capacity to turn over all the water once in two days. This will not only keep the visibility good, but will help to maintain that quite important condition—a uniform, fairly low temperature. I mentioned at the beginning their tolerance of unfavourable conditions, but I have had periods of some anxiety with them during the recent spell of very hot weather. In common with most people I have cursed the rotten summer we have had (a most depressing one for the tortoises and lizards), but I have felt moments of consolation on observing that things could not be better for the Salamanders. We cannot have it all ways!

Water at about 50-deg. F., or a little less is best for them, but it proves—short of giving them running water—surprisingly difficult to provide. I have a small, well-shaded pond under a hedge, and on the hottest days I put them in it, much to the annoyance of the axolotls that own it. On very hot days the water in their tank goes up to 75-deg., a temperature which would, I am

(*Continued overleaf.*)



sure, prove fatal to these Salamanders if subjected to it for any length of time.

It is *most* important to provide a cover for the aquarium. They sometimes take it into their heads to go for a walk. Although we aim to provide such conditions as will keep *Megalobatrachus* contentedly in his tank, we cannot control the weather, and on four occasions during great heat one of mine has crawled out and fallen five feet on to a concrete floor, once moving a quite heavy wooden-framed glass cover in order to do so. Although appearing none the worse, I do not like to think of his having such a fall again, and suitable preventive measures have been taken. These animals are by no means helpless on land, and when put into wet grass in the neighbourhood of the pond mentioned above, do not always take the shortest cut to the water.

They are not a bit faddy or difficult as regards food. Ideally, I suppose, one should feed them on live fish, but then very few ideals are ever fulfilled. My trouble is that having bought a supply of Roach or Minnows, I usually decide that they look very nice and happy in a tank, and they thereupon become part of the menage instead of the commissariat.

Accommodation being strictly limited, therefore, I dare not contemplate feeding them on live fish! I once put an eel in with them, but he proved too big to tackle, and has now made his home with them among the rocks, emerging periodically to be fed from the end of a piece of wire. As a staple food, my Salamanders get small fillets of whiting. This is varied with sole, halibut, strips of raw beef, axolotls and newts. They are offered food every other day, taking it readily during cool weather, but in hot weather the intervals between meals are sometimes as long as a week. Worms, especially big *Lumbricus* and *Allolobophora*, are relished at all times. Their grip on their food is so strong that I can lift them clear from the water with a piece of fish one end of which they are biting.

Food is refused when the temperature of their water passes 67-deg. F. They show their discomfort thus and by the desire to leave their tank. They also rise to breathe too frequently—an action, by the way, which is at all times accompanied by the most peculiar in- and exhalant noises.

They undergo ecdysis periodically. The operation begins with a prodigious yawn, which apparently loosens the cuticle round the lips, and this then floats backwards. By rubbing itself against and under plants and rocks, the skin is pushed back as far as the pelvis. At this stage my larger specimen usually turns round, seizes the mass of cuticle in his mouth, lifts it off his hind legs and tail, and swallows it. I have never seen the smaller one do this, and she usually leaves her slough hanging in festoons on the plants. The whole operation does not last more than two minutes.

I find these the most active and entertaining of the big Salamanders. They are very spectacular, walking solemnly along the floor of their tank ; or swimming gracefully and powerfully ; or poised, perhaps supported by one foot or their tail only on a rock, at the top of the water. They dislike strong light and never bask in sunny water. It is a good plan to have a piece of plywood to cover the part of their tank where they are observed to prefer to be. It is easily removable for inspection, and gives just the right amount of gloominess to the water in which they are resting.

Club Reports

WEST SURREY.—The West Surrey Club held a meeting on Wednesday, September 9, at Great Bookham, by kind invitation of Dr. and Mrs. Waterfield. The first part of the meeting was devoted to a discussion on the coming BIRD FANCY Exhibition and the draft schedule. The chairman then introduced Mr. H. E. Morris, M.B.A.A., who gave a very explicit and instructive lecture and demonstration on " How to Set up an Aquarium." After explaining various qualities in sand, stones, and plants for use, Mr. Morris spoke of the various designs possible, and proceeded to demonstrate his method. He gave many hints and tips, and upon the completion of his demonstration the tank was greatly admired. After answering various questions put by members, Mr. Morris was thanked by all at the meeting in the usual manner.—W. L. DEIGHTON.

NORTH LONDON.—The North London Aquarist Society is holding the first meeting of the new season on Thursday, September 24, at the Men's Evening Institute, Holmes-road, Kentish Town, N.W.5. For particulars apply to Mr. L. Katterns, 96, Gaisford-street, Kentish Town.

LEYTON AQUARIA SOCIETY. — The Leyton Aquaria Society held their fortnightly meeting last Wednesday, September 9, with quite a good attendance. The chief business of the evening was a talk given by Mr. S. Plater, who spoke on remedies and illnesses relating to tropical fish, and part of the evening was given to discussion of the Leyton Aquaria Society's show, which takes place on Wednesday, October 7, at 8.15 p.m. Quite a good number of entries for the show were promised. We are glad to report the enrolment of a new member, and those interested in aquatic life should write for particulars of membership to the Secretary, E. Mitchell, 119, Ruckholt-road, Leyton, or to the President, D. A. Wood, F.Z.S., 682, High-road, Leyton.

RICHMOND.—Richmond & District Aquarists' Society are arranging an interesting and comprehensive programme for the coming season. All interested in ponds or aquaria, fish, reptiles, or amphibians are cordially invited. The first meeting of the season will be held at the " Orange Tree," Richmond, on Friday, September 25, beginning at 8 p.m. sharp. Mr. H. J. Dunbar will speak on the Chemistry of Water. For particulars of membership apply to R. V. Chatterton, 31, Station-crescent, Sudbury, Middlesex.

* * *

THE WIGMORE TROPICAL FISHERIES have asked us to convey to our readers their sincere regrets for the fact that, through an unfortunate oversight, they omitted to mention that the heaters and thermostats described in the September 15 advertisement are all manufactured by the Dowler Engineering Co. Readers are doubtless already familiar with many of the famous " Dowler " products; the name is in itself a guarantee of reliability and of a " thoroughly good job."

by the last flood we see the unmistakable signs of an Otter. How many fat Trout has he accounted for since he first opened his eyes to the light of day—or, rather, to the darkness of his underground home? What a pity we missed him! We will have to come out at night and watch for him. There is a full moon to-night, so how about it? All right, that's settled.

Do you know, I have a feeling under my waistcoat that there is something sadly amiss. 'Strewth! It is half past eight already! Breakfast-time for yours truly, and half a mile to walk back. How did you like your early morning's ramble? I hope you enjoyed it as much as I did. I think the dawn is always the best time of the whole day, and it is seldom I miss it when I am Trout-fishing.

Since a very small boy I have been interested in river life and lore, and on some other occasion I should like to describe as fully as I may the lives and habits of the wild creatures which dwell by the riverside, accompanied where possible by sketches from nature and by photographs. Although my chief interest in rivers is that of an angler, I am afraid fishing is very often allowed to " go to the wall " when I get a chance to observe birds and animals at close quarters.

If you are interested in Trout or sea-fishing in any form, I shall be very pleased to hear from you; any help on the selection or making of tackle, preserving of baits, or anything " angular " I can give is entirely at your service. All letters and inquiries will be answered promptly, and—

Did I mention breakfast? Well, it is ready now. Cheerio!

Is the Sand Lizard Becoming Extinct?

By PETER MICHAEL

MOST writers, in dealing with reptilian and amphibian subjects, seem to ignore or overlook the fact that the Sand Lizard (*Lacerta agilis*) is fond of water, as well as sand and sun. At least, he likes, if possible, to pass his leisurely days and live his rather sluggish life in a habitat which is not too far from the liquid element. I mention this mainly as an apology or excuse for introducing the comparatively little known lizard to the pages of WATER LIFE. This tastefully coloured lizard is a strictly local species, the distribution being rather curious: and this very fact seems in danger of bringing about the reptiles' gradual but nevertheless inevitable extinction. Whereas our other British lizards—the common Lizard (*Lacerta vivipara*) and the Slow Worm (*Anguis fragilis*)—are comparatively common species, the handsome Sand Lizard is to be found on the heaths and waste lands of Dorsetshire and Hampshire, on the dunes in the Southport (Lancs) district, and in the neighbourhood of Frensham Ponds, Surrey.

Identification is simple enough. It cannot, in the first place, be confused with the Slow worm, which looks more like a snake; and, secondly, it differs considerably from the common Lizard. The usual colouring of the latter reptile is greenish-brown or light brown, with a darker line running down the middle of the back, and dark markings, flecked with yellow, on the flanks. The underparts are yellowish-green in the case of the female, and in the male they are orange. In contrast, the Sand Lizard is usually considered a more beautiful creature, though I doubt whether all observers will agree on this point. The female is attired in dusky brown, toning nicely with the brown or golden-brown of sand, and spotted or flecked with darker markings on back and sides. The male is more colourful, his livery being of a greenish hue—at its best in late spring and early summer, when the green is that of the emerald and every bit as brilliant. I have never compared the tails by actual measurements; but from casual observation the tail of *Lacerta agilis* appears longer, slimmer and more flexible than that of *Lacerta vivipara*.

A Hampshire man, born and bred, I have encountered numerous Sand, as well as common, Lizards on the sandy, gorse-clad heaths of my native county, particularly in the neighbourhood of Aldershot, where the common species in particular was, until recently, as abundant as its names implies. Yet even the common Lizard seems to be declining a little in this district, while Sand Lizards are not so plentiful as they once were. No doubt the development of town planning and the encroachment of housing estates have a lot to do with this state of affairs.

In the Frensham district the same thing seems to be happening, though admittedly Sand Lizards are by no means conspicuous by their absence—provided you look for them, that is. But five, six, or seven years ago one could rely on them to come forth and sun themselves on the heather in " battalions." So long as the watcher kept reasonably quiet, they gave ample time and opportunity for study, and I have counted as many as half a dozen in one gorse bush or briar.

But the " Surrey Seaside " has become more and more popular now, and one does not see so many sandy-brown or emerald-green Lizards dozing contentedly near the reedy margin of Frensham Great Pond. The Sand Lizard is considerably less active than, and certainly not so adventurous as, the common species; no doubt it has grown to resent the intrusion of hordes of hikers and holiday-makers, and so disappeared.

Having given my observations on the present distribution of this reptile in my area, it would be interesting to hear what readers in other parts have to say.

* * *

LEICESTER AQUARIST SOCIETY.—The monthly meeting of the society was held at the Leicester University on Monday, September 14. The evening was given over to discussion, and several interesting problems arose. The problem of *p*H was brought up, and the President, Mr. Plunkett, interested the members with an experiment by a *p*H indicator, and acid and alkali, which cleared up several doubts entertained by members.

—E. BALLARD, Sec.

. . . . . .

Will Mr. F. Hansford kindly let us have his address?

The Iguana as a Pet

By "AMPHIBIUS"

THAT it can be depended upon not to bite is only one of the points in favour of this large and spectacular lizard. Its fearsome appearance is not supported by its equable disposition and its colour—sometimes approaching the brilliant—is pleasing and decorative.

The Iguana, alas! is disappearing rapidly in company with Podocnemis and Anaconda from the haunts in which it was, even recently, extremely common. It has always been eaten by man, its flesh, as is that of all edible reptiles, being described as "like tender chicken"; but it is the merciless slaughter occasioned by the demand for its skin for women's handbags, shoes, and belts, that is causing the dwindling in numbers of this magnificent animal. It used to be found over a large part of South and Central America, but one must now travel ever-increasing distances into the forest to find it at all.

Whether it is to thrive in captivity or not will depend to a large extent on its condition when first bought. Ask the dealer to put one on the floor. If it just sits where it is put, do not have it, but ask for another. If, however, it runs away or, raising itself deliberately on its legs, aims a vicious swing at you with its tail, buy it, after making sure that claws and digits are undamaged. It is not advisable to buy Iguanas after June or before April. They need as much sun and fine weather as possible in order to build them up for winter in this country.

It is generally considered that Iguanas will not go through the winter in this country, but they will if given the treatment I am about to suggest. This may be considered rather drastic and risky by those who are accustomed to regard the Iguana as a most delicate hothouse animal, but it is based on my success with a number of this species, and will be found worthy of a trial. New work must be done if our knowledge is to increase, and the Iguana is one species regarding which I have found the textbook instructions to be quite inadequate.

The first necessity, the cage indoors, is nothing out of the ordinary. As large as circumstances permit, its temperature should be at least 70° by day, and one ten degrees lower at night will be high enough. The cage should be furnished with a thick layer of quite wet moss or peat, and a number of large, barky branches. A 60-watt lamp should be let in the roof, so that it powerfully illuminates one-half of the cage only, and some of the branches. In spite of what I have read, the Iguana does not seem to be at all fond of the water, although it usually walks well into the pot when taking a drink.

The aim should be to let the animal spend as little time as possible in his cage. Taming will be accelerated if his owner handles the Iguana as much as possible, and please do not pick him up by the tail! The proper way to pick him up is to pass the hand between the hind limbs along the belly, finally to support the thorax, with the body resting on the forearm. If the tail is held between one's body and arm it will be a check against a sudden leap.

All warm and sunny days throughout the summer should be spent outdoors. The Iguana is not an active animal, seeming only able to run a few steps at a time, and those awkwardly. The usual gait is slow and very deliberate, with many undulations of the body and tail, so one need not unduly fear it escaping. I put a small cloth belt round its middle, and to it I tie a long string. If necessary, I tether it. This sounds rather crude, but after trying a few times to scrape it off with its hind feet, the animal does not seem to mind it in the least. It is not, of course, at all tight.

The accompanying photograph shows a female of mine basking on a stump on the lawn. She was no

Female Iguana basking on a stump [*Photo by Brian Stanford*

exception in soon growing too tame to need either belt or tether, but while she did need one, it could be fastened to whatever she made her favourite basking spot. A similar stump was placed in the shade nearby, so that she was not compelled to stay in the sun. If no one was to be about, my owl's aviary was used for the Iguanas during the daytime, the owl being away, of course. They liked to lie along the perches and would hang on the wire netting, following the sun round.

Under such conditions of fresh air and sunshine the Iguana will grow healthy and well. Food should be given every day, consisting of lettuce, banana, slices of soft ripe pear, clover flowers, etc. Sometimes they will crop clover from the lawn. Of raisins, sultanas, and grapes they are very fond, and I used sometimes to amuse myself when sitting in the garden by scattering a handful on the grass, whereupon the basking animals would make for the spot and root them all out. They soon become tame enough to come and meet their owner on his approach with food.

They are not let out at night, not because I believe them not hardy enough, but because I believe no advantage would be derived from doing so.

Such treatment greatly increases their chance of passing the winter satisfactorily. In autumn their outings must cease, and they must reconcile themselves to some months of closer confinement. I am doubtful whether the special " suns " sold for reptile cases have any advantage over the ordinary electric bulbs. Having very little theoretical knowledge of the subject, it seems to me that only an arc or a mercury-vapour or quartz lamp is any substitute for the sun. Anyone who can afford one of the luxuries named has his difficulties minimized, but the fact remains that even an ordinary bulb makes things much brighter for reptiles during the winter, quite apart from any irradiating qualities.

I am convinced that much of the difficulty experienced—and not only with the animal under review—is due to ennui on the part of the reptiles, so I take pains during the winter to handle mine as much as possible as a means of interesting and livening them up a bit. The famous feeding difficulty manifests itself about a month or six weeks after they have been taken indoors, but one may rely on their reserves from the summer to help them to a certain extent.

Their fondness for basking before a good coal fire can be used as a means of " force-feeding " them. The term is quite unsuitable, as no force is used, but no better is available. The heat after a while causes them to open their mouths, as does also the sun, and this is not necessarily due to discomfort. At such moments slices of banana or grapes put into their mouths are readily chewed up and swallowed, never rejected, and the process is repeated as often as possible. No more violent measures are necessary.

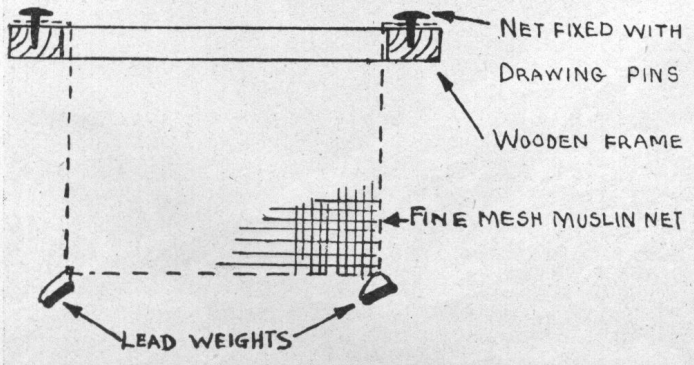
If put into a case and used simply as exhibits, then nothing short of the elaborate arrangements in use at the Zoo will keep them alive, but, treated as household pets along the lines suggested, they will thrive and be very happy, besides giving their owner great pleasure.

The price is reasonable—about twenty to thirty shillings each for young ones and females, but a good male with a well-developed crest and head usually fetches about £2 : 10 : 0.

A Useful Accessory to the Garden Pool

By W. D. WEBSTER

I BELIEVE, with many other aquarists, that young fry grow and develop much better in an outdoor pool. I should like to explain to WATER LIFE readers a little device I have made which may be very useful to them. I have some young Shubunkin fry which I prize considerably, and to put them in the pool with my large Comets would be asking to lose them;



so I have constructed a small floating home for them which I will describe. First I made a wooden frame about 12-in. square out of 1-in x $1\frac{5}{8}$-in. hard wood, oak or teak, as soft wood would become waterlogged and sink. I then made a square net about 7-in. or 8-in. deep, with, of course, a bottom to it, and fixed it on top of the frame, letting it hang down inside. This was made of a fine-mesh muslin, fine enough not to allow the fry to get out, yet large enough to allow small insect life to get in. The four lower corners of the net I weighted down with pieces of lead.

This, when placed in the pool, will float, and by putting in some floating weed such as *Riccia* or Frogbit to give shelter from the sun, it makes a fine little home for young fry with absolute safety from the larger inhabitants of the pool. I find it a good idea every day to dip a cup into the pool around the roots of the marginal plants (this is a favourite place for small insect life), and to pour this into the floating net. This ensures plenty of living food for the fry, which is essential for their quick development. Herewith is a sectional sketch to show the fixing of the net to the wooden frame more fully.

* * *

The Pope is well worth a place in the community tank with his deep violet eyes and lemon-green sides, which have a metallic lustre like leaf gold speckled with green. Feed him with plenty of earthworms, gentles, and all kinds of live food, then he will not bully other fish provided they are not smaller than himself. His tank must be well planted, as he is a very timid fish and likes to hide.

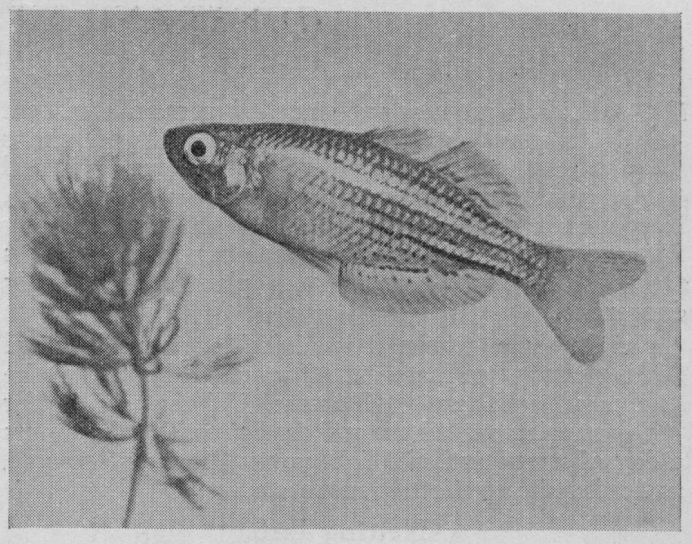
Australian Rainbow Fishes

FORMERLY, when one spoke of the Australian Rainbow Fish, one meant *Melanotænia nigrans*, but about eighteen months ago the first specimens of a new and even more handsome species were imported. This fish was identified as *M. maccoloughi*, and it is even more beautiful than our old friend. These species are extremely similar, the only obvious differences being in colour.

The Rainbow Fishes are members of the family of fish known as the Silversides or *Atherinidæ*, which is of very wide distribution throughout tropical and temperate waters.

Our title fishes hail from Australian waters, and with the Purple Gudgeon (*Mogurnda mogurnda*), are among the few Australian species which reach our aquariums. The general shape of the genus can be seen from the illustration. In *M. nigrans* the colouring consists of red and yellow stripes along the sides, with a brilliant red spot on the operculum. While *M. nigrans* is beautiful, *M. maccoloughi* is even more so. The body is marked in a series of black and bluish stripes on a ground of an indeterminate bluish-yellowish green. The fins are a definite yellow edged with a full red, which makes them stand out well and draws attention to the double dorsal, the front half of which is hard-rayed. These are fairly large fishes, the adults measuring about three and a half inches, but they are quite peaceful, and are well suited to community life.

Melanotænia species are fairly easy to spawn provided that they are given a lot of room; a thirty-gallon tank is not too much for one pair. In fact, they do best, from the point of view of breeding, in heated ponds or in the garden pool in summer; it is a little late to recommend this latter. As they are quite happy at 60° F., there is no reason why they should not be put outside. For spawning they require large bushes of fine-leafed plants, to which the adhesive eggs attach themselves. The parents are quite easy to sex when they are in condition, as the female is very considerably deeper bodied than the male. The spawning is a very hectic business, the fish chasing hither and thither at a furious pace. A very large number of eggs are laid as a rule. Hatching takes place in two to four days according to temperature, and provided the young have plenty of space, they are very easy to rear and grow rapidly. The *M. maccoloughi* have bred very successfully at the Derham Fish Farm.



The Australian Rainbows are beautiful, cheap, and easy to feed, besides being excellent community fish, so why not invest in a pair?

Viviparous and Sand Lizards

By W. G. RUFFLE

THE Viviparous Lizard (*Lacerta vivipara*) is a common inhabitant of the British countryside, although, on account of its swift movements and the similarity of its colour to the earth, it often escapes notice. In shape it resembles the familiar Green Lizard, but grows to only about half the length (the Green Lizard is generally about a foot long). In colour it is brown, with darker brown sides, yellow stripes separating the light from the dark. The underparts in the female are yellow, and in the male orange with black spots. It makes an excellent companion for the Green Lizard, and both kinds may be kept in the same vivarium, containing sand, moss, and drinking water.

Viviparous Lizards, as their name implies, bring forth living young. They breed readily in confinement, but fertilized females should not be kept with Green Lizards. Pairing takes place in May. Both species feed on live insects, chiefly spiders and earth worms. It is important to remember that very few Lizards or batrachians will eat prey that is not moving.

In winter they are best kept in a warm living-room, and as winter food meal worms are useful. The young ones are best provided with fresh moss gathered from the countryside, and changed frequently. They will extract nourishment from this.

A near relative of these creatures is the Sand Lizard, (*L. agilis*), sometimes found in Southern England. The male is more or less green in colour, but the female is grey with rows of white black-edged spots. The colour of the underparts varies greatly in both sexes. They pair late in May, and in about three weeks the female lays from five to eight white soft-shelled eggs, which take about five weeks to hatch. They should be treated in just the same way as the other varieties, but they will not breed so easily.

Another member of the family is the Wall Lizard (*L. muralis*), which can be bought quite cheaply from most dealers.

A vivarium containing one or two of each of these creatures makes a most interesting possession, providing much greater variety than one with one species only.

Ideal Background for Your Pond

By Mrs. K. COOKE

MOST aquarists some time or other manage to make for themselves an outdoor pond. In the majority of cases, because of the nature of the garden, the pond must be of a formal character. Lucky indeed is the aquarist who has as a background a rock garden; the illustration shows the pools in a garden of this type and the following notes may be of some interest to those readers who are about to construct a pool and whose garden has not taken too definite a shape.

Mrs. Cooke's delightful combination of water garden and rockery

First of all an endeavour should be made to break up the lie of the ground if it is too level, valleys and hills should be created by excavating the soil in certain parts of the garden and piling it up in others. If a single pool is wanted it should be placed in the lowest part of the reconstructed garden and needless to say should be given an irregular outline. If three or four are needed these should be arranged at varying levels so that one overflows into the other. Should a rock garden be constructed as a surround to the pools, it is really worth while to make an attempt to produce the effect of cliffs and bluffs around at least one side of the pool. The hills of the rock garden should, of course, be so arranged as to have the long gradual slopes facing south-east to south-west, and the more abrupt slopes, except so far as the pools are concerned, to the north.

In the example shown the large pool is some 30-ft. by 12-ft. in size and about 5-ft. in depth at the centre. The sides of the pool are sloping steeply on the south side and at an angle of about 30-deg. to 40-deg. on the north side. The concrete is about 6-in. thick and—here lies the secret of all successful and lasting pond construction—is reinforced on all sides and the floor with wire netting, wired together and carefully laid centrally in the concrete.

Thin concrete retaining walls were constructed on the gradual slope of the pool so that a layer of soil can be maintained all up this gradual slope out of the water to shade into the ordinary garden level. In this way the pool is given a background of marginal plants which does much to break up its formal character and give to it the desired natural appearance. As marginal plants, most of the Primulas and the water-loving Irises, such as the I. sibirica, lævigatas can be used with many of the modern tall and medium Spiræs and Astilbes as a background. It adds to the natural appearance of the margin if Dwarf Forget-me-not and Creeping Jenny (*Lysimachia nummularia aurea*) are allowed to grow in between the roots of the marginal plants. The latter will cover the edge, and many of the shoots will hang into the water and grow as aquatics.

The edges of the smaller pools are quickly covered by using some of the stronger growing alpine mosses such as the Arenarias—*Cæspitosa, Cæspitosa aurea,* and *Calearica*—and *Helxine solierii*. It may be of interest to tropical fans to learn that *Mollienisia velifera* were bred in the smaller pools during the warm summer of 1935. It seems unnecessary to add that this was not possible during the alleged summer of 1936!

Budapest Zoo

A famous inhabitant of the Budapest Zoo, the Brazilian Horned Frog (*Ceratophrys cornuta*), has died after fourteen years of captivity. The Frog, which lived on one live mouse a month, is said to have made a record for this type of amphibian, which generally perishes in captivity.

London Zoo

New at the Zoo Aquarium is an Electric Catfish from the Nile, a fish which has electric organs distributed all over its body. This fish, which is called " raad " by the Arabs—a name meaning " thunder "—does not shock other fish to death and engulf them, as does the Electric Eel of the Amazon River. Instead, it approaches them with an appearance of casualness till its bulky form just touches that of its victim. The shock, which is severe but not fatal, is sufficient to make the object of its assault bring up its previous meal, the Catfish remaining behind to enjoy its ill-gotten gains.—*Observer.*

Decorative Terrapins

WHEN speaking of terrapins one is apt to think only of the European Terrapin, and to forget the several delightful small species from the New World. At this time of year when the common species are already hibernating, there are doubtless quite a number of fanciers who would like to go on enjoying pets of this nature, but do not know of the desirable species available.

Elegant Terrapin

Here we intend to write of three species which are fairly often available to the collector, but first we will discuss the requirements of these droll little fellows. They do not need a very large vivarium as they never exceed about 2″ in length. A shallow aquarium about 2′ long is ideal. This should be divided into two parts, one half land, made up of sand and rocks, and the other half water, about 3″ or 4″ deep. The sand looks best if some small moisture-loving ferns are planted in it, or if it is covered with moss and lichen. A sloping landing place should be arranged to enable the inmates to scramble easily out of the water. These terrapins do not like the cold, and the vivarium should therefore be located in a heated room, where the temperature is not likely to fall below 55° F. during the winter.

Painted Terrapin

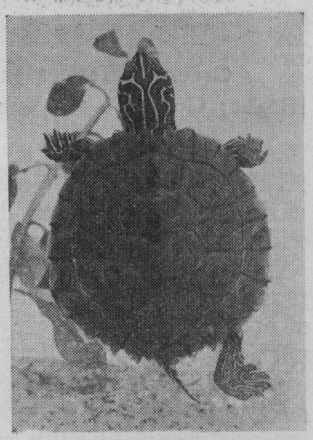
Now to describe the terrapins themselves. The Elegant Terrapin is quite often seen in pet shops, and is easily recognized by the bright green carapace. In older specimens this bright green becomes much deeper and less vivid in hue. The head and limbs are striped dark browny green on a pale yellow base, and the cheeks bear a vivid red patch. The under side of the shell is marked by strange concentric designs, which can be seen in the illustration.

The Painted Terrapin is the most handsome of the three. The upper side of his shell is a deep brown, with a longitudinal red line down the centre, and reddish markings around the edges. The head and limbs are marked with yellow and black stripes, many of the yellow stripes being also picked out in red. The edges of the under side of the plastron are marked red and black and yellow, while the main part is a light yellow with a large red patch each side. This really is a most handsome species ; especially is it attractive when, standing on its hind limbs in the water or climbing up the glass sides of the tank, it displays its markings to full advantage.

The Sculptured Terrapin, while nothing like so colourful as the Painted, is nevertheless very striking and a fine contrast. His shell is much deeper through, and it comes to a sharp ridge at the summit. Where the individual plates of the shell meet, free edges are left, as can be seen in the illustration. This gives rise to the popular name. The head and legs are freely marked with fine grey and pale yellow stripes, and the under side of the shell is quite a pleasing brown. The upper side of the shell is a similar colour, though somewhat deeper.

Provided they are warm, these little fellows are quite easy to feed. Tiny strips of meat, small earth worms, and blood worms are readily taken, but, if you are a tropical fan and have a few baby live-bearers you do not want, you will earn the everlasting gratitude of your " Terries " by giving them these. Small strips of liver seem to be particularly acceptable, and it is our experience that they come to appreciate this food above all others, if it is fed to them in small pieces with the aid of tweezers. The strength of the jaws of these little fellows is truly amazing, and it is an amusing sight to see one of them seize the end of a worm held by a large Crested or Marbled Newt, and then, after a tussle, finally wrest it from him. In fact, they are the only creatures we have come across capable of taking care of themselves in the home of the larger and more vicious newts. Another peculiar feature about their feeding habits is that, in our experience, after receiving the tasty morsel each " Terry " will retire to his own particular corner to enjoy it. This may not prove to be the experience of others, but our specimens have each their own particular sleeping and eating places in same part of the vivarium.

Not only are these creatures noteworthy for their beauty, but also for their great intelligence, as the owner will quickly realize for himself. It is surprising how soon they begin to recognize the hand, and apparently the face, that feeds them, and approach to the tank is the signal for a headlong dash to the place below the lifted cover, where they all wait expectantly with heads up and necks outstretched.



Sculptured Terrapin

* *

The skeleton of a Sea Bass, claimed to be 15,000,000 years old, was found in the amber pit at Palmicken, East Prussia. Hitherto such skeletons could not be extracted from the soil, as they crumbled to pieces.

It is better to err by feeding too little than too much.—Wm. T. Innes.

Hibernation of Land Tortoises

By T. C. BUCK

NOW that autumn is well advanced land Tortoises, such as the Greek and allied species, which hibernate in a natural state, are becoming sleepy and are ceasing to feed. If they have been feeding well they should survive the long winter sleep, as then they can store up enough fat to enable them to fast for several months.

Land Tortoises may be hibernated in England by the following method. As soon as ground frosts are reported, place the Tortoises in a box every night. The box, which may be one which originally contained tinned fruit, should be filled nearly to the top with hay, dry leaves, or other garden litter. Cover the box with a sack. Allow the Tortoises out in the garden so long as they remain awake. With the first very cold weather they will shut their eyes and cease to walk about. Leave them in the box and they will burrow into the leaves or hay. When this happens cover the box with plenty of sacking, straw or similar material to keep frost away. The Tortoises will get all the air they require, which is very little, through this covering. The box may be kept in the garden throughout the winter, provided it is well protected from frost and rain. Otherwise it may be placed in a cool outhouse or cellar. The box must always be in a cold position, otherwise the Tortoises' hibernation will be interrupted with, probably, fatal results.

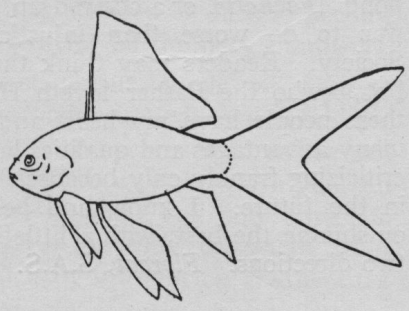
Do not disturb the Tortoises until the middle of March, when an inspection should be made. If they are awake they should be brought out of the box and coaxed to eat and drink. They usually prefer a long drink of water before eating anything. Tortoises, after awaking from hibernation, often refuse food for some weeks if the weather is dull. This need cause no alarm, as I have kept one which did not commence feeding until the end of June but which successfully hibernated the following winter.

Goldfish Standards

2.—THE COMET.

(a) Scaled. (b) Scaleless, otherwise known as the Calico-Comet.

DESCRIPTION.—*The Head*: Wide and short. Its length slightly greater than its depth. The shape is oval. *The Eyes*: Small, round, and in line with the top of the gill plate. *The Mouth*: Small and slit-like. *The Body*: Long and moderately arched above and below. The arch of the back rises evenly from the snout to the commencement of the dorsal fin, which is the highest point. It is flattened somewhat at the sides, tapers towards the base of the tail, and rises slightly to complete the curves of the limits of the tail.



The Tail: Long, broad, with pointed tips, well forked and carried expanded. *The Dorsal Fin*: The taller the better. The first three rays are carried erect. *Pectoral Fins* (*paired*): Long, broad and pointed, and held well away from the body. *Ventral Fins* (*paired*): Long, broad and pointed, and held well away from the body. *The Anal Fin*: Single, long, broad and pointed.

The Scaleless Comet or Calico-Comet is similar with the exceptions of its scalelessness and coloration. The whole fish should be completely scaleless, including its gill covers. A particular feature of its coloration is a sprinkling or dusting of tiny black spots throughout, including the fins.

The colours of the Calico-Comet are valued in the following order:—Blue, violet, red, yellow, well mottled with black spots.

TABLE OF POINTS.

	Scaled	*Scaleless*
Body	20	15
Head and Eyes	5	5
Tail	30	30
Fins	25	10
Colour	15	35
Style and type	5	5
	100	100

Fishing—and Cooking—Story

IN one of his poems in " The Bad Child's Book of Beasts " Mr. Belloc thus describes the Whale:—

The Whale that wanders round the Pole
Is not a table fish.
You cannot bake or boil him whole,
Nor serve him in a dish.

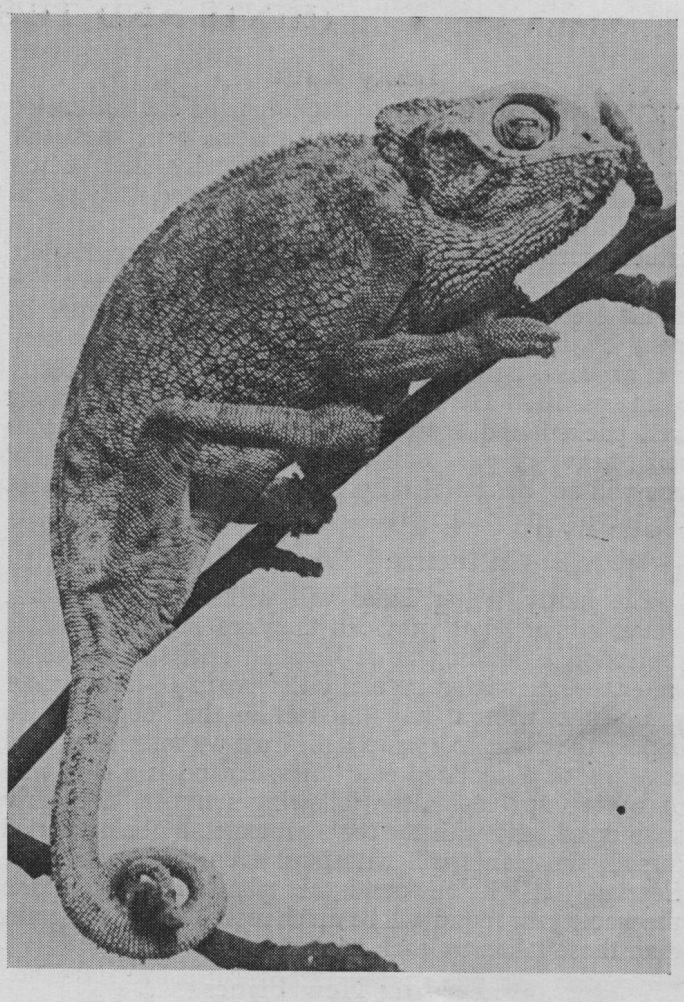
M. Henri Chambard, formerly chef to the Emperor of Abyssinia, pulled off a feat that can only be compared to that which nonplussed Mr. Belloc's chef in the poem. He cooked whole the 731-lb. Tunny caught by Capt. McTillop on board Mr. T. O. M. Sopwith's yacht *Vita* six miles off Scarborough. It was cooked in the kitchens of the Trocadero in a specially constructed casserole, into which it had to be lifted by twenty men and a pulley. The fish, which was 9½-ft. long and 2½-ft. thick, was braised for twelve hours. M. Chambard approached his task with the utmost nonchalance. He got used in Abyssinia to roasting whole several oxen at a time.

—*Daily Telegraph.*

What's New?

RECENT visits to dealers in tropicals have resulted in our seeing some interesting new species. Of these, first and foremost was the Neon Tetra (*Hyphessobrycon innesi*), definitely the most brilliant little fish we have ever seen. Writers are prone to speak of tropicals as little jewels, etc., in the most flowery language, but few fish come up to their rather exaggerated descriptions; here actually is a fish that is a real jewel in colour and in size. The Neon Tetra is a bare inch long, and is very light-bodied, with transparent fins; there is a blue band running along the lateral line, and below this in the hinder part of the body is a red line. The amazing thing about these two markings is that, incredible though it may seem, they really are absolutely as vivid and luminous as the neon signs. To be convinced you must see them yourself. The demand greatly exceeds the supply in spite of the price, so most of us will have to be content with seeing the fish, but this we should not fail to do. We will be publishing an authoritative article on this species next week.

Mr. Boughton has imported several species of Dwarf Cichlids, some new, some old favourites, and these very beautiful fishes are to be strongly recommended to those who would like to keep Cichlids, but who can only think in terms of 8-in. Jack Dempseys and 60-gallon tanks, which they are unfortunately unable to accommodate. The Dwarf Cichlids mostly do not grow much over 2-in., and are quite happy in a tank of only five or six gallons, where with a little persuasion they will breed and raise their families much after the fashion of their big relations.



At the Wigmore Fisheries we saw a strange sight for a fishery; in fact, a tank, without water, containing several fine Chameleons. The most interesting thing about this show piece was that one pair had mated, and the female was laying quite large white eggs, which she deposited in depressions in the sand. Quite a number of customers were being entertained by seeing the Chameleons fed with beetles, the appearance of the great long sticky tongues causing considerable wonder and excitement. One of the Chameleons kindly posed for its photograph, which is reproduced above.

The Making of Sunken Pools

(*Continued from page 372*).

To introduce fish straight away into a newly made pond is fatal to the fish and to the hopes of the would-be pond keeper. The chemicals that come out of the cement when first covered with water, chemicals noxious to all water life, have to be dealt with. There are three ways of dealing with them: by soaking, scrubbing, emptying and refilling over and over again, through a period of many weeks; by covering the wall with a preparation that makes a barrier between the water and the cement (such a preparation being in itself harmless); or by neutralizing the chemicals from the cement by other chemicals. Which of these methods is the best? The first, if one has the time and the patience, especially if one can work a run-through of water continually, to wash slowly the poisons away as they come out of the cement. Few, however, have the patience to wait many weeks, and will be forced to decide on the second or third method. Of these I consider the second the better, if I may judge mainly by the experiences of many friends and customers who have tried both. To be quite fair—and some of my acquaintances may be surprised to know that I like to be fair—what happens often, when the third method is employed, is that after the first filling the neutralizing compound is used, and tests show the water free from an excess of alkaline substances. The owner cheers, shouts " all clear " and puts in his stock. Result? Trouble! Why? Because the fancier has not realized that the water will continue to draw poisons from the cement for weeks, not for days only, and that the first neutralization has, after all, achieved but little. That is why we say number one for choice; number two method as the best alternative.

The Soft-Shelled Tortoises

By "AMPHIBIUS"

THE soft-shelled Tortoises are very interesting inhabitants of the aquarium and it surprises me that they are not more widely kept. I can find no mention whatever of them in the literature—admittedly very scanty—dealing with reptile keeping, so a few notes about mine may be of interest.

The family to which they belong: *Triony choidœ* includes six genera, all of which are aquatic. They are fond of lurking in the mud in shallow water in rivers and lakes, often with only the extreme tip of the proboscis visible and catch their food, consisting of almost any animal matter on the move, by suddenly darting out their head and seizing their prey in extremely sharp jaws.

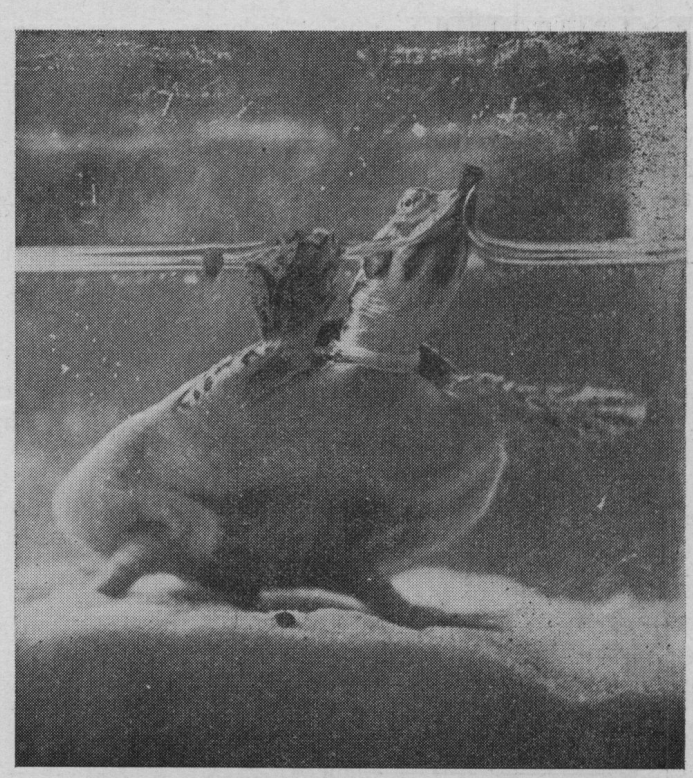
Representatives of one genus: *Pelochelys* are sometimes found in the sea, while the least aquatic is the Indian Emyda which is often met with quite a goodish distance from water and is capable of seizing what suitable prey it can upon land.

Many of them grow to a huge size, a diameter of 5-ft. being relatively common and disks exceeding even this in length may be found. They come from Asia—particularly rich in them, Africa, and the warmer parts of America. The following are among the species occasionally available:—The Chinese Trionyx, *Amyda (trionyx) chinensis;* the Snapping Turtle, *trionyx ferox;* the Ganges Trionyx, *Trionyx gangeticus,* and the Indian Emyda, *Emyda granosa.* They are well worth the high prices usually asked for them and I would recommend Terrapin enthusiasts to have a try with them.

They are not, as a whole, very hardy but they become very tame, are extremely good doers when their water is not allowed to get colder than 65-deg. to 70-deg. F., and are quite unusual in shape and habits. Very small specimens are best, and as the prices mount with size, are cheapest and they are more brightly coloured than the adults, all of which tend to become a uniform grey, brown, or khaki colour above, but retaining the paler colours below.

When little, these Tortoises are extremely active and simply race about, so the bigger their tank is the better. Two American Spiny soft-shelled Tortoises that I have at present (see photograph) are scarcely bigger than a penny, but they manage to make the 4-ft. aquarium which they share with various other little Terrapins look quite full at times, they are such busy little mites. They have a habit of suddenly dashing from one end to the other, rapidly burying themselves in the sand, sticking out their heads after a minute or so and looking round with an expression that plainly says, "There, that's foxed everybody!" An action which seems to have no significance whatever, but which obviously affords them the greatest satisfaction.

In no part of the tank does the water need to be more than 3-in. deep, and they should be able to leave the water at one end. Such plants as Burr Rushes, Great Water Plantain, *Sagittaria,* etc., can be planted on this area with advantage, both from the æsthetic point of view and also because a well-planted little island is more like what the animal can be expected to walk on to in his natural state, than is the usually provided slab of stone or unpicturesque expanse of damp sand.



One of the Author's American Spiny Soft-Shelled Tortoise —*Amyda spinifera*

There should be a continuous slope from the "dry land" end of the aquarium to the other—even under water, so that the occupants can select the depth they like best. Such a slope is easily maintained if stones of varying sizes are set in the sand at intervals to act as retainers. The sand itself should be very fine—the finest obtainable—well washed (what a job sand washing is!), and at least 3-in. deep. *Salvinia* is an excellent surface plant, providing welcome shelter and some sprigs of *Elodea* are appreciated to run about among. I am unable to get *Lemna* to flourish indoors.

The little soft-shelled Tortoises are easily fed. Tiny shreds of meat, worm and liver are relished, but I think that live aselli and gammarus are the best and most natural food for them at this stage of their lives. It is most amusing to watch them, when hungry, spot one of these crustaceans and literally bolt after it all out. As a rule the shrimp wins and finds shelter under a stone, but when caught, the tiniest of them are eaten with gusto. They do not seem to be able to manage the large ones—perhaps the many appendages make dry eating or stick in their throats!

On sunny days, together with all my other little Terrapins, the little *A. spiniferas* are put in enamel bowls with sand on the bottom and stood in the fresh-air for

(*Continued on page* 391.)

rubber tubing, one of them being punctured on the curve. On first aquaintance this little apparatus is apt to appear very mysterious, but the principle upon which it works is in reality remarkably simple, for it is none other than the well-known law that a fluid always finds its own level.

If the siphon is filled with water and placed with its long arm in the aquarium the water level in the tube C and in the tank will be the same, and if the tank level is above that of the air hole at D the water will flow along the tube and run away below D until the tank level is brought down to that of D. As a result of this, by fixing the vent D at any given point you will be able to maintain the tank level at that height regardless of any water which you may run in.

For bending the glass an ordinary bats-wing flame is required. Glass tubing is cut by making a mark on it by a few strokes with a triangular file and then snapping it between the fingers. Cut pieces of tubing of suitable lengths and revolve one of them in the flame, being careful to support both ends. In a minute or two it will become soft and can be bent into any shape desired. It the tube projects at least 3-in. on either side of the flame it is possible to hold it with the bare fingers without getting burnt. Make six U-tubes.

Now light your gas-ring again, take two of the tubes, plug one end of each and hold one at the tip of the blue cone just where you need the air hole. When it begins to look hot blow hard down it with the mouth and when the glass is really soft you will be able to blow a hole right through the side of the tube. The projecting edges can be smoothed with one or two light strokes from a file. Assemble the siphons as in the diagram.

The last piece of glass work is very simple. Take another length of tubing and using the reduced bats-wing flame soften it for a length of not more than 1½-in. When it is quite soft pull the ends swiftly apart and when cool break in the middle. You now have two glass jets very similar to a fountain-pen filler. You will only need one of them and it should be fine enough at the nozzle only just to permit the passage of a pin. Make a frame to hold the jet over the funnel and fit your reservoirs with a little tap each.

Now we are almost ready for there remains only the completion of the filter. You should fit the cork on to the arm of the smaller of the two siphons. If it is a tight fit lubricate it with a little water. Fit to the drainage tube of the filter and so arrange the siphon that the bottom of the long arm is just level with the base of the cork. Fill the jar with water and, covering the air hole with your finger, draw water through with your mouth. As soon as it reaches the other end you can release your finger from the air hole. The water will continue to run slowly out until the level in the jar is the same as that of the air hole. As a final touch push the siphon down the drainage tube until the base ot the arm is about level with the bottom of the silver sand.

It is possible to use the siphon without the drainage tube if the long arm is carried down to the bottom of the jar, but the narrow aperture is very easily obstructed by the stones and a flood is the inevitable result. Be sure that no air can gain entrance around the cork.

Fit up the other siphon in the aquarium, and, if you have done your work well, water will travel out of the jet into the funnel and down to the aquarium, carrying with it a chain of air bubbles to be released under water to the great benefit of your fish. The waste water will run out of the automatic siphon into the filter, carrying with it most of the fine particles of matter suspended in the aquarium, and thence, after being cleaned, will flow into the lower reservoir. The complete passage of the water from top to bottom can be adjusted to occupy anything from one hour to two, according to taste. When the flow is completed all that you have to do is to turn off both taps, reverse the reservoirs, and off we go again.

If this is done morning and evening it should be all that is necessary to keep an aquarium of up to ten-gallons capacity clean and fresh, even in the hottest weather.

Now you have an aquarium which is truly professional both in function and appearance, something of which you may justly be proud.

One last word. Always be careful to keep the tap of the lower reservoir fully open so that the water from the filter can gain entrance, otherwise, if you forget . . .

The Soft-Shelled Tortoises

(*Continued from page* 389).

a sun bath. Shelter is available, of course, if they want it. They love it and I am sure it does them good. They are most alert little things and a sudden shadow sends them scurrying into the sand. The photograph accompanying this article was taken in such a bowl.

The Chinese Trionyx is the hardiest of the family; we should expect this hardiness when we know that the species is found as far north as Jehol and Hopei. If we ever have a good summer, so that they have a fair start, I intend trying to acclimatize the Chinese Trionyx and let them hibernate in an outdoor pool. The one I have now is put into the Tortoises' enclosure on all days except the most unpleasant (during summer only, of course). She usually ambles lopsidedly round the enclosure once or twice like an animated bit of leather, before slithering quite silently and without any splash, into the pool, where she stays for the day.

About sunset she is netted out and taken indoors. I occasionally find the stock of young Axolotls reduced by one after such a day, but normally she is ready for her once-per-two-days' meal of two or three fingers of beef steak, eaten with quite obvious enjoyment, before she buries herself under the sand for the night.

Near relatives of the Chinese Trionyx (*i.e., Amyda japonica*) are bred in considerable numbers on extensive farms in Japan where they are a highly esteemed article of human diet.

It is worth mentioning that these Tortoises are wonderfully adapted to an aquatic life, being able to breathe under water by means of very highly vascularized filaments in the throat which perform the function of gills. Needless to say there are no gill openings, the water being taken in and expelled by the mouth. The action is very obvious in my tiny ones, but less so in the bigger one.

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The Radiated Tortoise (*Testudo radiata*)

By "AMPHIBIUS"

ALTERNATIVE names for this animal are Malagasy Tortoise, or Coui, but the former belongs by rights to a species which became extinct about 300 years ago, and the latter sounds a bit silly; so, in spite of the fact that as a description it fits several members of the genus *Testudo*, I prefer the name "Radiated."

It is a very picturesque beast. Each neural and costal shield has a yellow or orange areola from which bands of the same colour radiate, the annual increments increasing in width with age. The yellow rays are the more striking by reason of a jet-black ground colour to the shell. There's a good deal of individual variation, some having the orange rays increased at the expense of the black, so that the relationship of rays to background is apparently reversed. Of the six I have at present, no two are alike. One female, which I believe to be very old, is completely smooth, and the yellow and black colours merge together; another is almost entirely black, with a great reduction in the width of the rays. A third has each shield raised into quite a high boss, giving him a knobbled appearance, this being a characteristic of the young ones; and the other three show variations of the conventional pattern.

They come from Madagascar, and are occasionally in the market, so occasionally, unfortunately, as to justify their being called rare. Only half hardy in this country, they want rather careful treatment during their first year; but when acclimatized, the sight of a few walking about the garden in brilliant sunshine is a sight to gladden the heart of not only their owner, but of anybody who sees them, and an adequate reward for the constant care bestowed when they are newly imported.

I have always been unsuccessful with very young members of this species, and so am inclined not to recommend their purchase. Maybe the journey upsets them beyond the point of recovery, but I have found it most difficult to persuade them to eat, if, indeed, they would take anything at all. Their only wish seemed to be to get into the densest undergrowth they could find, where they sat all day without movement. Older specimens, on the contrary, settle down as quickly as any tortoises I know, and will usually feed well on and from the first day of their arrival.

They are happiest when given the run of a garden, and, if fed regularly every morning before they start out, the damage to flowers will be reduced to a minimum. Their favourite food is undoubtedly water melon, and if provided with plenty of this fruit they will seldom, if ever, drink. I have an arrangement whereby my fruiterer saves me any melons that are what he calls "specked." These he lets me have for a few coppers so that feeding doesn't work out as expensive as it sounds. Radiated Tortoises will spend three or four hours daily eating water melon, even managing the rind. Of course the usual foods, such as cabbage, lettuce, endive, cherries, and bananas are eaten, and they are particularly fond of various sedums, probably on account of their high water content.

Their days are divided between eating and basking in the sun, and, when familiar with their surroundings, they will lie irradiating themselves with their limbs and head extended to their fullest exent, but ready, however, to withdraw instantly or trundle off on being disturbed. They are very active in spite of their bulk, and, like most other tortoises, would rather climb over than walk round an obstacle. It was an awful job to pose them for their photographs. Their markings cause them to blend perfectly with their normal background, and it was necessary to put them on a sheet so that they would show up. Four of them showed their disapproval by refusing to budge an inch out of their shells, and two, I regret to say, by a prolonged mictur-

(*Continued on page* 416.)

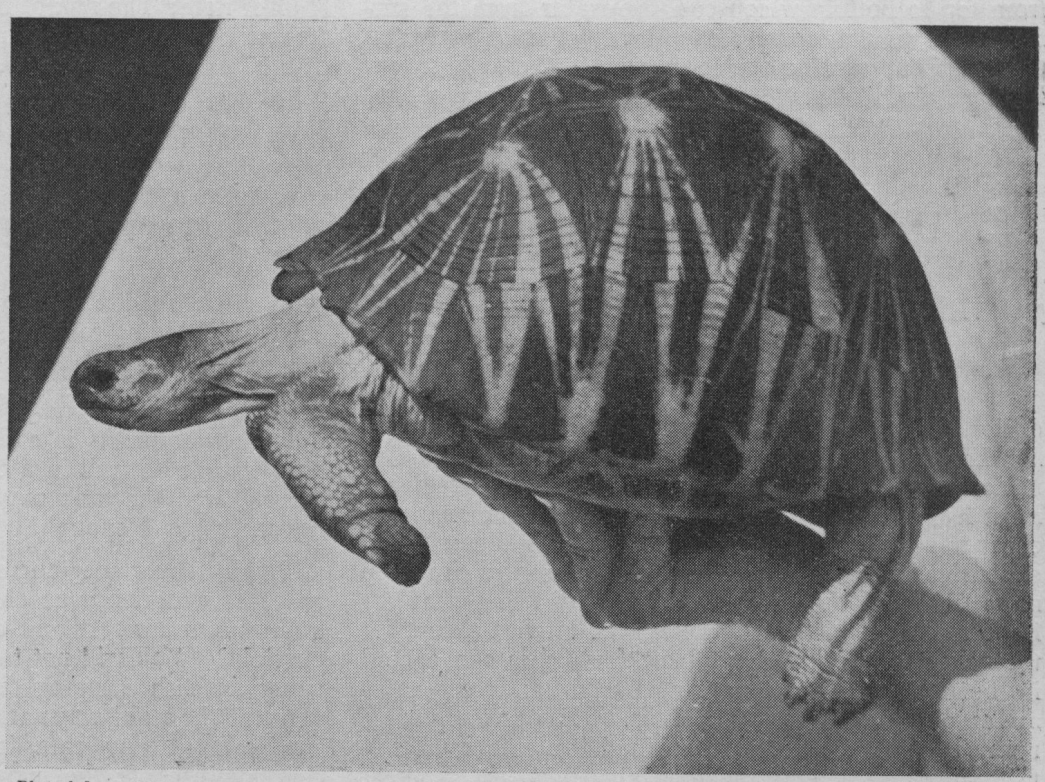


Photo by] [*L. Hudson Banks*

Testudo radiata—comparison with the man's hand will give a good idea of its size.

Fishy Tales

By CHARLES H. LEA

THOSE who have never angled must often have marvelled at the average fisherman's ability to tell tales that are more miraculous than credible. Some day a philosopher will arise who will explain the connection between lies and fish, but until he does, those who do not fish must envy the tellers of tales that are fishy.

That epic old liar, Baron Munchausen, could tell a fishy tale as well as any man in fact or fiction. He once caught a whale which had an anchor and forty fathoms of cable concealed in its mouth. At least, so he said. On another occasion he encountered an equally large monster. He was bathing in the Mediterranean, and saw a huge fish rushing at him. With great presence of mind the Baron curled himself up, and passed straight into the fish's stomach. Here, like Jonah, he remained in darkness, and then he conceived the notion of dancing the hornpipe. This so upset the fish that it reared up in the water and was promptly harpooned by a passing trader, whereupon the prisoner was released.

Smaller articles than men can pass into fish, and the stories of lost rings recovered are legion. On the armorial bearings of the city of Glasgow is a fish with a ring in its mouth. This is a representation of St. Kentigern's fish which saved a queen's life. The story goes that a queen who fell in love with a soldier gave him a ring. One day, finding the soldier asleep upon the banks of the Clyde, the king saw the ring, which he himself had previously given his wife, and in his anger he threw it into the river. When he returned to the palace he ordered the queen to appear before him wearing this very ring, which he knew was out of her reach. In her alarm she sent for the holy St. Kentigern, who went down to the river and caught the very fish which had swallowed the ring. The queen's reputation was saved, and Glasgow honours St. Kentigern, who with the aid of a fish assisted a sinful woman to deceive her husband!

A Newcastle historian has recorded a somewhat similar incident of a man who lost a ring and found it within a few days in a fish his wife was preparing for dinner. Polycrates of old is said to have thrown a valuable ring into the sea to propitiate the angry gods. A fisherman caught the fish which swallowed it, and thinking he was doing his ruler an act of homage, sent Polycrates the ring. Polycrates thereupon guessed that the gods did not accept his gift.

The fishiest of all fishy tales was told by a man, who, having listened to a few hardened anglers telling their tales, went one better.

"Did I ever tell you how I lost my gold watch?" he asked.

"No!" cried the anglers. "Let's have it."

"I was on the pier at Blackpool," he said, reminiscently, "and I pulled out my watch to see the time. The watch slipped into the sea and was lost. When I returned to Manchester I told my wife, and she was very concerned. On the following Friday we had fish for dinner, and when my wife opened it to clean it, what do you think was inside?"

"The missing watch!" shouted the listeners incredulously.

"No," replied the narrator as he moved to the door. "Only bones!"

The Radiated Tortoise

(*Continued from page* 409)

ition on the sheet, which had, as a result, to be hastily concealed from the head of the household. However, these last two consented to stay put long enough to get the snaps which accompany this article.

Their housing is important. The sugar box of the Moorish or Greek tortoises should now give way to a properly made structure of more or less the same design, draughtproof and raised a couple of inches or so off the ground. It will be found advantageous, where the number of tortoises kept warrants a biggish house, to have a roof that lifts off. This facilitates inspection of and attention to its inhabitants. There should be a door, and the whole wants to be packed fairly firmly with clean hay. These are suitable quarters during the summer—if there is one. This year it has been too chilly for all but acclimatized specimens to sleep outdoors, and the lack of sunshine, too, has been felt. The necessity of alternative (indoor) accommodation will therefore be appreciated by anyone proposing to keep these beasts.

They do not, of course, hibernate, and must be kept warm and feeding throughout the winter. The best accommodation is a well-heated greenhouse or conservatory, in either of which they should be kept off the floor. If there is no staging, a wooden platform, as large as possible, should be built and surrounded with wire netting. A good, thick layer of peat or bracken will make it more comfortable for them, and easier to clean, and with peat there is usually no smell if regularly changed. The soiled peat can be used in the garden. Failing a greenhouse, they will live quite well in a large case, but wherever they are, the temperature should not fall lower than 70 deg. F.

On account of their large size—mine range from 11-lb. to 16½-lb.—they are not easily lost, so an enclosure round the "house" is not necessary from this point of view; but 16½-lb. on a flower bed doesn't improve the latter, so where there is not a good deal of herbaceous planting, shrubbery, or lawn (none of which takes much harm), their owner must decide whether the flowers or the tortoises are the more important, and arrange accordingly. An enclosure must be so placed as to get the benefit of every possible bit of sun, and is improved by the presence of a few strong shrubs. It should be of a size suited to such large and relatively active animals.

The Spanner Fish

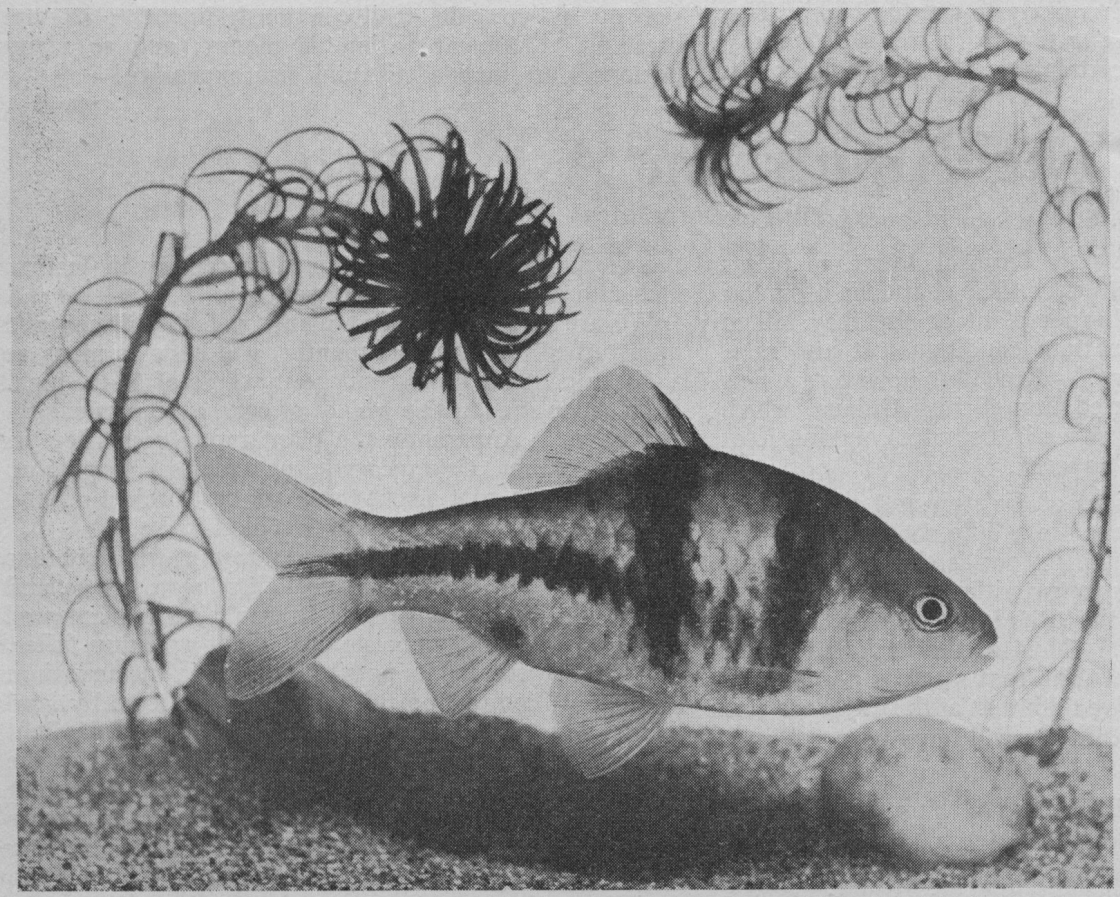
(*Barbus lateristriga*)

THE Spanner or Plus Eleven Fish as this Barb is known, is one of the larger tropical fishes and is well suited to the community tank of big fish. For many years this species was confused with *B. everetti*, the Clown Fish, chiefly because Rachow in his excellent little catalogue got the illustrations muddled. Though the descriptions were correct in the text no one troubled to read these with the result that the Clown Fish became known as *B. lateristriga*. It was not until 1932, when the real *B. lateristriga* was imported in large numbers to Europe from the Malay Peninsula, that the mistake became evident, and even then it was some time before every one had the matter quite clear.

Imported fish are, as a rule, under 2-in. and not quite so deep bodied or so humped as the fish in the illustration, which is a particularly fine specimen and about 4½-in. long. This is near the maximum size for the males, but the females grow somewhat larger and are much deeper-bodied when full of spawn. Wild fish are said to attain a size as great as 8-in., but we have never known aquarium specimens reach this size. The markings are crisp black on a silvery-white ground, in the older fish the edges of the marks become a little blurred but not so much as to detract from the general effect. The arrangement of the marks leads to the popular names. The fins, particularly in the conditioned male, are flushed pink.

Easy to feed, not at all particular in the matter of temperature, and long lived, one might expect these to be an easy fish to breed but strangely enough they are very difficult. This may possibly be because we are unable to try with fully grown specimens. The spawning requirements and the actual spawning greatly resemble that of the Goldfish, and continental breeders state that the fry, when you have once got them, are very numerous and quite easy to raise.

In the community aquarium the Spanner Fish should always be associated with the Clown Fish as the two species make a good contrast and agree well, but it should be a community of big fishes as, though these big Barbs are really quite shy fellows, they are very rough and boisterous at meal times much to the embarrassment at least of the other fishes and to the great detriment of the plants; the latter should be very sturdy specimens such as Giant Sagittaria and Vallisneria, and thick clumps of *Ludwigia*.



Barbus lateristriga [*from Sisson's Perfect Aquaria*

Lizards

Among the reptiles brought back by Mr. Boulenger from America are a pair of Gila Monsters from the Arizona desert. This reptile has long been notorious as the world's only venomous Lizard. It is a bulky animal, some 2-ft. long with a broad head, stumpy tail, and a hard tuberculated skin vividly marked with pink and black—a form of warning coloration. The animal makes sure its poison shall take effect by hanging on with a bulldog grip, instead of merely striking, as do most snakes. The venom, though seldom fatal to human beings, is sufficiently virulent as to cause severe suffering. Madame Phisalix, the famous pathologist of the Pasteur Institute in Paris, was a few years ago incapacitated for over six months after being bitten by one of these reptiles. The Lizard's massive tail contains a reserve of fat which sustains the animal in times of dearth, and is analogous to the tails of certain desert mice and the camel's hump.—OBSERVER.

The Bitterling

By NORMAN BAKER

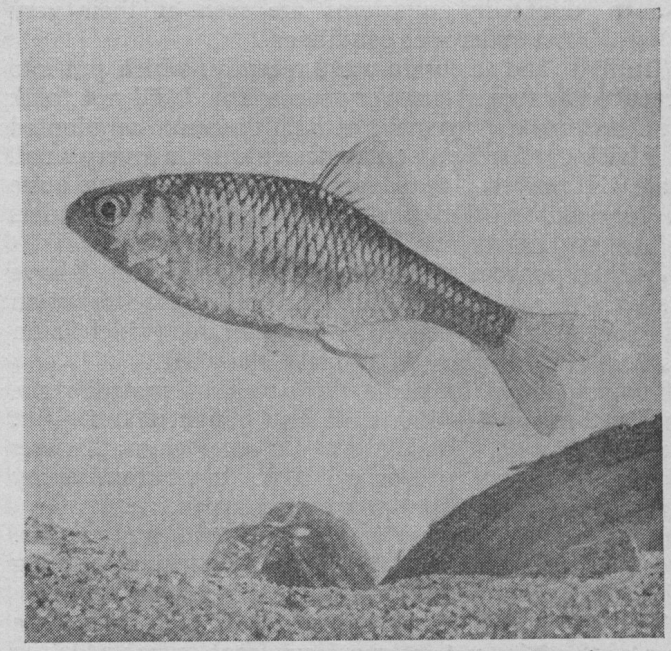
THE Bitterling, *Rhodeus amarus,* is a small but extremely interesting Carp-like fish from the rivers of Central Europe. It is 2-in. to 3-in. in length, and about two-thirds as deep as long, in the centre part of the body. The colour is silvery with a fairly well-marked bluish lateral stripe along the hinder half of the body.

The spawning time is from April to June, in outdoor ponds, and it is during this period that the male fish displays the most beautiful colouring, and the females demonstrate a unique method of laying their eggs. Essential to the spawning act are mussels, either the Painter Mussel, *Unio pictorum,* or the Pond Mussel, *Anadonta mutabilis,* and these must be alive and active. With the approach of spawning the males become very beautifully coloured. The body then assumes sparkling rainbow hues and the fins become flushed crimson. Strutting around in this beautiful garb, a male Bitterling is far more gaudy than many "Tropicals." Peculiar white patches may also be noticed around the eyes and the upper lip. In many Carp these patches of small wart-like papillæ are observed above the eye and on the upper lip at spawning time. The female, though she does not undergo the amazing colour transformation of the male, exhibits a very interesting phenomenon. The genital papilla becomes extended as a pendulous egg duct, which may be more than 2-in. long. The male spends a great deal of time inspecting the mussels in the vicinity, and having found one to his satisfaction, with much quivering and display, he encourages the female to poise over the chosen mollusc. The female lowers the egg-duct into the gill cavity of the mussel and an egg is laid. The milt is discharged by the male and it is carried into the mussel and so to the egg through the inhalent siphon of the mussel. The eggs are laid singly, are comparatively large, about 3-mm. in diameter, and often a completed spawning will number between thirty and forty. The eggs lie between the folds of the mussel's gills. Here they develop and hatch; the young fry feed on the organisms carried through the gill chamber with the current of water produced by the mussel's siphon. Between twenty-one and twenty-eight days they leave the strange nursery as fine little fish about ½-in. long.

Bitterling is an excellent fish for the temperate aquarium and the males readily display, but breeding is rather difficult. In the garden pond they breed readily, but they are small fish and the process cannot be observed. Large numbers are raised at Haig's Fish Farm.

An aquarium of at least ten gallons should be given to a pair. It should be in a sunny position, with 2-in. of sand on the bottom, bright and sparking water, and a temperature not exceeding 60° F. Two or three mussels of different sizes should be introduced when the tank is well established and the strong light has led to a growth of suitable foodstuff for them. The parents are best moved to another tank after spawning, though often the fry have been successfully raised with the parents.

It would appear that this breeding process is very



Female Bitterling showing Pendulous Egg-duct

convenient for the fish as they just throw the responsibilities of their parenthood on to some poor unsuspecting Painter Mussel. Actually it is not quite so simple or one-sided. The breeding periods of the fish and the mussel coincide and while the Bitterling are busying around the mussel, the latter ejects large numbers of its larvæ, known as *glochidia,* which attach themselves by short filaments to the fish's skin, and then encyst. After an incubation period of about four weeks, the young mussels hatch out and fall to the bottom of the water. Of course, not only the Bitterling, but also any other fish in the vicinity of the mussel is liable to become an unsuspecting host to the *glochidia.* This strange form of mutual parasitism, which involves no loss or discomfort to either party, is known as commensalism.

Bitterling are inexpensive to acquire, and will with care and attention exhibit one of the strangest breeding processes among all aquarium fish, cold and tropicals alike. Bitterling are easy to feed and will readily devour earth worms, blood worms, *Enchytræ,* and dried food. Mussels, however, are difficult to feed and the tank must be kept in a good sunny place where the water will tend to go green. Watch out to see the mussels do not die. The gaping shell of a live mussel will rapidly close when tapped. A dead mussel will quickly result in a fouled tank and dead fish, so take care!

* * *

To the Editor of WATER LIFE.

May I correct a mistake in "The Soft-Shelled Tortoises" in November 24 issue.

At the beginning of the third paragraph, "5-ft." should read "3-ft." A figure 3 (admittedly a bad one) was wrongly transcribed and I failed to notice it when checking the manuscript. Only one species, I believe, grows to 5-ft.—Yours faithfully, AMPHIBIUS.

The Alligator Terrapin

By "AMPHIBIUS"

SIMPLY breath-taking tales are told of the " absolute ferocity, diabolical cruelty and cunning " of the North American Alligator Terrapin. American anglers are responsible for the " ferocious " bit of it, and seem to think it most unreasonable that when it finds a steel hook caught in its throat and feels itself being dragged out of the water, the poor creature should struggle and attempt to escape. Because it makes use of its likeness to a stone or rock to obtain its food, it is labelled " cunning," and finally it is called " cruel " because it seizes its food in precisely the same way as almost all carnivorous animals the world over do, from Lion to Dragonfly, to wit, in its jaws. In truth, it is just an animal occupying its own niche in Nature; minding its own business and a nuisance to nobody until man came along and wanted to monopolize the fish upon which the Terrapin has been living for countless ages.

The old naturalists of the last half of the late century had a merry time slanging the animals they did not much like and knew nothing about. After copying each other, they quoted each other in support of their misstatements, and as a result a whole lot of silly tales have persisted, in many cases until to-day. Debunking them is a very satisfying occupation!

Nothing, however, can alter the fact that the little babies which are exported annually for the purpose from America, make delightful pets. They can be kept without heat and when of sufficient size, say with a 3½" to 4" carapace, can be allowed to hibernate outdoors in a reasonably deep and suitable pool. It may very likely be safe to put even the babies outside in winter, but never having had the courage to do this, I cannot say.

In a tank—furnished with a suitably planted island—they need about 2" to 3" only of water, and the same of fine, washed sand. Smallish pebbles can be dotted about, singly and in groups, as these little Terrapins like to be half buried in the sand among them, at such a depth that they can stick their noses above the water-line when they want to breathe. I am always amazed at the length of neck that these, and so many other Terrapins can produce, apparently from nowhere.

I hope I shall not be thought to be making too much of a fetish of the planted island, but it is so easily made in a sizeable tank, and I fairly grind my teeth with rage at the people who keep on advising for Terrapins " a tub or bowl with a projecting rock for them to bask on." Most unsuitable! And so dull for the poor little beasts. Let not the owner of such a furnished " vivarium " think for one moment that his pets are happy. In animals which cannot laugh or wink, resigned apathy is too easily mistaken for contentment.

I would most strongly advise those who keep or intend to keep little Terrapins to scrap all their bowls, basins and minute aquaria and buy a 4' aquarium. Up to twenty babies of all kinds, provided they are much of a size, will live happily together in it, and I think most people will agree that it is far easier to look after one big tank than lots of little ones. In time, also, a well-planted tank comes to look a bit like that acceptable substitute for the œcological norm which it should be every pet keeper's effort to achieve and maintain.

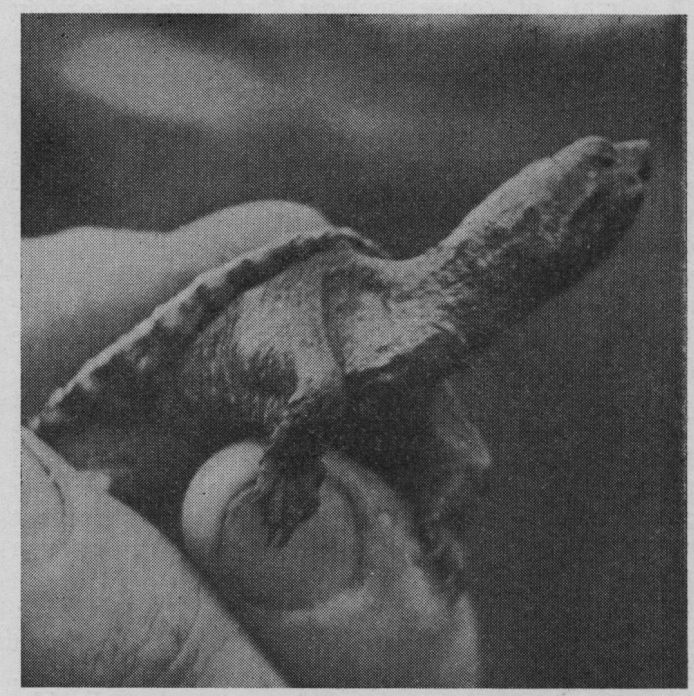


Photo by Brian Stanford

Not a very frightening beast—baby Alligator Terrapin

Food: this as for other Terrapins—tiny bits of meat, worm, fish, and liver, and they will probably catch and eat some of the *Gammarus* that ought to be kept as the efficient scavengers they are in every aquarium. Alligator Terrapins will probably feed from forceps on and from the first day of purchase. Small as they can be, I have yet to meet the baby that is unprovided with a coat of green algæ on his head and back. This growth is typical of them, and I well remember, about twenty years ago, a veritable monster in the old Brighton Aquarium whose back was quite a forest. He now reposes in a glass case in the Brighton Museum after, I believe, forty years in his tank.

This animal, by the way, is often called, by dealers and others, the " Snapper," a name which belongs to the soft-shelled Tortoise, *Trionyx ferox*. Temmincke's Snapper, however, is a near relative of *Chelydra sepentina*, and is usually described as being *even more* ferocious, cunning and cruel. As, to my sorrow, I have never possessed one of these animals, I cannot rebut these accusations with such confidence as in the case of its near relative, but I suspect them of being equally unfounded.

Babies of *Macroclemmys temmincki*, when available, have not been priced more highly than *C. serpentina*, but adults are usually between seven and ten times as costly. I cannot understand why this should be, as I believe the former is bred in large numbers for human consumption in America.