

One of this pair of box tortoises has been turned over to show the completely closed under shell (plastron)

## BOX TORTOISES *by* ROBERT BUSTARD

*(Photographs by the author)*

NOW that the warmer weather is approaching we can once again turn our attention to reptiles that are suitable for life in the outdoor enclosure. One very interesting group which immediately springs to mind is the box tortoises, which can be allowed to roam freely if the garden is securely walled in. Box tortoises have long been popular pets in Britain, where their attractive coloration, longevity, relative hardiness and intelligent nature have made them firm favourites with collectors.

Box tortoises are once again quite readily obtainable in this country. Those most commonly kept are the American species belonging to the genus *Terrepene*. They do not grow very large and those available usually have a shell length of about 4 to 5 inches. Unlike other tortoises, box tortoises will clear your garden of slugs, they are largely carnivorous and will devour any grubs, slugs, earthworms and the like which they find. They are also frugivorous, being very fond of any soft fruit such as bananas and strawberries.

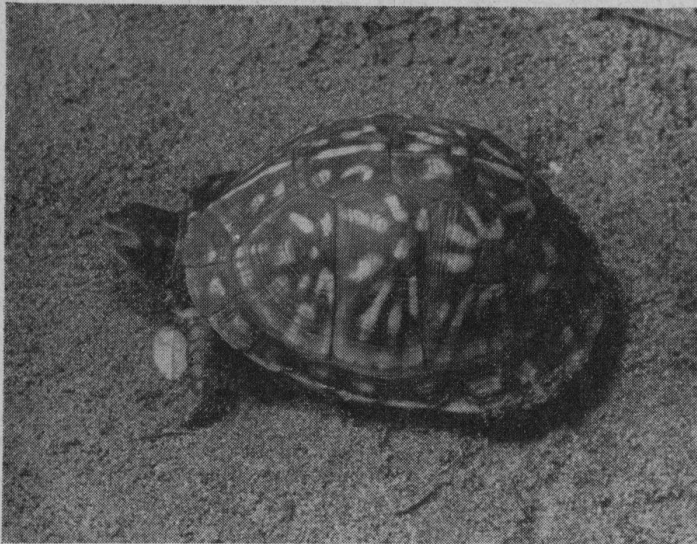
Many collectors prefer to keep their box tortoises in an enclosure in the garden so that they do not wander away. If this is done the chosen location should receive a reasonable amount of sunshine. The enclosure for box tortoises should also contain some vegetation for them to hide amongst and to provide shade. It is a good plan to provide a small home for them as do most tortoise collectors. This can be a wooden or metal box sunk into the ground, consisting of a back, two sides and a roof; the front is open. The box is sunk into the ground until the roof is about 6 inches above ground level. Loose earth and dead

leaves can be added, and into these the box tortoises will burrow during cool spells.

Box tortoises are thought to be aberrant terrapins which are once again becoming terrestrial creatures (terrapins are tortoises which have taken to a semi-aquatic existence, with various adaptations, such as a streamlined carapace, webbed feet etc.), and they still frequent damp places, unlike true land tortoises. This must be remembered when they are kept in captivity and a shallow depression should be provided with mud and a water depth of only 1 to 2 inches. Whereas most terrapins will feed only in the water box tortoises feed readily and indeed largely on land. They do not, however, hesitate to enter the water if they see a tempting earthworm. When in water the swallowing of the food is usually done above water.

The general appearance of these creatures—reminiscent rather of tortoises than terrapins, owing to the raised carapace—belies their nature. They can and do move quickly, and frequently fight over food in true terrapin fashion, unlike the slow dignified tortoise, which unless chasing a mate moves in a most leisurely manner. It is this facet of the behaviour of box tortoises which gives them much of their appeal. They quickly learn to come to their owner for food and when he appears in the enclosure or opens the door he is likely to be met by all the box tortoises at once. Should one specimen be given a large earthworm, too big to swallow at once, it will race off pursued by the others. Captive specimens readily accept raw meat.

Box tortoises are so-called because they possess a hinge

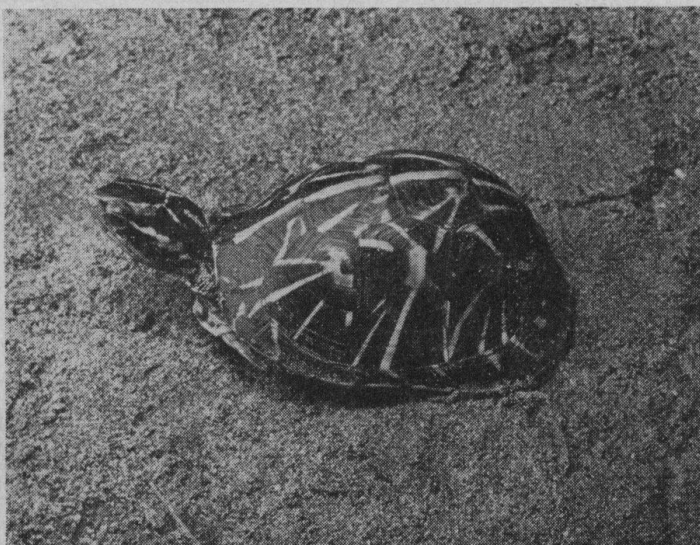


Carolina box tortoise (*Terrepenne carolina*). A hardy and intelligent species that is usually available from dealers

running across the plastron, which, when moved, allows the two sections of the plastron to enclose the animal completely. Box tortoises, it should be noted, are by no means the only testudines which possess a movable plastron but they possess it to a marked degree. One specimen is shown closed up on its back in the accompanying photographs. This is not, of course, a natural position, the specimen being turned over so that the complete closure of the plastron against the carapace can be seen. When newly purchased they tend to close up when handled but they soon become tame and trusting, their natural greed soon overcoming any shyness.

The species most commonly available is the Carolina box tortoise (*Terrepenne carolina*) or one of its sub-species. The average price is about 30 shillings per specimen. Coloration is very variable; the plastron is normally yellowish with brown markings and the carapace is brown with bright-yellow markings. There is a notable vertebral stripe and ridge which is made more conspicuous by being bright yellow.

I strongly urge that several, or at least a pair, of them are



Ornate box tortoise (*Terrepenne ornata*). This species prefers a drier habitat than does the Carolina box tortoise

kept. They are easy to sex as the female has brown eyes whereas those of the male are red.

During the winter I bring my specimens inside and house them in a roomy vivarium at a temperature of about 65° to 70°F. The winter quarters should always contain a shallow dish of water.

A very handsome species occasionally available is the ornate box tortoise (*Terrepenne ornata*), which is lavishly streaked with vivid yellow on a dark, sometimes blackish, carapace, making it decidedly reminiscent of the starred tortoises. The ornate box tortoise lacks the distinctive eye colour of the Carolina species and prefers a drier habitat, otherwise it requires identical treatment in captivity. Specimens are likely to be somewhat more expensive than the common box tortoises and when available usually cost between 40s. and 50s. each.

I strongly recommend box tortoises to anyone who has not tried them; they make handsome, interesting and very long-lived pets.

## CACTI IN THE FISH HOUSE

MANY cacti and other succulents can be re-potted during this month. A start can be made with those plants which show fresh growth. When in this condition they are able to stand the change more easily than if they were still resting. When re-potting it is essential to remove all the old soil, as this will have become impoverished by the action of the roots during the past year. Do not use too large a pot. For the globular types it is enough to leave a half inch between the plant and edge of the pot for small plants and an inch for larger plants. See that the fresh pots are quite clean and use a piece of broken flower pot as a crock as large as possible to cover the drainage hole, which, of course, must not be blocked. For potting use a good porous soil; special compost for cacti can be purchased from some nurserymen, and if this is not available use John Innes potting compost no. 1 to which has been added a one-sixth extra part of very sharp, coarse sand (that known as washed river grit is ideal). See that the soil is "crumbly moist" when used, and then do not water for a week.

## CULTURE OF WATER FLEAS

ABOUT a month ago I was expecting the arrival of a pair of blue gularis. However, in spite of the fact that the New Forest swamp conditions yield perfect "cyprinodont water," the tap water is so alkaline that it does not register on the normal pH set. In view of this, I had either to treat the tap water or to import it. The latter proving impracticable I went to Woolworths and bought a polythene bowl. I filled it with water to which I added mulm and assorted muck from my filters, uneaten raw meat, liberal helpings of dried food and long-deceased bog vegetation. The foundation was soiled peat stable-bedding.

After a fortnight, the pH stuck immovably at 7.6. I decided that even if all the known methods of making water go bad and acid failed, my bowl of vile-looking liquid should fulfil some useful purpose, so I added some *Tubifex* and left the bowl in a dark corner of the fish room for a fortnight.

I shone a torch on to the water the other day to see what had happened, and was surprised to see that the water was thick with *Daphnia*. The parental stock could only have

(Please turn to page 12)

# The AQUARIST AND PONDKEEPER

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## Editorial

IN "Aquarist's Notebook" this month Raymond Yates has something to say about crocodiles and alligators as pets. Alligators when small are so popular for the home aquarium in America that the demand has been outreaching supply. British Guiana is reported to be exporting these reptiles to supplement numbers from Peru and Colombia. One animal dealer despatches over 8,000 baby alligators each month. A story we were told some time ago illustrates the state of things at the receiving end, although something must be allowed here for some over-enthusiasm on the part of the story-teller. A sewerman reported having been bitten by a large alligator during his duties beneath the streets of New York, and, it was said, despite some initial scepticism on the part of the authorities, search revealed several of the animals thriving in the warmth of the sewers. The explanation given was that many owners of small alligators, finding that these pets are unsuitable for ordinary aquaria, had disposed of them by flushing them down toilets into the sewers. We do not believe that these reptiles could live and grow under sewer conditions, but we are sure that the young alligators offered for sale in such large numbers do not live long with those who buy them as some kind of novelty toy.

SOME important points about the way to manage an aquarists' society successfully are discussed by Bob Calrow of Hendon Aquatic Society in this issue (page 43). A complaint frequently made by societies is that difficulty is experienced in obtaining speakers for meetings. We have spoken about this with several well-known lecturers, who have explained regretfully that some societies offer them fees that are inadequate to cover the expenses and inconvenience of going to a meeting out of the lecturer's home area. This is a matter that societies should consider carefully. Society finance is always tricky but member subscriptions are often ridiculously small by present-day values and could be raised substantially to provide the means to obtain the services of first-class lecturers. Interesting meetings promote better attendances and bigger membership.

# South African Girdle-Tailed Lizards

by ROBERT BUSTARD

(Photographs by the author)

**S**OUTH Africa is the home of an interesting though small family of very spiny lizards. These are found in rocky and semi-desert areas. As will be seen from the photographs, certain species are much more heavily armoured than others, and so are less active and unable to move with the speed and agility of the lightly armoured species. The largest of these lizards is about 12 inches in total length, the average being some 6 to 7 inches. They feed on insects. They produce living young, usually two in number but sometimes only one and these are about half the size of the parents.

The commonest species, known scientifically as *Cordylus cordylus*, exists in two colour forms which themselves are variable. One is often referred to as the red girdle-tailed lizard, since the colour is frequently red or red-brown; sometimes it is yellow-brown. The other, the black girdle-tailed lizard, is jet black. These small lizards are very active and common in rocky areas. The upper surface is covered with heavily armoured scales and the tail especially is very spiny, being covered with whorls of spines.

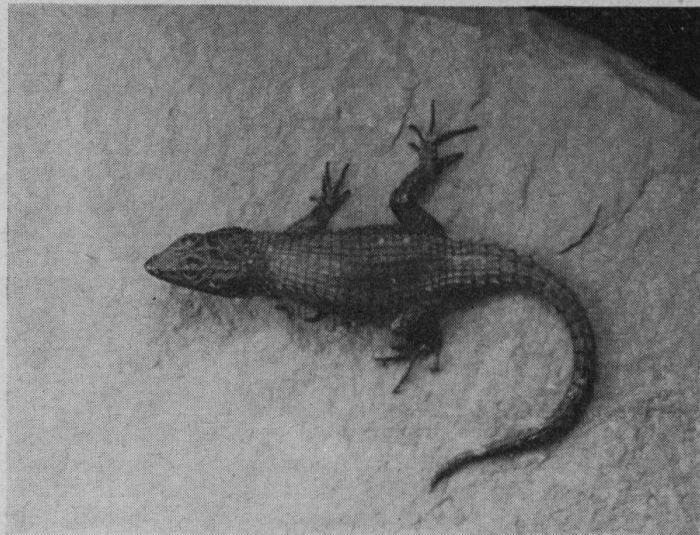
Another species, known as the armadillo girdle-tailed lizard (see illustration), is very well protected by armoured scales and the tail is exceptionally spiny. In this species the armour-plated scales and spines are seen to their best. The coloration is an attractive yellow-brown or almost orange colour, and the sight of this 6 or 7 inch lizard walking around in the sand reminds one of a miniature prehistoric monster!

All these lizards have a weak link in their defences, and the armadillo girdle-tailed lizard, at least, is very conscious of its soft belly, and has devised an interesting behaviour to protect this region. It also serves as protection against snakes which might try to eat it. Let us watch one of these lizards and see what happens.

The armadillo lizard is slowly walking about looking for insects and basking in the sun when suddenly it sees a small snake approaching. It has no chance of reaching



The red-brown zonure (*Cordylus cordylus rubra*), a species differing from the black zonure only in colour



The black zonure (*Cordylus cordylus niger*), an agile species found in rocky areas. This armoured lizard has a spiny tail

the safe retreat in the large rock, some yards away, which has been its home for its 5 years of life. However, the idea of making a bolt for it never occurs to the armoured lizard. It merely curls up into a ball and grasps the end of its tail in its mouth. In this manner it is protecting its soft underside against attack but is also posing a very difficult problem for the 3 feet snake that would like to make a meal of the lizard. This snake is in the habit of pouncing on small lizards unawares and holding them in its coils to prevent them escaping. While they struggle in vain to escape it squeezes them to death, and when they no longer move it loosens the coils, searches for the head and swallows the lizard whole, head first.

However, the snake sees the armadillo girdle-tailed lizard lying motionless on the sand. It stops, and while we watch, it flicks its tongue in and out, touching the lizard in the process. (Despite popular belief the tongue of the snake is never used for poisoning anything, that is done by the fangs and in this case the snake is harmless.) In all snakes the tongue is a sensory organ used for taste, smell and for feeling strange objects. Since our lizard has remained still the snake is not excited to constrict it, and woe betide the snake which tries to squeeze one of these prickly lizards, and it therefore passes on to the next process in feeding, namely swallowing. It is important for the reader to appreciate that snakes and other reptiles do not think in such circumstances but carry out the required actions by instinct. Instinctively, the snake looks for the head of the lizard as it always swallows its prey head first. Had our lizard not curled up into a closed ring or ball, but merely lain still, the snake would now start swallowing it head first. It would be a prickly meal and indeed it might well choke the snake, in which case both would die in the process.

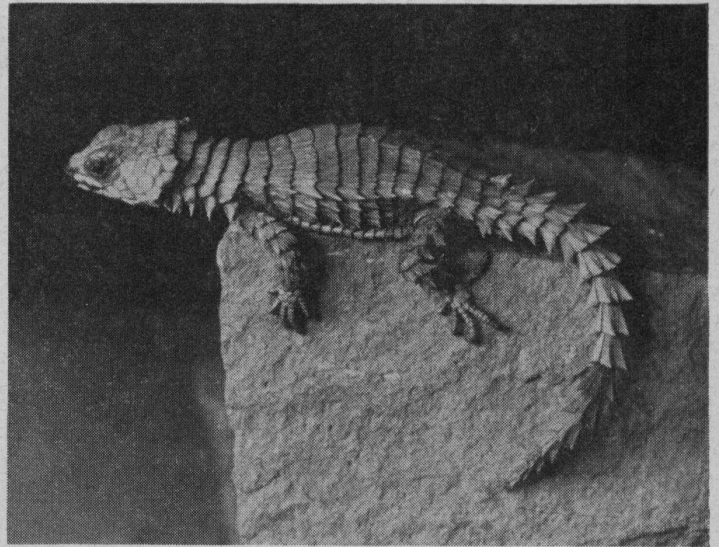
Our armadillo girdle-tailed lizard remains still, this has often happened before, and he "knows" that he is safe against the small lizard-eating snakes. Meanwhile the

snake searches for the head and, having found it, tries to engulf it. Snakes never chew their food but swallow it whole and secrete saliva abundantly to ease the process of swallowing. The snake makes no progress since the lizard is holding its tail firmly in its mouth and it cannot swallow the head with the tail sticking out of the right side of the mouth. The snake may stop to re-examine the situation, the tongue carefully examining all over the lizard, but in vain it searches for a starting place. The lizard has formed a closed ring in which there is neither beginning nor end.

Here the snake's instinctive behaviour breaks down. There is no answer to this problem and although it may take some time for the hopelessness of the situation to reach its tiny brain, eventually it gives up and continues its hunt for food elsewhere. After a short time our armadillo girdle-tailed lizard slowly uncoils and looks around. All is safe, so it leisurely makes its way back to its favourite boulder, stopping on the way to catch a beetle and pounce on a couple of flies.

Unfortunately I am unable to show a photograph of this, since my specimens are so tame that they will no longer coil up when handled. The great girdle-tailed lizard uses its tail like a spiked club, striking with it at its enemies. This 12 inch lizard also uses it as a defensive barrier when hiding in cracks in the rocks, as do all of these girdle-tailed lizards. The appearance of these interesting little lizards is well illustrated in the accompanying photographs of specimens in my collection.

Throughout the animal kingdom these fascinating adaptations in behaviour to protect the species constantly



Most spiny of the armoured lizards is the armadillo girdled zonure (*Cordylus cataphractus*), and this species shows the protective behaviour of coiling with tail in mouth when it is molested

occur in different forms. The ways in which Mother Nature takes care of her creatures, and protects them from their enemies, are marvellous. In wild life there is a continual struggle for existence and only those that are adapted to meet this survive to produce future generations.

## Herpetologist's Notebook

**T**HIS month's article on zonures may make several collectors wish to keep these delightful little lizards, so perhaps a few remarks on their maintenance would not be out of place.

*Cordylus cordylus* (both the red form *C. c. rubra*, and the black sub-species *C. c. niger*) live well in company with the armadillo girdled zonure (*Cordylus cataphractus*). All these lizards are of a similar size—6 to 7 inches.

I keep mine in a vivarium with a floor area of 24 in. by 24 in. This is covered with sand, and stones are set round the sides of the vivarium to provide hiding places and basking sites. Suitable cacti and succulents, grown in small pots hidden by the surrounding sand and rocks, greatly add to the appearance of the set-up. A small dish of drinking water is provided. The vivarium should otherwise be dry (I remove the vegetation to water it) and a temperature of 70° to 80°F is suitable.

Zonures (or girdle-tailed lizards) are insectivorous and will accept bluebottles, gentles and mealworms as well as spiders, caterpillars etc. They become very tame and will soon accept food from the fingers. Like all semi-tropical lizards they do not hibernate.

The above-mentioned species are specially recommended. Prices are very variable indeed. The closely related crag lizard (*Pseudocordylus microlepidotus*), which grows to 12 inches and will accept raw meat, is also an ideal vivarium inmate. This lizard should, however, be kept alone or with other lizards of a suitable size. The blue-speckled zonure (*Cordylus coeruleopunctatus*) is much sought after by collectors; it has some sky-blue scales and an orange throat. It does well in close confinement.

I do not recommend *Cordylus polyzonus*, which has been quite often available in late years. This species tends to be very nervous and certainly does not get enough food in a community vivarium.

Zonures frequently breed in captivity and gravid females are commonly imported (unwittingly). It is not unusual therefore for the collector to be presented with a family. The young, usually two in number, are about half the length of the parents and feed on small mealworms, flies and gentles. For further details see: Bustard, R., *British Journal of Herpetology*, vol. 2, no. 1, December 1955, pp. 8-9. Bustard, R., *British Journal of Herpetology*, vol. 2, no. 4, July 1957, p. 71.

I have found that zonures do well in company with skinks of a suitable size and nature. The following South African skinks are usually available and do well in the vivarium: three-striped skink (*Mabuia capensis*); speckled skink (*Mabuia homolocephala*).

May and June are good months for purchasing tortoises—common varieties such as *Testudo graeca* and *Testudo ibera*, for outdoor life. The weather is usually favourable at this time and it allows them some months to settle in and feed before their first hibernation.

I strongly advocate purchasing tortoises from a reputable reptile importer who buys quality and not quantity, and although such a tortoise will cost more (the price will not exceed about 10s.) it is definitely worthwhile. Should the collector wish to select a tortoise himself from the local pet store (and I emphasise that this is not good policy for beginners) then he should select a medium to large specimen as these are much hardier than their small and rather cute counterparts. When lifted up, or when the shell is tapped suddenly, the tortoise should retract into its shell. However, in a pet shop away from the sunshine, they tend to be rather sluggish. The eyes should be clear, and they and the nose should be free from discharge, and the soft parts should be examined to see that there are no wounds or adhering ticks.

R. B.

# Some Problems of Vivarium Construction

by BARRY R. JAMES

**T**HROUGHOUT the many years that I have been a student of Herpetology, one thing has always puzzled me. Namely, the sparse and desolate appearance of other people's vivaria.

Aquarists, especially those specialising in tropical species, invariably take great pride in arranging and maintaining their tanks so as to resemble the natural habitat of their pets. Rock strata, plants, different coloured gravels and other devices are all used to create, as near as possible in a small space, the illusion of a section of the pond or river bed. The result, if imaginatively and sensibly arranged, is both pleasing to the eye and beneficial to the inmates.

Herpetologists, however, seem to limit their ingenuity to an aquarium containing a layer of gravel, a dish of water and a piece of rock or bark. In my opinion a tastefully furnished vivarium containing living plants can give as much pleasure and needs as little attention as a tropical-fish tank.

Aquaria, unless provided with some form of drainage, are invariably unsatisfactory for use as vivaria, except for aquatic species such as terrapins and frogs. Just as aquaria are intended to house creatures whose natural environment is water so terrariums must be constructed for the specialised needs of terrestrial species.

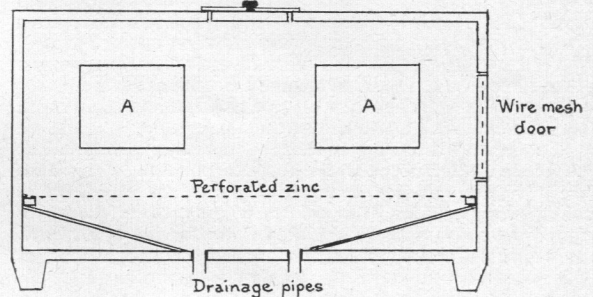
In my experience the enemy of reptiles is bad drainage, which leads to stagnation and a perfect breeding ground for disease. Living plants also suffer in these conditions and possibly it is the disappointment of seeing plants dying off in their aquaria that has discouraged vivarium-keepers from adding a little bit of greenery to their cases.

It is possible to build a vivarium incorporating all the factors necessary for the successful maintenance of the inmates and I shall describe the construction of one of my own cases.

I commenced by buying a large second-hand television cabinet, the dimensions of which were 3 ft. 6 in. by 1 ft. 6 in. by 1 ft. 10 in., and which cost 10 shillings. I stripped all the interior fittings and covered the interior with three coats of good white enamel paint. I fitted a door, constructed from a conveniently sized picture frame, at one end. A piece of wire mesh cut to size and nailed on the frame completed the door and satisfied the need for ventilation and access to the interior of the completed case. The large holes present in the back of the television cabinet I glazed with 24 oz. glass.

The next and probably the most important step was the installation of the drainage system. I started by boring two parallel lines of holes in the centre of the base. I then cut half-inch sections of copper pipe and fitted them into the holes with putty. This manoeuvre was to allow the escape of the excess of water that would accumulate in the bottom of the case. Next I cut a large sheet of plywood to fit the inside of the case and then bisected it along its length. The two halves were then fitted in position at an angle of approximately 33 degrees to the base with screws, as shown in the diagram. The boards were waterproofed with enamel paint and the edges sealed with putty where they were fixed to the sides of the case.

A large wooden frame was made to fit the inside of the



Sectional view of the vivarium; positions of the two windows (A,A) are indicated at the back of the case

case and a sheet of perforated zinc was nailed to it. This virtually completed the drainage system. All that remained was to fix a front board in position and seal up the joint with the drainage boards.

Illumination was provided by means of two 100 watt striplights and heating by a small 100 watt greenhouse heater, which is suspended from the roof of the case by a hook. I glazed the front of the case with a single sheet of 24 oz. glass in such a way as to allow easy removal for cleaning etc.

## Furnishing

The compost used will, of course, vary with the species to be housed. In this particular instance I intended to keep a pair of calotes, various tree frogs and ground toads. My base mixture was two parts of peat, two parts of loam, one part of leaf mould, one part of coarse sand and a little powdered fertiliser.

To avoid the mixture being washed away I first placed a layer of moss over the whole of the interior, about half an inch deep. I then put in my compost about 7 inches deep at the back, sloping to an inch or so in the front.

A large mossy log obtained from a nearby wood was embedded lengthways into the bank of base mixture. One or two pieces of stratified rock, a large branch and a small plastic bowl disguised with cement completed the more solid furnishings. I then introduced my plants and arranged them to my satisfaction.

The art of arrangement is the same as that required for aquascapes; namely, that the larger plants and rocks etc. are placed at the back and the smaller specimens at the front, thus preventing the reptiles from being hidden behind a mass of vegetation.

## Other types of vivaria

The principles outlined above will apply equally to other types of miniature landscapes, except that for desert-living species more sand and no peat will be used in the compost. Most cacti I have found will do well under such conditions provided that they are not overwatered in winter.

Here is a short list of house plants which, as a florist,

I can recommend as being particularly suited for the close confines of vivaria.

*Temperate vivaria* (where the temperature does not exceed 70°F). 1, *Hedera helix* chicago; 2, *Hedera canariensis*; 3, *Chlorophytum*; 4, hart's-tongue and other evergreen ferns and asparagus fern.

*Desert vivaria*. 1, Cacti such as *Opuntia*, *Mammillaria* etc.; 2, *Sansiveria*.

*Tropical vivaria* (temperature between 70° and 80°F). 1, *Rhoiciesus rhomboidea*; 2, *Sansiveria*; 3, *Philodendron scandens*; 4, *Ficus elastica*; 5, *Vriesia splendens*; 6, *Helixine*; 7, asparagus fern; 8, small palms; 9, *Tradescantia*.

Information about the individual care of these plants can be obtained from a good florist, although many nurserymen attach printed labels giving the country of origin and hints on the care of the specimen purchased.

I hope that these brief suggestions may encourage some of our more conservative vivarium-keepers to experiment a little with the lay-out of their cases and gain a great deal more satisfaction in including a tiny portion of an exotic landscape in their home.

## PET ANIMALS ACT, 1951

by FIREMOUTH

THE start of the year means renewal of one licence or another to most of us, and it was quite a surprise, on mentioning that my Pet Licence needed renewing, to find that, although this Act has been with us for over 10 years, very few aquarists were even aware there was such a thing!

The Pet Animals Act, 1951, affects all those who are in the habit of selling fishes and it is as well to be aware of its implications. Like most Government Acts it is not in some ways easy to understand, and this is an effort to try and simplify it for you.

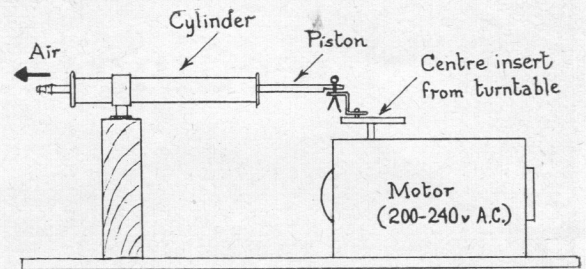
Section 7 of the Act states that anyone who keeps and sells fishes, reptiles or amphibians by way of business is affected, and the premises from which he operates (even if they are his own home) become a "Pet Shop," which must be registered as laid down by the Act.

A person who merely keeps and sells pedigree animals (fishes etc.; pedigree animal means one whose breeding makes it eligible for registration with a recognised club or society keeping a register of animals for that particular purpose) or their young will not have to register so long as he is not running a business (business is not clearly defined—probably an undertaking from which all or a considerable part of one's income is derived, where one renders an account to H.M. Inspector of Taxes in accordance with "Schedule D" of the Finance Act, 1918). Further exemption, even if you are carrying on a business of selling fishes, from the Act may be if the fishes you sell were originally bought or acquired by you for breeding stock or show specimens, then later finding them not suitable for that purpose, you now make a "business" of selling them. Your local council must agree this is in fact what you are doing.

If this Act does affect you then you must apply to your Local Council for a licence to keep a "Pet Shop", and this will cost you 10 shillings. Before they grant one the Council will require that you fulfil certain conditions (too numerous to mention here), but they are all in the H.M. Stationery Office leaflet, reference 14 & 15 Geo. 6 (Ch 35), price 3d.

The licences are granted at the discretion of the Council and are valid for 1 year. They will never be granted to street vendors. One important feature is that they give the authorities power to instruct any of their officers or veterinary surgeons to inspect your premises.

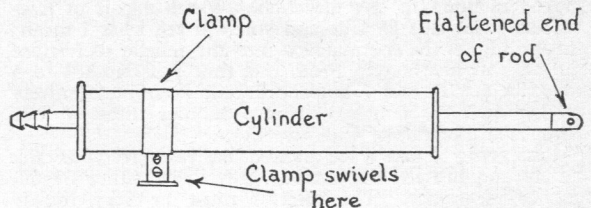
## A Piston Air Pump



Side view of the piston air pump

A CHEAP, quiet and reliable piston pump, which will supply air to a number of tanks, may be easily made by anyone possessing a bicycle pump and an old, single-speed electric gramophone motor of the type which normally has a regulator allowing it to run at between 45 and 85 rev./min.

The pump cylinder is cut down to about 7 inches in length, and the piston an inch or so longer to allow for flattening and drilling of its end to take the split pin which connects it to the crank piece. A clamp is fitted tightly to the cylinder but has a loose separate portion to allow the rotary movement of the cylinder.



The cylinder is made from a shortened bicycle pump and fitted with a clamp that allows it to swivel from side to side with the rotary movement of the gramophone turntable

The only critical measurement is that of the crank (made from a bent piece of Meccano strip), which must be bent to give a full movement of the piston in the cylinder, without allowing it to catch at either end.

The air-outlet connection was made from a bicycle tyre valve with the valve tubing portion sawn off, and a brass serrated piece soldered in place, but a football pump adaptor is quite suitable. From here the air may be taken to a "kettle" arrangement if a steady flow is desired, or to a double male-hose connection fastened to the baseboard so that there is no movement in the air line to the tanks.

Remember to keep the piston and other moving parts well oiled, and always use three-pin electrical supplies; earth the metal body of the motor and use waterproof supply cable and connections.

J. G. EUSTON

## ERRATUM

We thank those readers who have written to point out that the upper colour picture on page 209 in our January issue had an incorrect caption to it. The pair of fish shown in the picture are nigger or black ruby barbs (*Barbus nigrofasciatus*).

# Arum Lily Frogs and the American

by ROBERT BUSTARD

(Photographs by the author)

**T**HIS month I have chosen two species which do well in the vivarium but which seldom receive much publicity. Both when available are likely to cost about 7s. 6d. to 10 shillings each.

## Arum lily frogs (*Hyperolius horstoecki*)

These delightful tiny frogs from South Africa are little more than an inch in length. The ground colour is golden brown above (below it is white) and a pale stripe runs along each side of the body, starting near the nostril and passing just above the eye (see photographs). This stripe is variable, usually being silvery grey or yellow. This is all we see of the frogs at rest but when they are disturbed the limbs quickly appear; the hands, feet and underparts of the thighs are bright pinky-orange.

Arum lily frogs, so called because they are often found resting within the blooms of the arum lily, are long in proportion to their breadth. They are powerful jumpers and can cover about 2 feet at one leap. The toes of the hands and feet are provided with suckers like so many tree frogs (e.g. *Hyla arborea*).

In captivity they are frequently seen sitting several deep; for some reason one frog sits on top of another and it is quite common for me to find three in this position. They do not sit on top of each other at random but each one sits exactly on top of the frog below and always faces

the same way.

The vivarium for them need not be large: mine is 15 in. by 15 in. by 24 in. high and has the ground of damp earth covered with moss. There is a small water dish, a fern and some reeds. In these humid conditions they do well at a temperature of about 60°F. Food is entirely insects as for the European green tree frog.

The marbled rush frog (*Hyperolius marmoratus*) is occasionally available and requires identical treatment. Wide black stripes contrast with the white back.

## American toad (*Bufo americanus*)

This is one of the more easily obtained species of American amphibians and does well in the vivarium. It requires similar treatment to our native *Bufo*. The vivarium in which mine were housed was 18 in. by 12 in. by 12 in. and these toads prefer a damp but not wet habitat. The coloration is variable and blends in fairly well with their surroundings, as with many toads. The extent to which this occurs may be judged by the accompanying photograph of two specimens resting on a fallen and partly decayed birch log (*Betula*). Without the shadows they would be well-nigh invisible.

These toads are greedy feeders on any small forms of life. Movement triggers their interest and they will accept earthworms, beetles, grubs, bluebottles etc.



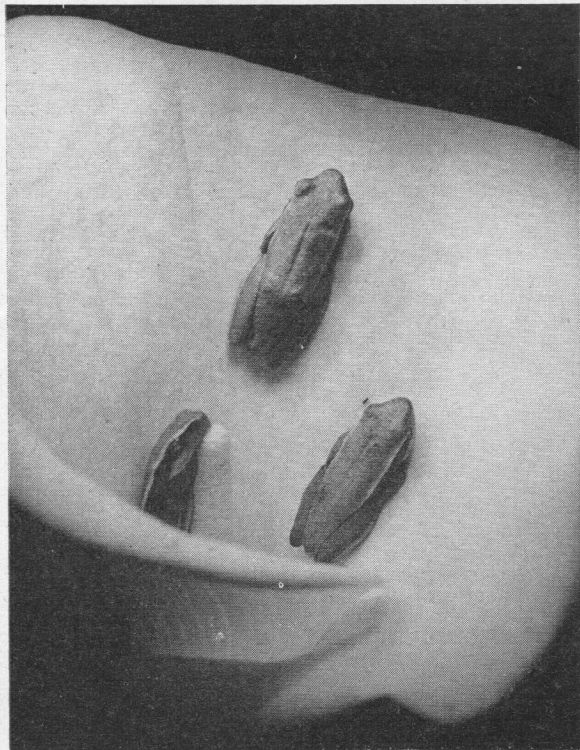
American toads (*Bufo americanus*) at rest on a piece of rotting bark, with which their body colour and pattern harmonises



# Toad



Two arum lily frogs in the alert state, with limbs ready to launch the frog to safety if it is approached



Arum lily frogs rest inside an arum lily (one on the left is "stuck" to the spadix)

# THE CLOWN LOACH

by JACK HEMS

THE majority of tropical loaches are full of interest and charm, but the species that appeals most to me is the extraordinarily handsome clown loach, which goes under the formal name of *Botia macracantha*. This enchanting fish is native to the freshwaters of Borneo, and was first introduced to aquarists in this country 23 years ago. Unfortunately, like some other loaches, it has resisted all attempts to breed it in the aquarium.

The basic colour of the clown loach is pale gold, suffused with a delicate shade of pink. Three broad black bars adorn the flattened sides. The first passes over the longish head and through the conspicuous gold-rimmed eyes to the throat. The second girdles the centre of the body. The third is situated near the tail and continues on to the dorsal and anal fins. As a distinct contrast to this striking black and gold colour scheme, the pectoral, ventral and forked caudal fins are marked with vivid orange-red. There are six barbels on the snout and a tiny spine is set in a groove below each eye. Both sexes are coloured alike.

In the wild the clown loach is reputed to reach a length of 12 inches, but few specimens exceed a third of that size when kept in captivity. It has a temperature range of roughly 65° to 95°F, it never attacks or bullies other fishes and usually remains remarkably free from any illness or disease. It is reasonably lively during the day, but is noticeably more active at night.

Normally it takes all its food from the floor of the aquarium, but some specimens, more enterprising than their fellows, will swim excitedly towards the surface when food is introduced and snatch what they can of it as it falls through the water. None the less, the fact remains that as the clown loach is essentially a bottom-dweller it often goes without its proper share of food when it is placed in the company of other fishes. So to guard against its dying of slow starvation, within the space of a few months, it is advisable to drop some food (preferably small worms, or tiny pieces of meat) into the aquarium after dark.

Assuming therefore that the clown loach is kept with fishes as inoffensive as itself, and that it gets sufficient to eat, it can be said, with truth, that it will live for years. As a matter of interest, a clown loach I have now has lived in a community tank for 7 years. It is in robust health.

By nature the clown loach is a timid fish easily scared by any sudden movement in front of its tank. Its immediate reaction to such a happening is always the same: with a rapid flick of its tail it makes for the safety of plant life or rockwork. There it will stay for a short while until it feels all is well. Then out it scurries from its hiding place to continue its search for edible matter lying on, or buried in, the sand.

The clown loach spends its days swimming and resting in turns. When it rests it often assumes such strange postures that the newcomer to tropical fishkeeping not infrequently

Continued at foot of page 234

## (3) European Amphibians

by ROBERT BUSTARD, B.Sc.

ALMOST all the European amphibians will flourish, and, indeed, many will breed, in an outdoor reptiliary. Some, however, that are of small size and secretive disposition, will seldom be seen, and these I tend to keep indoors. This is a matter of personal preference. If kept out of doors they require little attention naturally and can usually be found in their favourite hiding place if required.

The European green tree frog (*Hyla arborea*) is the only species of frog likely to be kept which is not now to be found in Britain. This delightful little creature seldom measures more than 2 inches and is a beautiful grass green dorsally. Being a true tree frog the fingers and toes end in adhesive lamellae, the so-called "sucker pads", which enable the animal not only to climb among foliage but to rest on a vertical sheet of glass or indeed to sit upside down on the roof of its vivarium or reptiliary. I have always considered these frogs to be an ideal outdoor species, especially if there is plenty of growing vegetation among which they can live, as they seldom descend to the ground except to enter the water to breed in the spring. Tree frogs feed on any winged insects, and bluebottles are the mainstay of collectors, since quantities of gentles can be purchased quite cheaply and easily. They can be bred by placing a fishhead or a piece of bad meat in a place where it is likely to become fly-blown, and then later transferring the gentles to the reptiliary, where they will appear later as bluebottles. One need only introduce a few flies to watch the acrobatics of these delightful animals. They leap after their food with a total disregard of where they will land but their amazing ability to cling on to anything usually provides them with a safe landing.

There are only two species of salamanders in Europe; the spotted salamander (*Salamandra salamandra*) and the Alpine salamander (*Salamandra atra*). The foregoing is by far the easier to obtain and is a most attractive animal, being blotched in vivid yellow or yellow-orange on a black background. The average length is 6 to 7 inches and they are well built. Spotted salamanders do well either indoors or in the reptiliary. In either case they must have access to water, as when purchased in the spring or summer they are frequently gravid. They produce a number of young by taking a hip-bath. The babies are provided, at birth, with well-developed eyes and four limbs and external gills. They live in the water and require similar treatment to axolotls. After several months they metamorphose and take on the vivid coloration of the adults. Baby salamanders both in the water and on land require tiny earthworms or white worms. They will take minute pieces of raw meat if it is moved slightly. The adults feed on earthworms but gentles and mealworms can also be offered. The Alpine salamander requires similar treatment but it produces two fully developed young, which are provided with lungs and live on land from birth.

The European newts are more aquatic than the British species and are often kept in aquaria with a land area at



Photo:

R. Bustard

Fire-bellied toad (*Bombina bombina*). This small species has an attractive red-orange pattern on its undersurface

one end. Worms are the best food. The aquatic habit applies particularly to the Italian crested newt (*Triturus cristatus karelinii*), the marbled newt (*T. marmoratus*) and the Spanish newt (*Pleurodeles waltli*). Indeed the Spanish newt is almost entirely aquatic throughout its life. I provided my specimens with a wooden raft on which they occasionally sat, otherwise they remained in the water. The Spanish newt is the largest of the European newts, with a total length of a foot. The marbled newt is particularly attractive, with delicate green markings. The Alpine newt (*Triturus alpestris*—not to be confused with the Alpine salamander) seldom exceeds 4 inches and is much less aquatic than some. The variable coloration is most attractive, being frequently of a purple colour above with or without markings. On the flanks this gives way to sky blue and the underside is orange.

One of the most attractive of the European toads is the green toad (*Bufo viridis*). Coloration is very variable but usually includes green and the marbled effect is most striking. In size it is somewhat smaller than our common toad but requires similar treatment. The much smaller midwife toad (*Alytes obstetricans*) is a drab species but has remarkable breeding habits so it is worthy of a place in the outdoor reptiliary, where it may breed naturally. Mating takes place on land in this particularly terrestrial species, and the males collect egg strings, often from several females, and carry them around, wound round their hind legs until the tadpoles are ready to hatch, when they take them to the water.

Of a similar size (2 inches) are the fire-bellied and yellow-bellied toads (*Bombina bombina* and *Bombina variegata*)

respectively). They are very agile little creatures, and spend long periods floating in the water among weeds with just the eyes and nostrils protruding and catch their food by sheer speed. I feed these small toads largely on flies and bluebottles. There remains one toad that is occasionally available, the spadefoot toad (*Pelobates fuscus*), which is a rather boring species to keep because of its habit of digging itself into the ground, where it can be hard to find!

The European amphibians provide a happy hunting ground and I well remember when they became available again after the war and I was able to unpack my first parcel. Their hardy nature, often beautiful coloration

and active habits, combined with their relative cheapness, make them firm favourites among collectors.

#### Prices

Examples of typical prices at present of the specimens mentioned in this article are:

European green tree frog, 2s. 3d; Spotted salamander, 7s. 6d; Alpine salamander, approx. 10s. to 15s.; Italian great newt, 2s. 6d; marbled newt, 10s.; Spanish newt, approx. 15s.; Alpine newt, 4s.; green toad, 3s. 6d; midwife toad, 6s. 6d; fire-bellied toad, 6s. 6d; yellow-bellied toad, 6s. 6d; spadefoot toad, approx. 8s. to 10s.

## Shot Darkly With Reds

by T. ROLAN

**B**LACK rubies! And what visions of exotic jewels shot darkly with deep crimsons and reds these words conjure up. But applied to fish—? The aquarist knows that *Barbus nigrofasciatus*, variously called the nigger barb, the ruby barb, the 'purple-headed carp' in Holland or the 'crimson head' in Germany, can more than live up to this most beautiful of its popular names. When the male is in first-class condition its breeding colours are magnificent. The head and foreparts then show a ruby-red glow that darkens to jet black from the dorsal fin to the tail and is underlaid with faint shimmerings of red. This colour phase, since it is associated only with courting procedure, is not permanent, and the males when out of breeding trim, and the females at all times, are a pale olive colour faintly banded with black. They are then rather plain little fish. So it is up to the aquarist to do his best to ensure that the males retain their beautiful coloration by keeping them in first-class breeding condition.

In order to achieve this with these fish it must be remembered that they require plenty of space, plenty of air and good feeding. Black rubies are extremely active and move readily around so that they need sufficient swimming space and a reasonable depth of water. They also need good supplies of oxygen and must be kept supplied with fresh water; the occasional replacement of about one-quarter of their tank water by water from the tap has been found to be beneficial. The tank should be kept scrupulously clean, and, though they can withstand a temperature range as wide as 70° to 90°F (21° to 32°C), it is generally acknowledged that at 75°F (24°C) they show the most intense activity and coloration.

In their eating habits they are most obliging fish and can make do with dried food alone, but they will not reach a peak of condition unless they are fed on a varied live-food diet. Adult brine shrimps, mashed earthworms and, as they have small mouths, *Daphnia* and *Cyclops* in particular, will serve as a staple diet. It should also be remembered that they eat considerable quantities of food and that they should therefore be fed liberally.

It is a challenge to the aquarist to bring these fish up to their finest trim, but there are other characteristics apart from their beauty that make ruby barb so well worth keeping. They have the virtues of the genus *Barbus* with none of its vices. That is to say they make good community dwellers, since at maturity they are only 2½ in. long and they are by nature really peaceful neighbours; the males

go in for mock battles and mad chases round and round in narrow circles or throughout the length of the tank, but they are not addicted to the fin-nipping that a number of the smaller barb species indulge in, and a rogue ruby barb is a most unusual phenomenon. Then, as we have seen above, they are not difficult to feed, as they are omnivorous, and, finally, they are not difficult to breed. In South Ceylon, where they are found in slow-running, placid streams, the ruby barb is prolific, and in aquaria, too, it spawns easily. Novice fish breeders in particular, do well with these fish since there are no problems of sexing.

The parent fish must be of a reasonable size to provide plenty of eggs. In fact, the most satisfactory breeding results are obtained with well-developed fish aged from 9 to 15 months, chosen for their good coloration and, in the female, her nicely rounded shape. Preparatory conditioning is necessary, during which time the fish are fed liberally on a live-food diet, and this can be carried out either in separate tanks, in which case the fish are transferred to a smaller tank for the actual spawning, or the whole process can take place in one medium-sized spawning tank divided into two sections by a sheet of glass that can be removed when the fish are ready to spawn. This will be after about 7 days, by which time the male fish will be very active and showing all his wonderful courting colours and the female really plump.

The spawning tank may be prepared as follows: the bottom should be covered with round small stones or a layer of marbles to act as an egg trap, since, like all the barbs, the black rubies are avid egg-eaters. Fresh tap water that has been allowed to stand for a few days may be used to a depth of about 8 in., and plenty of spawning plants in the tank; either fine-leaved plants such as *Myriophyllum*, *Cabomba* or *Limnophila* or artificial media such as nylon wool or coconut fibre will be quite suitable. Some free swimming space should be left, however, for the fish to chase each other in. As for water temperature, this should be raised from the 75°F (24°C) at which conditioning takes place to the 78° to 80°F (25° to 27°C) required for spawning.

This usually takes place in the early morning, so, during the previous evening, the parent fish, female first, followed in a little while by the male, should either be transferred to the prepared spawning tank or, if the second method is being used, the glass partition between the fish should be removed. There will be quite a lot of chasing by both male and female and the semi-adhesive ova will be deposited

# Spadefooted and Narrow-mouthed Toads

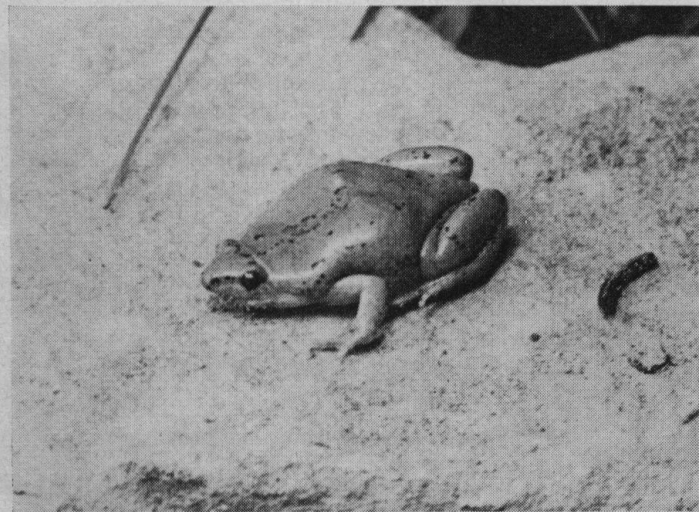
by ROBERT BUSTARD, B.Sc.

**A**LTHOUGH both of these toads belong to families with a wide distribution and a good number of species, only a very few are commonly available to British collectors. Hence it is possible to discuss them both within the space of a single article.

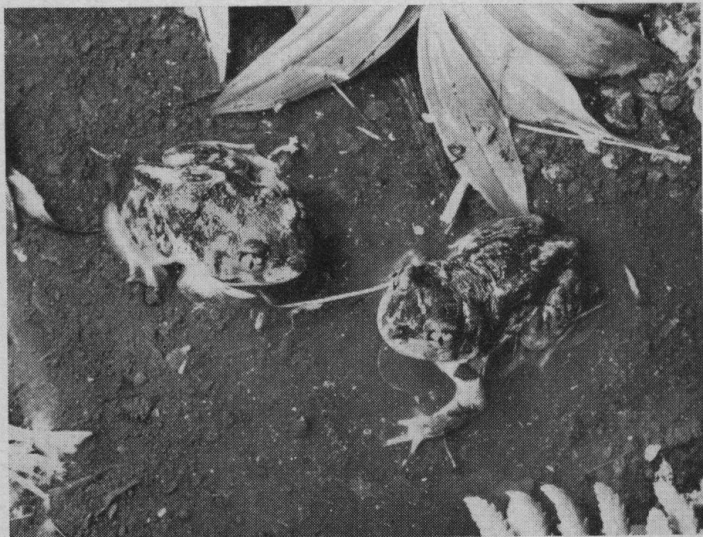
The spadefooted toads are so called because their hind feet show adaptations for digging. They occur in Europe, north-western Africa, southern Asia and in North America. The European spadefoot (*Pelobates fuscus*) and the American eastern spadefoot (*Scaphiopus holbrooki*) are the only two species likely to be available. The European spadefoot is a small toad, measuring about 2½-3 in. Above it is marked with brown or red-brown on a background of grey or brown or even yellow; below it is dirty white. One characteristic feature of this little toad is the presence of a metatarsal digging spur on each heel. The U.S. eastern spadefoots shown in the accompanying photograph are attractively marked in shades of green and yellow, marbled with black. They measure about 2½ in. Their vertical pupil, indicating their nocturnal habits, can be seen in the illustration.

In Nature spadefooted toads spend long periods in their burrows, which are constructed in loose ground by a kind of shuffling movement aided by the adaptations of the hind feet. Their food includes the normal toad diet of earthworms, slugs and insects, and feeding in captivity presents no difficulty as the three stand-by items—mealworms, gentles and bluebottles, are all acceptable. My specimens have always been fed largely on gentles and earthworms, for if not immediately eaten the worms may come to the soil surface at night when the toads are active and uneaten gentles are later consumed as bluebottles.

The vivarium for both species should contain damp soil or mud to a depth of not less than 4 inches. They are strong swimmers but out of the breeding season need have access to only a small pool. In setting up the vivarium it is a good plan to have a sunken region which can contain the pool and be surrounded by mud. Higher regions can



Narrow-mouthed toad (*Microhyla carolinensis*)



Photos:

Robert Bustard

American spadefooted toads (*Scaphiopus holbrooki*) in shallow water in spring

consist of damp soil, which should not be water-logged. No hiding places need be provided as the toads burrow into the ground.

The eastern narrow-mouthed toad (*Microhyla carolinensis*) is the species of the family Microhylidae most likely to reach the amateur. The head is small and the mouth region certainly narrow. The total length is about 2 in. The dorsal colour is greyish olive with faint darker markings. In their natural surroundings these little toads are said to be creatures of habit rather like our common toad (*Bufo bufo*). At night they regularly forage along the same paths and return just before dawn to their home by means of short, rapid jumps. They feed on small insects, spiders, small earthworms and slugs.

My three specimens were housed in a 20 in. by 20 in. by 20 in. vivarium, which proved sufficiently large for these small creatures. Later they were put into an outdoor reptiliary, where they do well, at least during the warmer months, but like the European midwife toad (*Alytes obstetricans*) and fire toads (*Bombina bombina*) are seldom seen there because of their small size. The indoor vivarium had a floor covering of 2 inches of garden soil, on which two pieces of turf were placed. These covered almost three-quarters of the floor area. In one corner a small dish was sunk into the ground to act as a pool and at the back a few small flat stones were provided as hiding places. Later I discovered that these were really unnecessary as the toads had made their homes in small burrows below the grass roots.

Perhaps the quaintest members of the family are those of the genus *Breviceps*, of which the flat-faced *Breviceps mossambicus* is typical. These little creatures are remarkably fat, almost balloon-like, and have very short limbs. They are most unusual among amphibians, and indeed among animals in general, in being unable to swim. They are the most ridiculous-looking amphibians that I have kept, and would undoubtedly be better known among vivarium enthusiasts but for their specialised feeding habits—their diet is mainly termites.

Specimens of these toads are likely to cost about 7s. 6d. to 10s. each.

# Lake Turtle and Amboina Box Tortoise

by ROBERT BUSTARD, B.Sc.

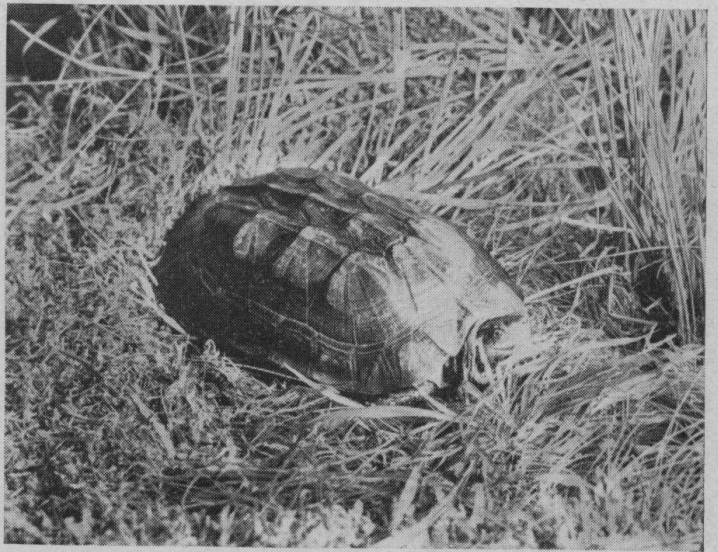
THE subjects of this month's article are Asian chelonians. Both could be classed as terrapins with a fair degree of accuracy, as in the British connotation 'terrapin' refers to all chelonians, other than marine species (turtles), which habitually enter the water or live under very damp conditions. The truly terrestrial species we call tortoises.

This nomenclature is somewhat arbitrary and in America the word 'turtle' embraces all chelonians, including those species that are truly land dwellers. Recent correspondence in *The Aquarist* (July, 1962: pages 82-83) prompts me to stress this arbitrary nature. By 'terrapin' we ideally think of species which are at home on land or in the water, like typical amphibians. However, we must remember that there are freshwater chelonians, such as the soft shells (*Amyda* and *Trionyx* for instance), which are totally aquatic and which are as perfectly adapted to an aquatic existence as any of the marine turtles. Like them they move clumsily on land. What should we call them in popular terms? Clearly according to the above British definition such species are terrapins, which shows how rough and ready popular names tend to be.

The lake turtle (*Geomyda trijuga thermalis*) has this name because it is featured on collectors' and dealers' lists as a 'turtle'; it is common on the island of Ceylon, from where I have received several specimens. It grows to a considerable size, and one giant female, which I had for some time, measured just over a foot, on the flat, and weighed 7 pounds. This female laid a number of large calcareous-shelled eggs measuring 50 mm. by 29 mm. (2 in. by 1½ in.). The eggs had been deposited in the water dish so no attempt at incubation was made. There appears to be a variation in size of the eggs in different clutches from specimens from the same region. A specimen that I received from Ceylon along with my own and which joined Mrs. Pickard-Smith's collection in Sussex deposited a total of five eggs which measured 1½ in. by ¾ in. These were laid by a much smaller specimen, which may account for the smaller size



Amboina box tortoise (*Cyclemys amboinensis*)



Photos:

R. Bustard

Ceylon lake turtle (*Geomyda trijuga thermalis*)

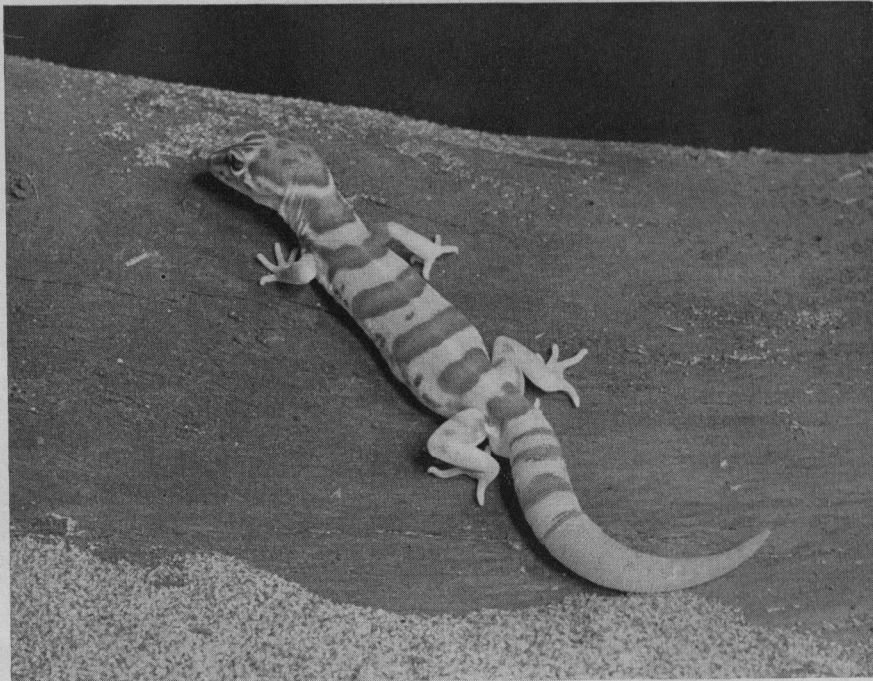
of the eggs. Had they been larger they would have been unable to pass through the gap between carapace and plastron.

The coloration of my very large female lake turtle was a drab olive-brown on the carapace and the soft parts were a dull olive-grey. The carapace was worn quite smooth, possibly due to age, and the three longitudinal lines, which are well-marked ridges even in well-grown specimens (see the photograph) were only represented by three yellow lines. Young specimens are, as is so often the case, much more attractive. The soft parts and carapace are blackish tinged with olive but the head is marked with orange. These markings may still be found on quite large specimens and were present on two 6 in. lake turtles which I kept. In my view the prettiest size for this species is undoubtedly about 3 in. This is an ideal and most practical size to obtain, as they are large enough not to be delicate, and their attractive coloration and alert habits can be appreciated before they grow large. The raised pattern of the carapace, which is characteristic of this species, is shown in the illustration.

The amboina box tortoise (*Cyclemys amboinensis*), like the lake turtle, is a species that is less commonly seen than many other terrapins. Both, however, can be obtained quite frequently in Britain, where they can be expected to live for many years under similar conditions. In this way they are a much better purchase than the tiny, but beautiful American terrapin hatchlings which are imported in such numbers each spring and summer. The carapace of the amboina box tortoise is not particularly attractive, but the head, striped in grey and yellow, is quite striking. Box tortoises are so-called because they are considered to be terrapins which are in the process of reverting to a terrestrial way of life. Some of the American box tortoises (genus *Terrepene*) have travelled much further along the road to terrestrial life than *Cyclemys*, which still remains rather terrapin-like. The word 'box' refers to the remarkable hinges on the plastron, which enable both the front and the back portions of the plastron to be pulled upwards in

Please turn to page 154

# The Desert Ground Gecko



An adult desert ground gecko, showing the mating spurs at the base of the tail. This specimen is unusual in retaining the banded pattern of coloration

by ROBERT BUSTARD, B.Sc.

*Photographs by the author*

THE desert ground gecko (*Coleonyx variegatus*) lives in regions of California, Arizona and Nevada in the south-western United States. It is a small lizard with a total length of about 6 inches, of which half is tail. The coloration is variable. Youngsters have a banded pattern with five broad, dark brown bands across the body, but as they grow, the bands start to break up, and dark spots appear in the previously uniform light areas between the dark bands. The banded appearance is seen in specimens up to about 4 inches in length, when it usually starts to disrupt, and many old adults have the banded pattern completely replaced by spots. The ground colour is a dull yellow with a pinky suffusion.

The desert ground gecko, in common with all the members of its genus, has a number of interesting features, some of which are unusual in geckos. In the first place they have well lidded eyes, whereas most geckos, like snakes, lack eyelids but possess a transparent spectacle that covers the eye. Climbing is not a strong point with the ground geckos. The popular idea of geckos is of small lizards running up the walls of houses, and across ceilings upside down, in the tropics. Many geckos, however, are poor climbers, and lack the adhesive lamellae which all the excellent climbers possess in a most advanced state. In common with many geckos *Coleonyx variegatus* possesses a

fat tail, which is not as well developed as in certain other species. The tail serves as a food store, which may be drawn upon in times of need, and in captivity where food is usually plentiful, the tails are normally well rounded. They commonly reach a diameter of about 7 mm. at a distance of about one-third of the way down from the base, and a weight accounting for almost 20 per cent of the gecko's weight of approximately 5-8 grams.

The geckos live extremely well in captivity and there are records of specimens surviving for periods of 10 years and over. Many geckos prefer winged insects as food but *Coleonyx variegatus* are quite happy to accept mealworms as basic fare. I have established a community of these geckos to study their behaviour and to breed them. They are housed in a vivarium measuring 30 in. by 20 in. by 20 in. and the simple furnishings include a 2 in. layer of dry peat covered with  $\frac{1}{2}$  in. of sand, and several pieces of bark to provide basking sites and hiding places. There is also a small water dish sunk into the sand and two little succulent plants are included more for my satisfaction than for that of the geckos.

The vivarium is heated by a carbon heater lamp instead of the usual pearl electric light bulb. The former is preferable for geckos because they tend to be nocturnal, or more accurately crepuscular (creatures of the twilight or

evening), and bright lights are less suitable. The carbon heater lamps provide the necessary heat but a much subdued light, which is still quite sufficient for observation. The lights in my vivarium are switched on at about 9 a.m. and remain on for about 12 hours. The day temperature rises to about 86°F (30°C) and the night temperature averages about 60°F (16°C). This is quite suitable, as in desert regions there tends to be a large day to night differential in temperature.

Shortly after my dozen specimens had settled in I received a pleasant surprise—they were almost all out basking on the bark slabs at 10 a.m. and in the light of the bulbs. The only specimens which are seldom seen out during the day time are the two immature females. These are decidedly shy and are never seen basking during the day, even after several months in captivity. It may well be that temperature is the main factor which makes them evening creatures in the deserts where they live, where it will be too hot during the day. They are said to have an optimum temperature of about 82-84°F (28-29°C), and I have tried to provide this in the vivarium. The result is that shortly after the lights are switched on in the morning they come out to bask and move leisurely around. They are then in view for most of the day, although around 5-6 p.m. they tend to disappear and only a few are visible at any one time until the lights are switched off.

Without doubt the maximum activity takes place shortly after the lights have been switched off in the evening. Sexual activity is not seen during the day, but commences very shortly after the lights are put off in the evening. I have watched numerous matings and at present my females are starting to lay; each female lays a pair of very large oblong eggs. I am hoping to be successful in providing suitable surroundings for them to lay their eggs naturally (this can often be troublesome with lizards) and that I shall be successful in hatching them. I shall report in due course on my results and give tips for those collectors who would like to try for themselves.

These ground geckos are certainly among the easiest species to keep and a pair could be kept quite successfully with the conditions outlined above. In addition to meal-



An example of camouflage—a ground gecko on sand

worms, flies and bluebottles can be given but these should have their movements somewhat restricted as the geckos do not hunt their prey very rapidly.

Unlike some geckos, they are very easy to sex as male specimens possess a pair of external mating spurs, which can be seen at the sides of the tail base. Specimens, when available, are likely to cost about 30s. but against this is the knowledge that they are most entertaining to watch and should survive for 10 and perhaps 15 years with very little attention. An original pair might produce a colony if the eggs are carefully incubated and the young reared. Females will provide at least two clutches of eggs during the summer months and the young almost certainly breed when they are 2 years old.

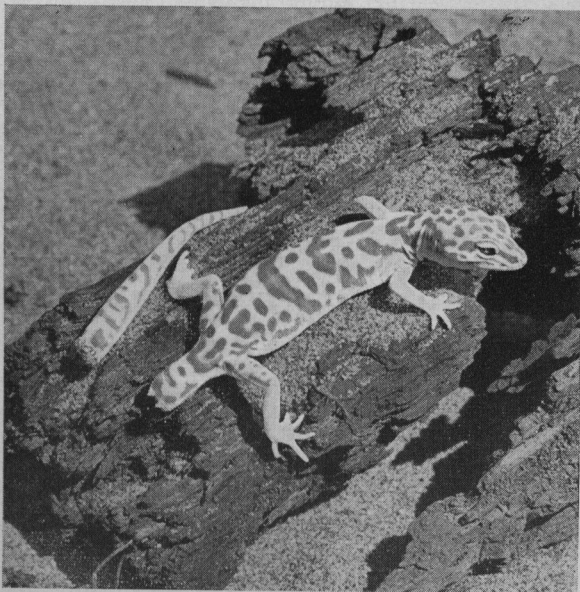
## What's in a Name?

ONE could hardly say that the subject of this note is original! Indeed, it is an old and familiar cry that asks, "Why must authors always include scientific names when referring to fishes and such?" The answer is a simple one even though it may not appear obvious to the layman. *Scientific names are given so that the reader may know exactly to what particular fish reference is made.*

The importance of this will be realised if the following points are suggested: (a) the existence of large groups of similar fishes, e.g. there are over 20 different species of *Rasbora* and more than the same number of the various tetras; (b) two species of the same genus can look so much alike that it necessitates a scale count to determine which is which, and yet their breeding or environmental requirements may differ considerably; (c) a fish known in one part of the country by a particular "common" name may be known elsewhere by another: an example of this is *Brachygobius doriae*, which is known in some areas as the bumblebee fish and elsewhere as the wasp goby.

Scientific names assist the reader in identifying the exact species referred to so that blunders by mis-identification can be avoided. Even though a great amount of trouble is taken in selecting and registering the names of fishes according to the International Rules of Zoological Nomenclature, in the end, "a rose by any other name (to me) smells just as sweet".

R. E. Macdonald



Female desert ground gecko that has just lost its tail in a fight

# *Pelmatochromis arnoldi*

**T**HIS is a cichlid that is not often seen, mainly I think, because it follows the accepted pattern of cichlid behaviour. This particular cichlid, although attaining a length of only 4 inches, can be extremely vicious, as I have found to my cost.

The colour is a mixture of yellow-green and silver with a row of five black dots on each side. There is a dark line running from eye to the base of the tail and also a dark line running through the eye. The male has a red belly, which shows better at breeding time. The shape diverges from the usual cichlid type and is more or less elongated. As with the majority of the genus *Pelmatochromis* this species comes from tropical West Africa.

Feeding proved to be an easy matter, any meaty meal being greedily accepted; this diet included chunks of heart and liver, earthworms and guppies. Prepared dried food was only rarely accepted.

Although my pair of *P. arnoldi* were too vicious to be kept with any other fishes they were extremely nervous when anyone approached their tank, this nervousness only being overcome by their greed, when they would dart out from behind a rock to take any food dropped into the tank.

When the fish reached a size of 3 inches it was found that periodically the female appeared slightly tattered, a sign that the male was ready to spawn; no jaw-locking or typical cichlid wrestling was ever noticed. The pair were never separated and no serious injury was ever seen on the female.

On 5th March this year the pair were placed in a 18 in. by 10 in. by 10 in. tank whilst the 24 in. by 15 in. by 12 in. tank that they usually occupied was cleaned with a view to breeding these fish. Two days later they spawned on the inside of a 4 in. flower pot provided for refuge. The eggs, about 250-300, appeared dark in colour and were fanned by both parents. After the first day it appeared that the female cared more for the eggs although at times both would cram themselves into the pot. Three days after the eggs were laid, they began to hatch. Next day the flower pot was empty and no sign of any fry could be seen.

The parents were returned to their original tank and no further spawnings were observed until 30th April. Once again the fish had been moved to a 18in. by 10 in. by 10 in. tank as a temporary measure; spawning took place as before. The flower pot containing the eggs was removed to a

24 in. by 8 in. by 8 in. tank, aeration was applied so as to pass bubbles by the eggs and 2 drops of 5 per cent methylene blue and 2 drops of 5 per cent acriflavine solution per gallon were added. Two days later the eggs hatched and about 300 fry lay in a mass at the base of the pot; only 12 eggs were noticed to have developed fungus. Three days after hatching the fry became free-swimming and the flower pot was removed.

Feeding was commenced with finely sifted *Daphnia*. Growth was rapid and on 13th May the fry were moved to a 36 in. by 12 in. by 12 in. tank. The colour of the young fish was silver with a heavy black line from eye to tail with a golden line running above. The fins had a slight yellow tinge. At 6 weeks of age the size of the fry varied from  $\frac{3}{8}$  to 1 in.; no sorting had taken place and the number was down to about 100. Feeding at this stage was *Daphnia* and Grindal worm with occasional feedings of dried foods. The black line was beginning to break and took the form of spots as on the parent fish.

At the time of spawning the parent fish had developed the typical cichlid breeding tube and the female was seen to enter the flower pot and deposit a neat row of eggs, about five or six in all, closely followed by the male, who appeared to rub his belly along the eggs. No effort was made by either parent to clean the spawning surface and some eggs were even laid on a thin covering of algae which covered the pot.

Six days after spawning the male fish died for no apparent reason; he was in full colour at the time and had been transferred to his original tank. Two days later the female was found lying on the bottom but still alive; all attempts to save her failed. The death of the adults still remains a mystery. No sign of physical injury could be seen on either fish.

At the time of writing, the fry have reached a length of 1 to 1 $\frac{3}{4}$  in. and are growing fast. The number is now down to 54, a mixed batch of striped and spotted fish as some of the fry still have not developed their spots. Although this is a species which must be kept on their own, they are in my opinion well worth the tank space for such an interesting and colourful cichlid.

Ralph F. Bayntun

## Lake Turtle and Box Tortoise

*continued from page 151*

*Terrepene*, thus completely enclosing the animal. In *Cyclemys* only the front portion can close up to protect the head and forelimbs. Specimens available are seldom more than 6 in. in length.

If possible the vivarium for both species should be roomy enough to have a decent pool area (which can be quite shallow—4 in.) and also a portion of land for them to walk about. Naturally much will depend on what is available but I do not advise anyone to consider purchasing either species unless they are prepared to give them a vivarium with a combined land and water floor space of 3 feet by 2 feet. I have allowed my specimens the freedom of an enclosure round a small shallow pool in the summer months and if an outdoor reptiliary with at least a small pool is available then accommodation need present no problem during the warmer months.

During the winter a bright light is to be recommended and the vivarium temperature should be maintained at

about 70°-75°F (21°-24°C). Draughts are to be avoided. Food for both species and at all times of the year can consist of strips of raw meat, fish or earthworms.

When available, 6 in. specimens of either species should be obtained for about 30 shillings. Smaller specimens may be somewhat cheaper.

## Bother with Bettas

*continued from the preceding page*

the other hand, were found to be able to breed every 3 days at a temperature of 80°F (27°C).

It is clear that the breeding temperature for fighters is fairly critical if the best results are to be obtained. Extremes of temperature must always be avoided and temperatures above 85°F (30°C) induce too rapid a growth in the embryos, which can lead to bent spines and abnormal fin-ray growth. Too low a temperature also may influence the development of the skeleton and make it difficult to rear well-proportioned specimens.



I AM pleased that, contrary to his customary practice, Mr. Kelly did follow up my letter in your June issue, because I feel that his original article could have shaken the confidence of exhibitors and they must be reassured.

The present system of appointment to this list was in operation many years before Mr. Kelly raised the subject in February at the F.N.A.S. meeting, and it has produced many first-class judges in the past.

I accept Mr. Kelly's assurance that his barbs were not aimed at me, but he must remember that I have worked as co-judge with most of the others on the F.N.A.S. list and I can assure all interested parties of their capabilities. I am proud to have worked with them, and have much to thank them for.

There must always be a 'freshman' in the ranks to fill the empty places left by the retiring old hands, but their further training and testing is already in good hands. I can speak from experience. I still maintain, therefore, that Mr. Kelly did rush in with a lot of questions which he should have been able to answer to complete his article.

With regard to the training scheme Mr. Kelly heard about, I must say that although I was invited to take the chair, all the credit for this is due to the progressive Bradford Society, and the progress made does serve as an illustration of how good judges are made.

J. M. SKINNER,  
Nr. Wakefield, Yorks.

#### Reflector for Top-lighting

SOME time ago I painted my community aquarium blue and its stand and cover pink, which looked very nice. However, with the inside of the cover pink, I found that my plants were not growing very well. I hit on the idea of using some of my wife's tin-foil, which she puts over the meat in the oven, to line the aquarium cover and I find it very good, both in colour and strength. My plants are now growing very well, and I would like to pass on this information to fellow aquarists.

W. D. ROSS,  
Newcastle, Staffs.

#### F.B.A.S. Standards

THANK you for publishing my letter about the F.B.A.S. Guides and Standards. The response from your readers confirmed my suspicions that a large number of aquarists were unaware of these publications.

At a recent meeting of the Federation Council, it was decided to sell at a reduced price (7s. 6d.) a limited number of complete sets of Guides and Standards, in the loose-leaf folder, which are slightly stock soiled.

J. A. HORNE,  
93, Bedwardine Road,  
London, S.E.19

#### Fishing Birds

I WAS much interested in your correspondence on owls and pond fish. A friend of mine bred some goldfish in a tub at the end of her country garden this spring. Puzzled by the gradual disappearance of her young fish she kept watch on the tub from her kitchen window. She observed a magpie actually taking fish. I have examined the adult female fish, which has a neat notch out of her tail. I take this to be further work of the magpie!

M. E. SIER,  
Godstone Green, Surrey.

#### Terrapins in Winter

PLEASE give me some advice on wintering baby terrapins. Mine are *Clemmys caspica*. Some books recommend hibernation for this species, but this seems rather risky to me.

J. SUMPTER,  
Portsmouth, Hants.

*Robert Bustard writes:* The safest method with any baby-size or small terrapins (with a shell length of below 3 in.) is to keep them indoors in a heated aquarium during their first winter. The water should be heated to around 70°F (21°C) and a 60 watt light bulb should be suspended 6-9 in. above the basking site. Water depth of 6 in. is suitable for most species and stones should project out of the water, allowing easy access to a flat dry stone for basking purposes. *Clemmys caspica* is a hardy species and I have successfully hibernated several specimens with a shell length of 4 in. out of doors in Scotland. An outdoor pool must have a portion with a depth of at least 2 ft., so that they can hibernate underneath the ice. Ponds should not contain dead or decaying leaves as these can give rise to toxic substances which may prove fatal, especially during prolonged freezing of the pond surface. In Scotland I bring indoors all American terrapins and keep them warm during the winter months but many species when larger have been successfully hibernated out of doors in pools, as described above, in the south and even the midlands of England.

#### An Unlikely Tale

'TIS said that a little learning is a dangerous thing, and this is amplified by a recent article in a Scottish daily newspaper, the editor of which informs me that its author is a University lecturer. The article said that the life of a goldfish can be prolonged by shortening its tail by immersion in hydrogen peroxide or in Lysol: "Your pet's tail will slowly vanish and you may put years on his life!"

As I am the "expert" (?) who replies to queries from readers in a Scottish weekly journal, much of my time is taken up in correcting wrongful advice that appears from time to time in local and national newspapers on the subject of pets. For instance, one of these papers told a reader that if she put a snail in the globe with her goldfish she would never need to change the water.

One of the things that amuse me is that while newspapers publish the misgivings of other people, they are most reluctant to publish corrections of their own errors, and the cutting I send you is a very mild published version of the letter I sent to the editor on the subject of docking goldfish's tails.

One shudders to think what the result would be if every little boy or girl who had a pet fish, or experts for that matter, followed the article's advice. Obviously the learned lecturer did not know or apply Emerson's "The wise man is the man who knows what he does not know and is willing to admit it".

ANDREW WILSON,  
Glasgow, C.1

## British Aquarists' Festival 1962

*continued from page 157*

Blackpool and Fylde A.S. third and Stretford and District A.S. fourth. The Roses Shield, presented for inter-society competition between Lancashire and Yorkshire, was won by Lancashire. Special prize for the society winning most awards went to Northern Goldfish and Pond-keepers Society and the trophy for the individual gaining most awards was won by C. J. Bennett (Northern Goldfish).

Results of the Fancy Guppy Association Show held at the B.A.F. (by courtesy of the F.N.A.S.) were: Males: Fantail, Multicolour and Delta, V. Partington, (Lancs.); Flagtail: H. Blackwell (Pennines); Swordtails: Colour Class, R. Beresford and J. Jeffery (Lancs.); Cofertails, C. Powell, (Radlett); Females, Original, Superba and Scalloptail, W. G. Phillips (Radlett); Wedgetails, P. Scott (Lancs.); Coloured, C. Chen (Radlett); Junior Class, A. Lawrence (Pennines); Ladies' Class and Breeders' Pairs: C. Kelly; Breeders' Teams, W. G. Phillips (Radlett). Mrs. C. Kelly won Best Fish in the Show award and became the first European to be awarded the Champion Medal from U.S.A. The Collins Cup for the section whose members won most awards went to Lancashire.

# Rearing Young Terrapins

by DAVID LASKEY

**I**N *The Aquarist* (November 1962, page 151; Lake Turtle and Amboina Box Tortoise) Robert Bustard has hinted at the difficulty of rearing hatchling American terrapins, which are freely obtainable in this country during the spring and summer. Readers may be interested to hear of my experience of raising a hatchling red-eared turtle (the elegant terrapin, *Pseudemys scripta elegans*) from the size of half-a-crown to a length of 4 in. in 2½ years. This terrapin is distinguishable by the red or orange stripe behind the eye, and in my specimens the carapace was green with black markings, the plastron yellow with black markings, and the skin green with yellow and black stripes.

## Acceptable Foods

I found that considerable patience was needed to find an acceptable food; finally the two terrapins ate well on scraped raw beef, very small pieces of raw cod and herring, and the stems of common pondweed (*Potamogeton*). They refused *Tubifex* worms, commercial dried 'turtle food', and also the doses of fish-liver oil and powdered cuttlefish bone recommended in the textbooks, but later did well and increased rapidly in size on a diet of tadpoles. These have the advantage of providing all the right food elements and plenty of exercise and amusement for the reptiles in stalking them. I have a large supply of tadpoles, having natural running water in the garden; after they lose their tails and turn into small frogs I feel an unscientific squeamishness about feeding them to hungry terrapins! This same spring water is used for the terrapin tank, and it may be of interest that it has a high acid content, from heavy clay soil. The rapid growth was, of course, accompanied by regular moulting of the skin and flaking of the sections of the carapace.

Despite the easy assurance of some dealers that terrapins of this kind will thrive at "average living-room temperature", I found that my specimens ate only with reluctance and spasmodically until heated water (average 75°F; 24°C) was supplied, with the usual thermostat and heater. Adequate dry land for exercise seems to be an absolute necessity; natural sunlight appears to give great pleasure and is certain to be beneficial, provided that it is not too much filtered by dirty or dusty glass.

The reptiles were first installed in a small fish tank (12 in. by 8 in. by 8 in.) with 3-4 inches of water and flat rocks on to which they could easily crawl. The tank was placed in a south-facing window and no artificial light was used.

## Living Accommodation

It was impossible to create a balanced tank, as one can do with fish, because of food pollution. They preferred to take their food in the water, carrying off scraps of meat placed on the rocks into the water to eat. This habit made it imperative that a change of water was made after each feed (once a day), since raw meat and fish are not conducive to clean water. There are other ways of solving this problem—keeping a separate tank for feeding (which has the disadvantage that the terrapins are handled excessively, and this water must be at the same temperature as the main tank) or alternatively using a larger tank which can be

aerated. I did not attempt the last-named on grounds of expense, but I am assured that terrapins in an aerated tank do not need to be cleaned out.

After about 12 months, the terrapins outgrew their tank, and to provide half swimming space and half walking space, they were transferred to a larger tank (30 in. by 12 in. by 10 in.), used as a vivarium with gravel and rocks at the bottom to a depth of 4 inches. Into this layer a removable plastic swimming tank measuring 4 in. by 9 in. by 12 in. (actually a food container without its lid) was sunk. In this was placed the heater and thermostat and a sloping rock to assist the reptiles to climb out. In the gravel was placed a pot containing a small plant—a peperomia of similar colouring to the terrapins. They enjoyed walking about, sitting on each other's backs (a habit with terrapins), basking in the sun with legs stretched out voluptuously, and climbing on top of the plant and nestling in the leaves. A sheet of glass was placed over the end of the tank holding the plastic container to minimise heat loss from the water.

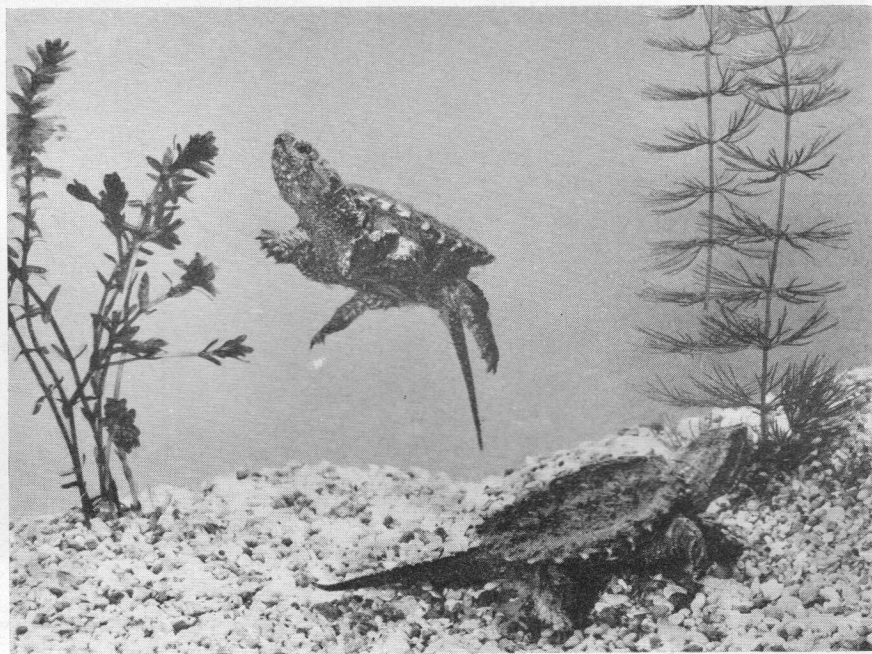
After 6 months in these quarters, one of them produced the male characteristics—thick tail and long claws, and I concluded that I had a true pair. In the spring, when the reptiles were assumed to be about 18 months old, I saw the beginnings of mating activity. The male pursued the female round the swimming tank, manoeuvred her into a corner so that he faced her, and brought his front legs round alongside his head (as one about to dive) and fluttered his claws over her head and face. This was not, unfortunately, appreciated by the female, and my visions of breeding elegant terrapins in this country were brought to an end by her death. The symptoms were loss of appetite and swelling of the feet. It may be significant that death occurred presumably at maturity, and the carapace of the female seemed to be slightly deformed, so perhaps some congenital defect was the prime cause. Two remedies were suggested for the condition: terramycin in the water, and painting the affected parts with red ink. The first had no effect, and the second I dared not try!

I am now considering larger quarters for the surviving terrapin, since it needs to swim more freely and is now 4 in. long. These American terrapins are supposed to be hardy in this country in the summer months, but in our unpredictable climate it is probably better to keep them without hibernation under such controlled conditions as I have described. Since I had no knowledge or experience of terrapins until I bought my two specimens, there seems to be no reason why more of these beautiful and interesting creatures should not survive, provided that patience and care are exercised, and that active, bright-eyed youngsters are chosen at the dealers and given adequate quarters and the right food.

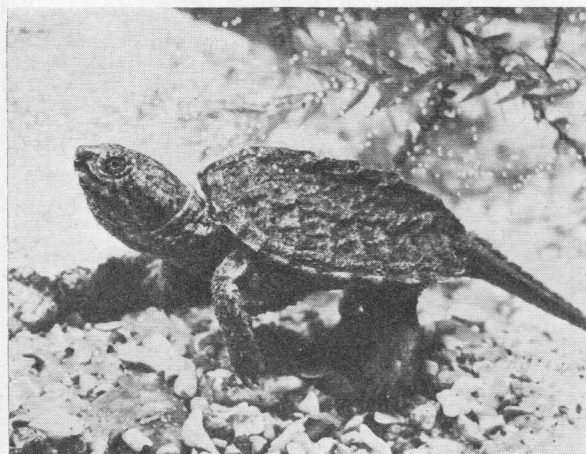
## Cacti in the Fish House

**D**O not prick out cactus seedlings too soon, as whilst the cotyledon, or food-bag, is still present the root is very fine and its junction with the plant is very delicate and easily broken. Wait until the food-bag is absorbed and then there should be a strong healthy root which can stand moving. The soil into which the seedlings are pricked out can be John Innes seed compost, as for seed sowing, plus 1½ ounces of hoof and horn grit and ¾ ounce of sulphate of potash, to each bushel.

# Snapper Terrapins



**S**NAPPER terrapins are abundant in North America from Canada to Florida and from the Rockies to the Eastern States. They are unusual among chelonians in that they do not rely on a strong protective shell for their defence but are actively aggressive animals—at least they appear so when disturbed. They possess large heads armed with sharp jaws, which, like the limbs and long tail, cannot be completely retracted within the shell. The carapace or upper shell is rough in baby specimens of both



Photographs on this page are of the common snappers (*Chelydra serpentina*)

by ROBERT BUSTARD, B.Sc.

*Photographs by the author*

species but more so in the alligator snapper, and the plastron is reduced. The common snapper (*Chelydra serpentina*) attains a weight of about 60 pounds but the alligator snapper (*Macrochelys temminckii*) is gigantic, and specimens of 200 pounds are on record. It ranks as one of the largest of the world's freshwater chelonians.

Snapper terrapins, on hatching, have a carapace length of scarcely 2 inches and specimens of this size are readily obtainable. They make most unusual aquarium inmates and have the advantage that they are really hardy and can be reared by the average amateur, unlike many of the beautifully marked but delicate 'painted' terrapins. In this connection the common snapper is much the hardier and hibernates regularly over much of its range. It has also been seen walking over the ice of frozen ponds and moving about below the ice. The alligator snapper is restricted to the south-eastern United States, especially the Mississippi drainage area, and as a result it is accustomed to warmer conditions.

In captivity they are very largely aquatic and I have always kept my specimens of both species in an aquarium with a small wooden raft, on to which they can climb when they wish to leave the water. Up to four baby specimens can be accommodated in a 24 in. by 12 in. by 12 in. aquarium, which should have a layer of compost and hardy plants such as *Elodea* that will survive a certain amount of rough treatment. In my experience even baby specimens are almost entirely carnivorous, so that plants

*Alligator snapper  
terrapins  
(Macrochelys  
temmincki)*

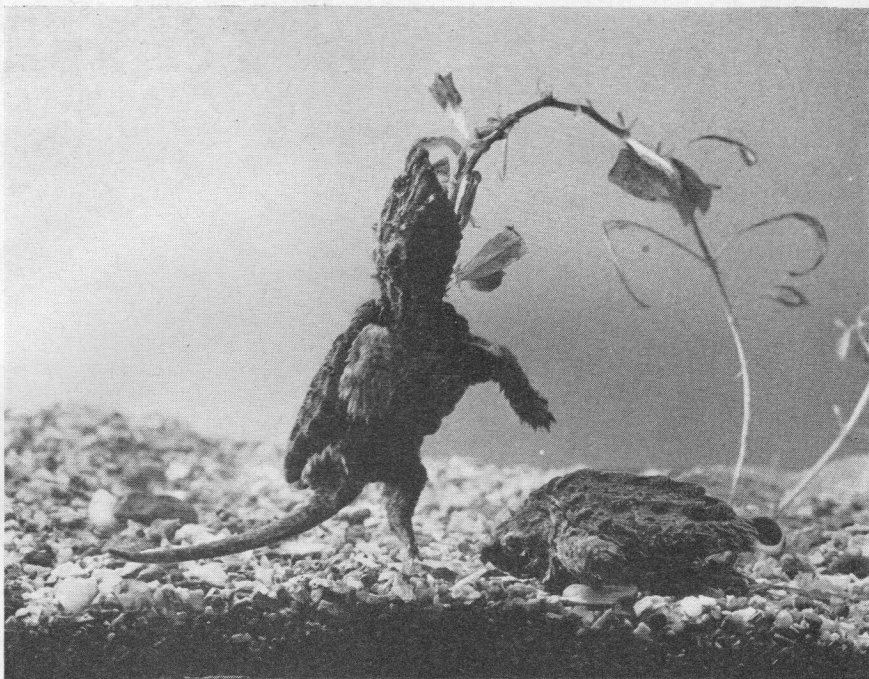
are unlikely to be eaten, but they will crawl through and over them. A water depth of 6 inches is adequate.

The amount of food required depends on the temperature at which they are kept. It is perhaps safest not to hibernate hatchlings but 2-year-old specimens of the common snapper can certainly be hibernated in a cool out-house provided that their tank cannot become frozen solid. Before hibernation they must be well fed so that they can build up fat reserves for the winter, and specimens that are not in excellent condition should never be allowed to hibernate. This applies to all species of reptiles and amphibians.

During the active season they may be fed on live food such as earthworms or tadpoles or on strips of raw meat or fish. My specimens were fed almost exclusively on earthworms because these are the cleanest food to give. Strips of raw meat tend to flake in the water and this flaking is even more pronounced with fish. Such fragments decay and foul the water. The frequency of cleaning out the tank will depend on temperature and feeding. If they are kept really warm they will be more active, require more food and will foul the water more quickly. They will also grow more rapidly. Taking these factors into consideration I have kept my alligator snapper terrapins active throughout the year at temperatures of approximately 60-68°F (15-20°C). The common snappers have lived at room temperature (50-60°F; 10-15°C) and all but hatchlings have been hibernated during the winter.

Snapper terrapins are thought of as large and sluggish. While this is true for large specimens it is not the case with hatchlings, as the accompanying photographs show. My specimens have always been quite active, especially when they were fed, which was done on alternate days. Certainly most of the time they rest on or walk about the bottom although they can swim freely when they so desire. The long tail is most conspicuous in baby specimens, and the carapace of baby common snappers is wrinkled whereas the alligator snapper's carapace has three strong keels, which persist even in large specimens.

At room temperature growth is slow and the juvenile antics will persist for some time. Indeed the collector will be able to house his specimens for many years, as when they grow they become less active and consequently require less space. The only precaution is that these terrapins should be kept away from other species that they might attack. Both the common and alligator snappers can be housed together, however, at about 60°F (15°C). The price of baby specimens is likely to be about 10s. to 15s. each.



## BRITISH AQUARISTS' FESTIVAL 16th - 17th NOVEMBER, 1963

Belle Vue Zoological Gardens, Manchester

### TRADE STANDS

It is requested that enquiries regarding Trade Stands should be made to Mr. Geo. W. Cooke, "Spring Grove", Fieldhill, Batley, Yorks., and not to Mr. C. Graham, who has now retired.

### NOTICE TO SECRETARIES

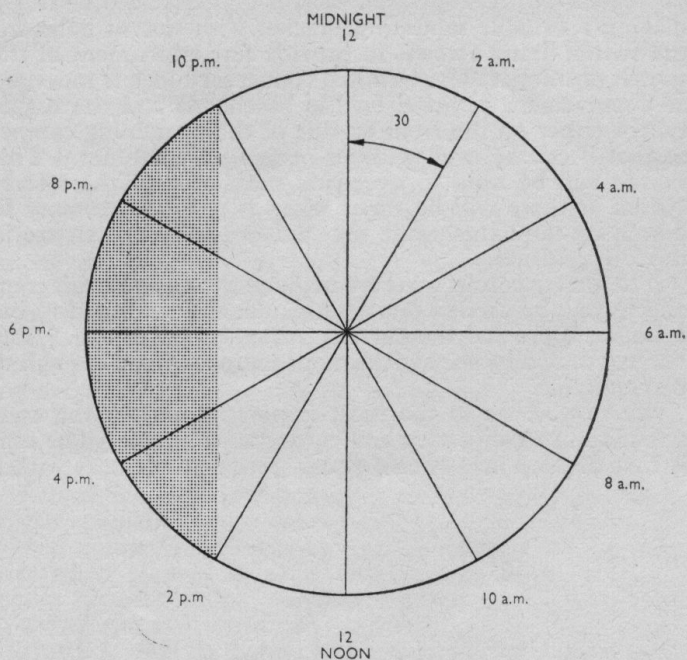
Society Show Secretaries are recommended to organise preliminary competitions among their members for the honour of presentation at this Festival, and Societies may decide to make their own awards based on the Festival Judges' decisions.

The 1963 British Aquarists' Festival has been designed to encourage the individual aquarist who is a member of a Society not only to benefit himself but also to bring prestige to the Society whose exhibit he is supporting.

# Fan-footed and

protractor and these are numbered from 2 to 24 hours in steps of 2 hours around the circumference of the cam and in a direction corresponding to the direction of rotation of the motor spindle. A straight line is then drawn across the cam from the time when the lamps are to be switched on to the time when they are to be switched off (e.g. from 2 p.m. to 10 p.m.). This portion of the cam is then cut away and the resulting shape of the cam will then be the means of activating the microswitch. This is effected by the cam rotating until the start of the cutaway section reaches the microswitch leaf, which is then released from the depressed position with the result that the aquarium lamps are switched on, and are left on until the cam rotates enough to bring the end of the cutaway section past the microswitch leaf, which will then be depressed and will switch the lamps off again.

It should be noted that to obtain this action the wiring connections to the microswitch must be made to the terminals marked 'common' and 'normally closed'. If the 'normally open' terminal is used the reversed action will be obtained, that is, the lights will be off when they should be on and on when they should be off.



Calibration of the cam, the shaded area showing the part to be cut off

The corners formed by cutting the cam should be rounded off smoothly and the whole of the edge of the cam should be smoothed to minimise wear on the microswitch leaf. The cam can then be fitted on to the motor drive spindle and rotated until the correct time calibration is in contact with the microswitch leaf. All that remains then is to switch on and the switch will then function automatically.

Variations in the shape of the cam can provide many uses for this type of switch. With a little experimenting it can be made to control the supply pressure in the capacity chamber of an aeration system, by switching on and off the pump at preset intervals, or the room temperature achieved by a simple electrical space heating system, to name just two applications that may interest the aquarist. With suitable auxiliary apparatus it can also, of course, provide a means of raising the aquarist from his bed in the early hours of the morning to feed his beloved fishes, before setting off for his day's work.

THE family Geckonidae, the geckos, includes several hundred species of lizards, many of which are very different in appearance. The two species which form the subject of this article are specialised for totally different modes of life: the fan-footed gecko is beautifully adapted for life on ceiling and walls and can scale a vertical sheet of glass with ease; the eyed gecko, on the other hand, is a poor climber and hides under stones on the ground. Both are equally interesting to keep and do not require a large vivarium.

The fan-footed gecko (*Ptyodactylus hasselquistii*) measures about 5 inches in total length and is a khaki-brown colour above, white below. There are darker and lighter coloured blotches on the back and limbs which help to camouflage it. This gecko inhabits the eastern Mediterranean, and the specimens shown in the photographs were caught near Jerusalem, Israel.

The vivarium for these extremely active climbing lizards must be escape-proof, and I make it a rule never to open the lid when the light bulb is on and the temperature is high. I provide food and fresh water before switching on the light in the morning, when the temperature is about 60°F (15°C). Even at this temperature they are capable of quite rapid dashes. It is most important to guard against an escape as should this occur recapture is extremely difficult. In addition, they can squeeze into the tiniest crevices, from which it is almost impossible to extract them without injury.

I had personal experience of this some years ago, when a friend who was looking after my collection while I was on holiday, allowed about a dozen *Hemidactylus brooki* to escape. Brook's geckos are excellent climbers and on my return he had only recaptured a couple of specimens. I recaptured all but one over a period of 3 weeks, and thereafter gecko eggs were found in the strangest places. One annoying trait was that two specimens used to actually rest on the outside of their vivarium and would allow me to approach to within about 2 yards before disappearing quicker than the eye could follow.

At the present time I have three fine specimens of the fan-footed gecko living in a 20 in. by 20 in. by 20 in. vivarium, which they share with an eyed skink (*Chalcides ocellatus*), also from Israel. The vivarium has 3 inches of sand on the floor, into which the skink burrows, and some rocks at the back which provide hiding places for the geckos. Both feed out of a small dish sunk into the sand and drink out of another nearby container.

Most geckos are nocturnal, as a glance at their large eyes with vertical split pupils shows, but the fan-footed gecko likes to bask in the sun and my specimens enjoy the warmth from the light bulb for most of the day. The day temperature is about 80°F (27°C).

Mealworms are always present in the dish sunk into the sand and form the basic item of food, but flies, blue-bottles and moths are introduced frequently to provide variety. The geckos are certainly easy to keep and my three specimens have almost doubled their weight since arrival. The fan-footed geckos are gregarious but it is inadvisable to keep more than one male in a small vivarium. An Israeli friend, Dr. Werner, tells me that if two or more males are kept together one will 'lord' it over the others, who will go off their food and slowly decline until they eventually die.

It is most important when purchasing these lizards to check the sex carefully. I have two females and one male. The male is easily distinguished by the swelling at the base

# Eyed Geckos

by ROBERT BUSTARD, B.Sc.

*Photographs*

*by*

*the author*



*Fan-footed gecko (Ptyodactylus hasselquistii guttatus)*

of the tail, which is most obvious when compared with a female specimen, in which the swelling is absent. Geckos must be handled with extreme care, as many species have thin skins that are easily damaged. In addition, their brittle tails are easily shed. Both my female specimens have regrown tails, and when I was lifting out the smaller one to photograph her I accidentally touched her tail (touched, not grabbed) and it was shed. Tail fracture takes place at special junctions between vertebrae and contraction prevents bleeding.

The fan-footed gecko, so-called owing to its greatly dilated digital pads, is an excellent species to keep. Young specimens, however, should be housed separately, as the adults might eat them.

The eyed gecko (*Pachydactylus geitje*) is a native of South Africa, where it is common in parts of the Cape peninsula and adjacent Robben Island. It is a small species, measuring about  $3\frac{1}{2}$  inches in total length, and its brown body is marked with pale and dark spots and has a sheen like satin. It has a fat tail, which possibly acts as a food store, and its large dark eyes give it a most appealing look. The manner in which it curls and stretches is decidedly cat-like. This attractive little ground-dwelling gecko likes moist (not wet) surroundings and the vivarium floor should be covered with garden soil and have growing moss and stones under

*Continued overpage*



*Eyed gecko (Pachydactylus geitje) with one of the two eggs that were laid and which hatched after incubation at vivarium temperature for about 4 months*

# Some Experiences with White-Spot Disease

by B. J. TARRY

**M**AYBE I am not the ideal aquarist, but I do pride myself on knowing how to look after my fishes, and for 10 years managed to steer clear of white-spot disease without once putting new fishes into a quarantine tank.

But, the inevitable happened, and about 3 weeks after purchasing some fish, I noticed the tell-tale spots on many of the inmates of my tank. I remembered the excellent series on the disease by Dr. F. N. Ghadially in the February, March and April, 1956, issues of *The Aquarist*, and after re-reading the series I decided to try treatment with methylene blue.

## Methylene Blue Treatment

With only one tank, the treatment had to be *in situ*, so I removed every plant and dosed as prescribed (15 milligrams per gallon), adding more as the colour faded. I raised the tank temperature to 82°F (28°C); no aeration was used, and the whole outbreak was cleared in a fortnight. The only fishes to die during or shortly after treatment were the very old ones, and most certainly death was not due to the drug. That was 3 years ago.

Quite recently, and not having learnt my lesson, I had a further outbreak. This time I decided to leave at least two plants of each variety I had in the tank, to leave the tank temperature at its normal setting (76°F; 25°C), to use aeration via a bottom filter and, using the drug as before, to make a careful study of results. My tank size is 36 in. by 15 in. by 12 in., the water is very hard and its reaction was pH 6.8, the latter reading being obtained by the addition of peat water to the tank.

Under these conditions the drug completely cleared the tank of disease, but, owing to the low temperature, a month was necessary as compared with a fortnight at 82°F (28°C). However, even the old fishes survived this time, and personally I found it far easier to leave the thermostat alone, particularly as it was an internal fitting type. Constant re-setting of this type involves repeated removal of the rubber bung, and hence weakening of its sealing qualities.

Even at normal tank temperature all fishes ate well throughout the time of treatment, but it was the effect of the drug on the plants that was surprising. Overhead

lighting was used as usual, and the bottom filter was left on for very long periods to ensure as thorough a circulation of the methylene blue as possible, even to the roots of the plants.

## Effects on Plants

Water wisteria was not affected in any way, and grew normally, as did anacharis (*Elodea canadensis*), the latter as a rooted plant and floating. *Hygrophila polysperma* also came out of the test apparently unscathed, but growth was retarded (a blessing in a way as this plant usually needed very frequent pruning).

The two species of *Cryptocoryne*, *C. willissii* and *C. griffithii*, both fared badly. Huge holes appeared in the leaves quite quickly, and further tests in very dilute solutions also caused holing of the foliage. But on return to normal conditions all the plants recovered. *Ludwigia* growth was severely retarded, and afterwards it took a very long time to send out new shoots. *Vallisneria spiralis* was completely shattered by the drug. Leaves dropped within a day or so, and within a week the plants had rotted down to the crowns. However, examination of the roots showed that they were living, but even now, 3 months after conditions were back to normal, fresh growth is only just commencing.

After eradication of the white spot, the tank was half emptied and topped up with fresh water, the process being repeated at weekly intervals until only a very slight blue coloration was noticeable. This was then allowed to clear naturally. The time taken from adding the methylene blue until the final disappearance of the colour was 8 weeks.

## Conclusions

Several conclusions can, I think, be drawn from even this simple experiment.

- (1) That raising the tank temperature does decrease the time taken for the drug to clear all traces of white spot.
- (2) That most species of water plants are affected by methylene blue.
- (3) That prolonged exposure to high concentrations of the drug has no serious effect on the fishes. In fact, quite the reverse: my fishes looked far healthier afterwards.

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## Fan-footed and Eyed Geckos

*continued from the preceding page*

which they can hide. From time to time the vivarium should be sprayed to keep it moist. The floor area need not be greater than 20 in. by 20 in. as they are not very active.

In captivity eyed geckos become very tame and trusting and can be handled quite easily. They bask in the sun or when the light bulb is on, on stones or moss, and are best fed on winged insects such as flies or bluebottles or small beetles. My specimens did not like gentles.

It is perfectly possible to breed eyed geckos in a vivarium of the size mentioned. The females lay eggs of a comparatively large size, as is shown in the photograph. It

is possible that sometimes one egg instead of the usual two may be laid. My specimens deposited their eggs in November and those that I was successful in hatching hatched after 4 months at a vivarium temperature of 75°F (24°C; day) and 60°F (15°C) at night. During incubation, the eggs, although they have calcareous shells like hen's eggs, required to be moistened every few days. Those which were not moistened failed to hatch and dead embryos were found inside. The eggs were placed in a small box in the gecko vivarium containing 1 inch of sand topped with moss and were placed in depressions in the moss. The hatchlings were fed on fruit flies (*Drosophila*). They measure about an inch at birth and are perfect replicas of their parents.

The cost of the geckos described in this article is likely to be about 15s. to 20s. each.

# Lizards Becoming Snakes?

by ROBERT BUSTARD, B.Sc.



Eyed sand skink, a species that does well in the vivarium

SNAKES and lizards belong to the same order of reptiles—the Squamata. Snakes are placed in the sub-order Serpentes and lizards in the sub-order Lacertilia. It is common knowledge that snakes once possessed limbs and, indeed, vestiges of these have been retained and modified as mating spurs in pythons and boa constrictors. One cannot, however, distinguish lizards from snakes by the presence or absence of legs as, although no snakes now possess well-developed legs, many lizards also lack these. Legless lizards still retain many lizard-like features; the shape of the head, for example, is lizard-like and the eyes usually have well-developed lids, absent in all snakes. The evolutionary path of these animals need not concern us further, although it is in itself fascinating, but many of these lizard species which are either legless or have poorly developed limbs make interesting vivarium specimens.

The slow-worm (*Anguis fragilis*), which occurs in Britain, is an example of a completely legless lizard, as are its relatives the glass "snakes" of Europe and America (*Ophisaurus apodus* and *O. ventralis*). As well as these popular examples there are many others which combine fascinating habits with hardness in the vivarium. Although many of these are members of the skink family, degenerates are found in a great number of lizard families.

## Eyed Sand Skink

The skink genus *Chalcides* shows a progression from well-formed limbs to an almost legless condition. The eyed sand skink (*Chalcides ocellatus*) possesses good limbs although they are small in comparison with the 6 inch animal. This skink does exceptionally well in the vivarium, where its requirements are modest. No special hiding places are necessary, as at night or when alarmed the eyed skink "swims" into the sand, completely disappearing in a few seconds. My specimens live in a 24 in. by 18 in. by

Photographs by  
the author

18 in. vivarium with 4 inches of coarse sand. Coarse sand is preferable as, although they possess a transparent lower eyelid and modifications of the ear opening to prevent sand entering, very fine sand can be a problem particularly to breathing—it makes them sneeze. The eyed skink likes a warm day temperature (77-86°F; 25-30°C), but at night 50°F (10°C) is suitable. A small dish of water must always be present and I keep another small dish supplied with mealworms or gentles. In addition to these, bluebottles are supplied from time to time.

## Three-toed Sand Skink

The three-toed sand skink (*Chalcides tridactylus*) from Mediterranean regions is frequently kept in this country. It can be described as a slow-worm with tiny limbs, the forelimbs scarcely an inch below the ear and the tiny hind limbs just in front of the tail base. Its total length is about a foot, of which considerably more than half is accounted for by the elongated body. The vivarium for these lizards should have facilities for climbing if they are to be seen to advantage, and this applies also to *Tetradactylus* and *Chamaesaura* described below. All are suitable for a vivarium similar in size to that for the eyed sand skink.

The vivarium, which should have a peat-sand or soil floor, is best provided with branches, moss and even some small climbing plants or young orange trees. A temperature of 77°F (25°C) during the day is suitable for all three. A water dish must always be present and food can be selected from among the following: spiders, flies and bluebottles, maggots, mealworms and beetles.

## Plated Lizard

The short-legged plated lizard (*Tetradactylus seps*), which attains a total length of about 7 inches and is a dark bronze colour, possesses a long tail and well-developed limbs. The similarly coloured whip lizard (*Tetradactylus tetradactylus*) has much smaller limbs and a proportionately longer tail, which accounts for 12 of its 15 inches. Both of these lizards travel rapidly through grass by a writhing movement of the body and tail, during which the legs are folded back against the body. In the vivarium their antics in catching food are delightful to watch. Both species will soon take bluebottles from the fingers and these are just within the maximum size of food that can be swallowed, and then only after considerable chewing. The sinuous movements of the whip lizard and the way in which the tiny forelimbs are vibrated when it is excited make it a most interesting species to watch. *Tetradactylus* alone of the three genera lays eggs. The eggs are decidedly oblong in *T. tetradactylus* and each specimen lays two eggs. The



specimens of *Tetradactylus* which I have kept have always had a slightly damp vivarium. This is easily maintained by spraying the moss every few days. These lizards are natives of South Africa.

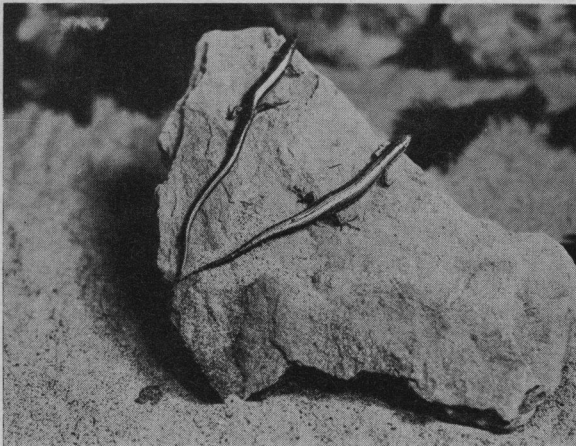
The anguine lizard (*Chamaesaura anguina*) is also from Southern Africa, although very similar forms occur in East Africa where the author has obtained them. This lizard has keeled scales and the tail accounts for more than three-quarters of the total length of 20 inches. The limbs are very much reduced, as can be seen in the photograph, and considerable patience was required to pose the specimen with the minute pale coloured forelimbs extended over the dark body region so that they would be visible. The anguine lizard, which belongs to the zonure family (Cordylidae), is, like the whip lizards, particularly partial to bluebottles, and is an excellent climber.

### Silver Sand Lizard

The last two species, like the first two described in detail, belong to the Scincidae. They inhabit South Africa. The silver sand lizard (*Scelotes bipes*), which is an attractive silvery pink colour with dark spots, possesses only two limbs, the front limbs being absent. It measures about 5 inches in total length and lives mainly underground, feeding



Silver sand lizard, a species with only one (hind) pair of legs



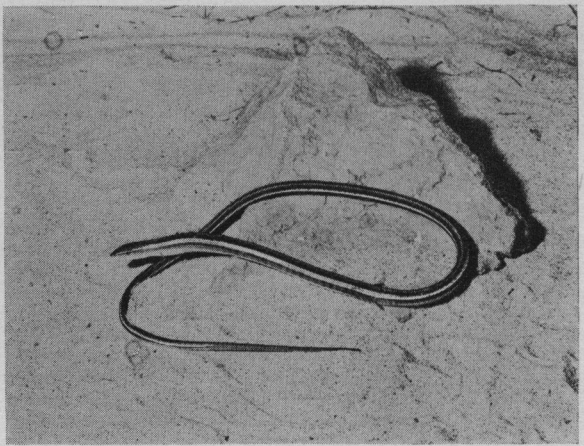
Short-legged plated lizard

on worms and slugs. The speed with which it can disappear into dry sand is fantastic. The virtually non-functional hindlimbs can be seen in the photograph.

The golden sand lizard (*Acontias meleagris*) has no external limbs and X-ray examination has shown that no internal rudiments exist. This 10 inch lizard possesses a tail of only 2 inches, and the head has a hard pointed snout for pushing its way through hard soil. The golden-amber coloration with black markings in the form of small spots is decidedly attractive. Food, as for the silver sand lizard, is worms and slugs, and both these lizards are viviparous.

South Africa is very rich in these degenerate forms and gradations occur in some of the genera mentioned above. Those interested should read the chapter "Lapsed Limbs" in Dr. Walter Rose's excellent book *The Reptiles and Amphibians of Southern Africa*, which was recently reviewed in these columns.

The price of the species recommended in this article is likely to vary from 7s. 6d. to 15s. for *Chalcides* species to about 30s. for some of the others.



The anguine lizard possesses tiny limbs, the forelimbs being smaller than the hind ones

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## The Es-Es Story

IN a newly published 16 page booklet describing aquarium products currently manufactured by their firm, Singleton Bros. (Electronics) Ltd. recall how difficult things were for the tropical fish-keeper 30 years ago. The Es-Es was the first aquarium heater to be made to the now-familiar glass-tube design, and to-day a number of other accessories for the aquarist are marketed under the Es-Es trademark. As well as descriptions of these items, the booklet contains a page 'For the Beginner,' notes on raising water fleas for fish feeding and information about aquarium heating in relation to tank capacity and room temperature. *Es-Es Aquarium Products* is obtainable from Singleton Bros. (Electronics) Ltd., 53, Victoria Street, London, S.W.1. for the price of postage only (sixpence).

drops of tube liquid fry food hours each day, and by the time the fry were free-swimming, the aquarium water was very cloudy and full of minute Infusoria. After about 4 to 5 days I found that there were about 30 free-swimming fry, but they were not all perfect specimens by far. After about 2 weeks I had lost them all.

Realising that the fish had died of starvation, although I had given them enough food in the early stages of life, I started all over again but with one big difference, which I feel is the secret of breeding egg-layers: I lowered the level of the water in the tank to exactly 6 in. from the bottom and then followed the same procedure as before except that I introduced the fry food into the tank as soon as the eggs were noticed in the nylon wool and gravel. This time the

spawning was larger and the parents could not get so many of the eggs on the bottom, owing to the new depth of the water in the tank and the white nylon wool, which, I feel sure, acted as camouflage!

I hardly lost a fish, and as I write this I am sitting by the side of my aquarium, which contains 70 nigger barbs about  $\frac{3}{4}$  in. long and which are just over 6 weeks old.

Naturally, artificial aeration has been introduced into the tank and the fish are now being fed on chopped *Tubifex* and dry food instead of micro worms and tube liquid food.

A shoal of these very beautiful barbs is a wonderful sight and I advise any amateur aquarist to try breeding them as I have already found there is a great demand for them on the wholesale market!

## Book Review

*Reptiles of Australia* by Eric Worrell. 207 pages, plus 60 pages of illustrations (many in colour). Angus & Robertson. 55s.

A NECESSARY preface to a review of this book is the clear statement that whatever its merits it is the first book to attempt to encompass Australian reptiles. Literature on Australian reptiles has been sparse and scattered, *Reptiles of South Australia* (1929) by Waite being the only authoritative text (I am at present resident in Australia and engaged in research on Australian reptiles). *Reptiles of Australia* claims to describe all Australian species and this it fails to do. It is like a dictionary, with illustrations, which is incomplete and contains careless errors; it reads more like the notes for a book than the book itself. Only briefest mentions of distribution, description and habits are given. For instance, of the 44 species and sub-species of geckos described eight species receive only a two or three line mention and the average space devoted to each of the 44 is only five lines. Readers accustomed to modern herpetological works like the American Handbooks of Natural History, Dr. Walter Rose's *Reptiles and Amphibians of Southern Africa* and the late Dr. Malcolm Smith's *British Amphibians and Reptiles* will be most disappointed with this book.

While it is true that Australian herpetology is still in its infancy the most serious indictment that can be made against the author is that he has totally failed to make use of the published literature on Australian reptiles. In a subject bristling with problems, it points to none! The photographs are likewise disappointing. Many are too small to distinguish any specific features or are of museum specimens in a poor state of preservation. The colour rendering of the colour plates is likewise in some instances very poor. Typical of the careless errors is the black and white full page plate opposite page 64, labelled Boyd's forest dragon, *Goniocephalus boydii*, and three pages later the same animal is shown in colour and labelled *G. spinipes* and the correct *G. spinipes* is labelled *G. boydii*. Errors of this sort greatly detract from the value of both text and illustrations. In my opinion Mr. Worrell has been responsible for much confusion by needlessly changing the nomenclature of many snakes. However, until critical reviews of this work are published this facet must be accepted, as all his name changes have been substantiated in his previous publications.

*Reptiles of Australia* serves some usefulness by the mere accumulation of information for those casually interested in knowing a little about Australian reptiles. However, we must still await the definitive work on these animals.

ROBERT BUSTARD

## Fin-Rot in a Wild-caught Specimen of *Corydoras paleatus*

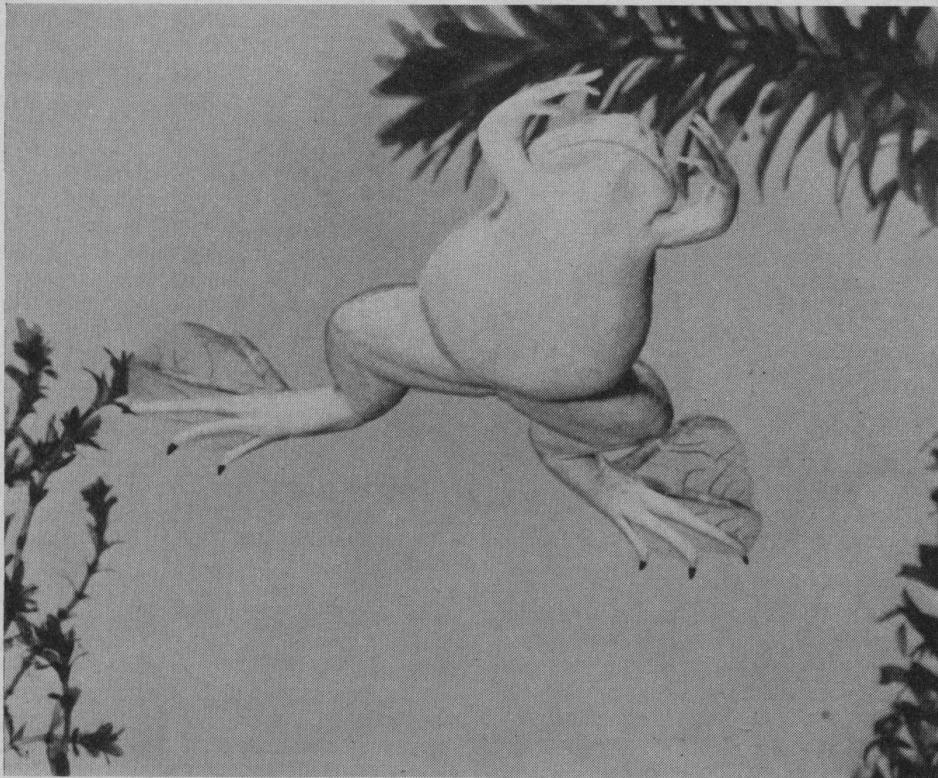
by Dr. D. A. CONROY

IN an earlier paper (Conroy, 1962) I described the occurrence of an interesting diseased condition in the South American armoured catfish, *Corydoras paleatus*. This condition was characterised by the presence of small haemorrhagic petechiae on the lateral body surface, and was thought to have been caused by bacteria.

Since the publication of the above description, it has been possible to observe a further disease in the same species of fish. With the object of studying the indigenous species of fish, a visit was made during the spring (October-November) of 1963 to the 'arroyo Lobería', a small stream in the vicinity of Miramar, Province of Buenos Aires (Argentina). As a result of this expedition, some three or four specimens of *Corydoras paleatus* were captured, all of which showed typical symptoms of bacterial fin-rot. The soft inter-ray tissues were destroyed, and in two fish the fin rays were markedly fragmented and rotted. Of particular interest is the fact that all of the fins were affected to a greater or lesser degree, a somewhat unusual state of affairs since the disease generally attacks either the caudal fin alone (tail-rot) or the unpaired dorsal and ventral fins. The 'arroyo Lobería' is a small slow-moving stream containing an abundance of silt and mud in suspension, and it supports a profuse growth of algae (Chlorophyceae) and other aquatic vegetation. The water level was observed to be abnormally low for the season of year, and it is thought possible that this influenced the occurrence of the case described. It is to be regretted that the lack of suitable equipment in the field did not allow of a full bacteriological examination, but the finding is nevertheless considered to be of interest as it shows that *C. paleatus* may suffer from common diseases such as bacterial fin-rot under natural conditions. This is of some importance when it is remembered that the group as a whole is held to be highly resistant to this type of disease.

Conroy, D. A. (1962): A diseased condition in *Corydoras paleatus*, *The Aquarist*, 27 (8), p. 156.

# South African Clawed Toads



Underneath view of the common clawed toad (*Xenopus laevis*)  
in the swimming position

by ROBERT BUSTARD, B.Sc.

*Photographs by the author*

CLAWED toads are highly specialised for an aquatic life and are one of the few amphibians that in the author's experience possess a personality. They certainly show most amusing antics and will come to the front of their aquarium at feeding times and go through the notions of stuffing food into their mouths. Almost certainly it lies in the eye of the beholder, but they do have a most appealing look at such times!

The common species is called *Xenopus laevis* from *xenopus*, meaning strange foot, and *laevis*, smooth. These names are well deserved, as three inner toes of the feet are clawed. They are said to be used to tear up items of food which are too large to be ingested whole, and this can be seen in the aquarium if a largish piece of raw meat is fed to a hungry specimen. Anyone who tries to hold a live wriggling specimen in their hands will certainly agree with the specific name as they are extremely slippery and most difficult to hold.

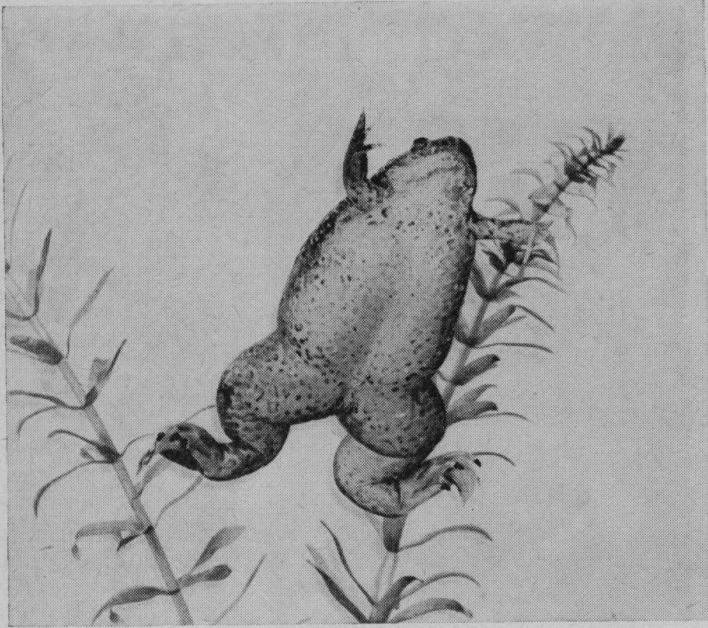
Another feature peculiar to the sub-Order to which these toads belong is that they lack a tongue. Most frogs and toads capture food on their sticky tongue but such an organ would be useless under water. *Xenopus* catches its food with its hands, which have four elongated sensitive fingers (the hind feet possess five toes). Larger items of food, such as earthworms, are crammed into the mouth with the fingers and the way in which the fingers can sift the mud to find food has to be seen to be believed.

The toads of the genus *Xenopus* occur in tropical and South Africa and have been sent to all parts of the world, where they had an important use in pregnancy tests. However, *Xenopus* is no longer required for this purpose. They can be induced to breed artificially by injecting the females with hormones, which causes them to spawn in a few hours' time. Males seem instinctively to know when a female is about to spawn and enter into amplexus with her to fertilise the eggs as they are laid. It is unlikely that the collector will breed this species, however, as they do not readily breed naturally in captivity.

Clawed toads are hardy and live happily for many years at room temperature: 60-65°F (15-18°C). At temperatures of about 46°F (8°C) they become torpid and the temperature should not exceed 85°F (30°C). They require very little attention, and the water does not require to be changed so frequently if they are kept at room temperature and fed on earthworms rather than on strips of meat or fish, which tend to flake in the water.

A 24 in. by 12 in. by 12 in. aquarium is suitable for a pair of adults or several smaller ones. Personally I always keep mine in a deeper tank (15 to 18 in.) because they are such beautiful swimmers. The hind feet are very fully webbed, as can be seen in the photographs.

Clawed toads are not very kind to aquatic plants, which will receive quite a battering in their presence, and therefore hardy types should be chosen, such as *Elodea*. In diet they



Gill's clawed toad (*Xenopus gilli*)

are strictly carnivorous and will eat any aquatic animals. In captivity, earthworms are the most suitable diet but raw meat or fish can be cut into strips and will be eagerly accepted. In laboratories they are often fed exclusively on liver. Feeding presents quite a problem to the kindly

collector as usually his clawed toads are grossly overfed, which is not a kind thing to do. They have enormous appetites and seldom turn down food, so that unless they are given very small amounts at one time, it is best to feed them only twice a week. In nature clawed toads are popular because they eat countless millions of mosquito larvae.

In 1926 Dr. Walter Rose, whose excellent book, *The Reptiles and Amphibians of Southern Africa*, was recently reviewed in *The Aquarist*, discovered another species of *Xenopus* in the Cape which he called *Xenopus gilli*. The common species grows to a snout-vent length of about 5 in. in the female, which is considerably larger than the male. *X.laevis* has an unmarked ventral region, whereas in *X.gilli* the ventral region is yellow-orange marbled with brown. Gill's clawed toad is also much smaller—2 in. In the opinion of Dr. Rose, *Xenopus laevis*, the larger, more cannibalistic and more essentially aquatic species, is slowly replacing the smaller more retiring *X.gilli*. If when out of the water *X.gilli* is touched on the nose, instead of jumping backwards like *X.laevis* it more often cringes its head down between its forelimbs.

Clawed toads have considerable powers of colour change which results in their matching their surroundings, and for this reason it is difficult to describe their dorsal coloration in detail. It varies from pale yellow brown, almost unmarked, through olive brown with darker markings to near black.

Clawed toads are certainly very unusual amphibians. The manner in which they use their forelimbs as hands, together with the eyes which are placed conspicuously on top of the head, gives them a 'character' of their own. Both species live well in aquaria in Britain, where they cost 7s. 6d.—15s. each.

## Zebras of Good Quality

*continued from page 186*

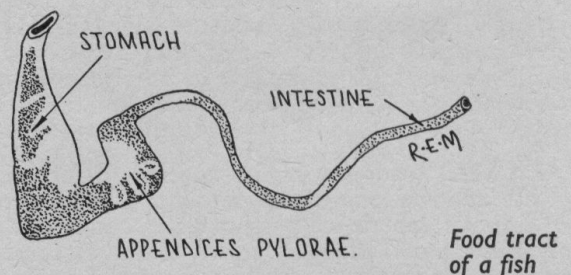
into a clean white handkerchief and then gently wash under a running tap to remove the salt from their bodies as much as possible. Try not to put eggshells and dead shrimp into the tank. The first feeding with brine shrimp should be small and the fry should be watched to ensure that the shrimp is being taken. When changing from one food to another larger one always feed the two foods together for a day or two so that the smaller fish in the spawning can continue to feed.

After brine shrimp the fry will progress to fine *Daphnia*, Grindal worm, large *Daphnia*, white worm and chopped earthworm, as they increase in size. Suitable sized dry foods can also be used, but the main part of the diet should be live, meaty foods, as much as possible.

Any deformed or stunted fish should be removed and, at about a fortnight or 3 weeks old, the fishes should be moved to a larger tank for raising to full size. Take care during this operation that the tank temperatures are identical and that the water in the two tanks is not vastly different in character.

Many aquarists spawn zebras and similar fishes communally. This requires a larger tank, of course, but otherwise the principles involved are the same. A ratio of six males to four females should prove suitable. One possible point to watch with this method is that if some of the fish finish spawning before the others and start seriously eating eggs then they will have to be removed from the tank, and this will probably disturb the other fish, which are still spawning, and make it necessary to remove them all.

## Fish Enteritis



WHEN any part of a fish's alimentary (food) tract becomes inflamed after the fish has been fed with a food containing an excessive quantity of an adverse substance (e.g. salt), or when the inflammation is caused by the fish eating decaying food, extra mucus is formed in the tract and symptoms of the complaint known as catarrh or enteritis develop. The inflammation generally occurs either in the intestine or the stomach of a fish.

This disease causes the fish to appear languid and show a complete loss of appetite. The excreta becomes yellowish and slimy and in the more advanced cases affecting the intestine, the excreta will probably include blood.

In all cases the fish should be subjected to an immediate fast lasting for about 5 days. When blood is present in the excreta, the fasting period should last as long as the excrement remains abnormal, even if this necessitates the fish being without food for a number of weeks. When the fast is over the fish may be fed (sparingly at first) with a new varied diet but definitely not with the food given before the illness began.

*R. E. Macdonald*

# Our Readers WRITE

## A Show Mourned

MAY I, as one of the oldest practising aquarists in the country, refer to (and I think most of the 'old hands' will agree with me) what I believe to be the greatest tragedy of our hobby, that the "National" as it was affectionately called, is no longer with us. The National Aquarists Society Show, which was held annually in June at the Royal Horticultural Society's Hall in London, was attended by thousands of aquarists every year, and no wonder in view of the fact that there was something like 1,200 tanks on view.

Most of you will wonder how it was that such an annual event was allowed to fade out. One realises, of course, that such an event is an expensive business to stage and I am going to suggest how one of the most expensive items—the provision of the hundreds of tanks required—can be met. It is, quite simply, to ask exhibitors to provide their own tanks. This may sound fantastic, but I should say that 75 per cent of the exhibits were shown in 8 in. by 6 in. tanks; any aquarist should be able to visualise a carrying case that would accommodate such a tank. This would enable the exhibitor to provide his own water with all the advantages that would provide, and obviate the necessity of filling by the working committee.

This I maintain would solve the greatest problem that faces the organisers of an aquatic show: the transport to and from the Hall and the provision and filling of a vast number of tanks. It is true that the organisers would have to provide a certain number of tanks for individual and Club furnished aquaria, but I have a feeling that even

Address letters to The Editor, *The Aquarist*,  
The Butts, Half Acre, Brentford, Middlesex

these could be provided by exhibitors, certainly by the Clubs.

No doubt this letter will rouse some controversy but I ask all aquarists who feel that we should once again have a truly representative and National Exhibition to write to the Editor of *The Aquarist* (not to me please, my fan mail is of such proportions that it is one of my greatest problems) and say what your feelings are in this matter.

T. H. MARSHALL,  
Buckhurst Hill, Essex.

*Mr. Marshall's suggestion is an interesting and practical one, but the main drawback to the staging of a large show in London has surely been the lack of finance to meet the costs of hiring an exhibition hall. Readers' comments are (as always) welcome, however.*—EDITOR.

## Message of Thanks

I WOULD be grateful if you could find space for these few lines, as I would like to sincerely thank all those who have sent me messages of good cheer during my stays in hospital. Both series of operations were successful and as much as I would like to reply personally to all those who have written to me, I am not yet able to summon sufficient energy to do so. Perhaps your readers would kindly accept these sentiments from my wife and myself as well as our thanks for all the messages and good wishes which we have been fortunate to receive.

R. O. B. LIST,  
London, N.W.6.

## Questions of Herpetological interest

I have a large vivarium consisting of a fibre glass pool and approximately 3 sq. ft. of dry sand with some growing foliage. My problem is that it is occupied by two 18 month old red-eared terrapins and I would like to introduce some other occupants which would not attack or be eaten by the growing terrapins. I had in mind the fan-footed or eyed geckos that you described in an article. Could you please suggest suitable alternatives, if any?

By far the best animals for your large vivarium would be those which would enjoy the large pool and so make the most of the facilities that you offer. Geckos are not suitable as none are aquatic. The following would, however, be ideal, a young iguana; the Australian water dragon (*Physignathus lesueurii*), which feeds well on raw meat, chopped banana and mealworms; the active, insectivorous water skinks (*Sphenomorphus quoyi*); a grass snake or other water snake; a young boa constrictor (2-3 ft. is a good size to obtain); the attractive box tortoises (especially *T. ornata*).

I have purchased a 24 in. by 15 in. by 12 in. aquarium which I intend using as a vivarium for keeping lizards. My query concerns the type of lizard which lives comfortably in a tank of this size. I want a species that is hardy and peaceful and can be induced to breed and, if possible, is lively and won't remain hidden for long periods and tames easily. I propose keeping the aquarium in my living room. What does one do about winter feeding? What are the best plants? Do you recommend top lighting?

In general I do not recommend aquariums as the clear glass all round fails to give many lizards a feeling of security.

answered by

ROBERT BUSTARD, B.Sc.

I recommend that you cover the back and sides of the aquarium. You could use suitable colour photographs from magazines of habitat scenery. The *Anolis* lizards fulfil your requirements but are arboreal and your tank is not tall. They would require a soil and moss covered floor and any climbing plants or ferns would be suitable. Alternatives better suited to your aquarium, would include the following (have myself bred all the lizards mentioned here in Scotland except the agamas): small skinks; zonures; fence lizards (*Sceloporus*); agamas. The skinks, zonures, agamas and fence lizards live well in fairly dry sandy surroundings with pieces of wood and flat stones as hiding places. The best plants are sturdy cacti, many of which do very well in these warm surroundings. I certainly recommend top lighting for about 10 hours daily. The temperature in the vivarium, which should have adequate ventilation, should be 75-85°F (24-30°C) during this time but 55-60°F (13-16°C) is satisfactory at night. During the winter most collectors rely on moths from moth traps and cultures of mealworms (*Tenebrio*) plus purchases of gentles (maggots). All the species suggested above will be active throughout the year with no ill-effects.

shrimp diet does not seem adequate, and guppies a few weeks old are appreciated. I have even seen one cleverly secured by a sea horse with its prehensile tail. The 70-odd year-old Fung Tak On (George Bing), doyen of Hong Kong aquarists, tells me that local sea horses are to be found near the famous Floating Restaurants of our Colony, in clusters of seaweed, and that this particular plant contains elements essential to the nourishment of the new-born babies.

As I stressed recently in an address to the members of our Chinese Y.M.C.A., Hong Kong offers a fruitful field for research into marine fishes' habits, and is in dire need of both a public aquarium and an aquarium society, neither of which exists at the moment.\* The only marine tanks seen in the Colony are in restaurants, where gourmets eye their prospective dinners. The unfortunate inmates, although provided with constant aeration, are usually overcrowded

and diseased, and may comprise such species as the goat-fishes and even the larger clowns, in addition to the ubiquitous grouper of local menus. Meanwhile this race of experts on freshwater tropicals and goldfish ignores the marines, dismissing them with a summary: "Very hard keep", and marine coral fishes remain perhaps the sole appurtenance of modern Western culture which are not actively imported and exported daily in this Far Eastern shoppers' paradise.

\* Since this article was written an aquarists' society has been formed in Hong Kong. This is the Hong Kong Aquarium Society, address c/o G.P.O. Box 14882, 17 Caine Road, Hong Kong, and in the Society's first report to The Aquarist it was stated that over 100 fishkeepers in the Colony had applied for membership. One estimate puts the total number interested in the hobby there at 3,000.

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## How to Culture Mealworms

by ROBERT BUSTARD, B.Sc.

I AM frequently asked by lizard collectors how to overcome the inevitable food shortages which occur from time to time, especially during the winter. Like most animals, lizards thrive best on a variety of food, but quantity is also important and it is valuable to have a standby food supply always on hand. Some collectors purchase gentles (maggots) and these are often not readily available during the winter and are relatively perishable. Often it is not possible to purchase small quantities suitable for the collector with only a few lizards. However, fly pupae will not hatch if kept cool and so one purchase can be made to last for several months. The gentles are allowed to pupate and the pupae are placed in a refrigerator at about 40°F (4°C). When flies are required a suitable quantity of pupae are removed and placed in the vivarium, where they will hatch in several days.

The other main standby, and for many lizards undoubtedly the most useful, are the larvae of the flour beetle (*Tenebrio molitor*), popularly known as mealworms. Mealworms can be purchased readily throughout the year but since they are expensive (if any quantities are used), and are very simple to breed, it is a good plan to keep several cultures on hand. The life cycle is fairly long, which means that it takes several months to get a culture to the stage where you can start cropping it, but once it reaches this stage mealworms will be available from it for many months. Ideally, several cultures should be set up at intervals of about 6 weeks and cropped in rotation. Activity will be increased (and the life cycle accordingly shortened) if they are kept warm; 77°F (25°C) is a good temperature. Large biscuit tins or other similar containers are suitable as culture containers and several handfuls of food mixture should be placed in the bottom, then a layer of sacking, then more mixture followed by another layer of sacking and more mixture. The best food mixture consists of pollard and bran (1:1, by volume) or alfalfa and bran (1:1, by volume). The containers are covered with lint or other material which will retain the insects but allow free ventilation. When a culture is set up, about 100 beetles or pupae or larvae should be added, the culture labelled and dated and put aside for some months. Naturally the cycle will be completed sooner if beetles are used to set up the culture. When beetles are present in cultures their fertility can be improved by feeding

them with raw carrot. Once a week I cut a carrot in half and drop it into each culture containing beetles.

Only the larvae or mealworms are useful as food. They are accepted as food by most lizards and the size can be selected to suit the lizard, which is a great advantage.

Mealworms are excellent food for all agamid lizards. With large lizards such as bearded dragons (*Amphibolurus barbatus*), which relish mealworms and will take 50 or more at a sitting, it is perhaps best to feed them on mice and other large prey unless large stock cultures are kept. For the smaller agamids, however, mealworms are excellent, varied with other food as available. These remarks apply equally well to iguanids. Perhaps it should be stated that the common iguana (*Iguana iguana*) is not strictly vegetarian as popularly thought, and relishes mealworms as well as raw meat in addition to the usual vegetable food. The zonures (*Cordylidae*) and the Anguidae (which includes the slow-worm, a slug- and worm-eater) as well as the popular American alligator lizards (*Gerrhonotus*) also relish mealworms. The Varanidae (monitors) largely prefer raw meat or larger prey but the many small species of insectivorous pygmy monitors common in parts of Australia, such as *Varanus acanthurus* which does well in the vivarium readily accept mealworms. The large families Teiidae and Scincidae together with the well-known members of the Lacertidae also contain many species which do well on mealworms.

Lizards like the green lizard (*Lacerta viridis*) have large appetites and if they are to be adequately fed without a great deal of expenditure of time or money it is essential to culture mealworms. Even those fascinating lizards the chameleons may often be induced to take mealworms. Some specimens of *Chamaeleo chamaeleon* will accept them, together with most specimens of *C. bitaeniatus bitaeniatus*, *C. bitaeniatus höhnelii* and *Microsaura pumila*. Although many geckos, like chameleons, tend to feed on winged insects the majority will also take mealworms. I maintain a research collection of several hundred geckos in Australia on a basic diet of mealworms, maggots and flies. Mealworms are also acceptable to many frogs and toads, some insectivorous snakes and many insectivorous mammals and birds.

Now is the time to set up cultures if they are to be ready for use next winter.

# My Elegant Terrapins

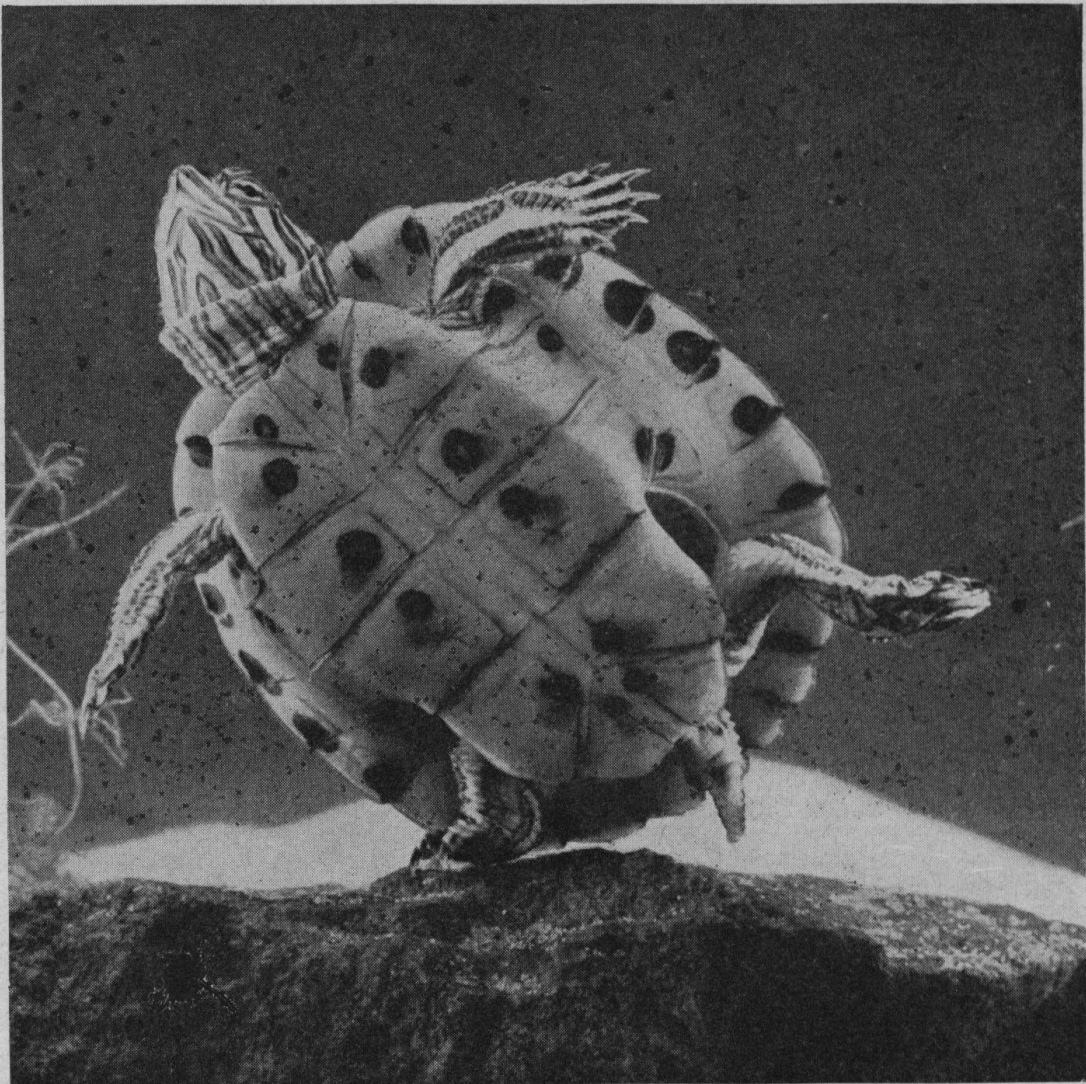


Photo:

*Elegant terrapin, underneath view*

Robert Bustard

by JENNIFER DUNFORD

“TAKE the liveliest one” said the man in the pet shop, pausing in his task of cutting up dogs’ meat, “it’s more likely to live.” My friend with whom I was staying leaned over the tank with me, and we picked out a baby terrapin which was paddling up and down by the glass, objecting to its confinement more than most of the animals.

Just then a slightly smaller one started to move around, too. I do not like keeping animals singly, I could not decide which one to have, and, anyway (according to what I had read), one at least would probably die, so I bought the two. I added two drums of ‘turtle food’, and at another shop bought a packet of dried flies I thought my fishes might like for a change.

Back at my friend’s house, the pair of terrapins brought

exclamations of delight from mother and sister. Everyone falls for baby terrapins.

“Oh, aren’t they lively!” “Like little toys!” “They can’t be real!”

The half-crown-sized babies trotted gravely about on green-and-yellow pin-striped legs, putting out their heads from a fold of skin like a polo-necked sweater to show an orange stripe behind each eye. Their shells, striped green and yellow round the plates, were so perfect they appeared to be moulded in plastic. Removed to the tropical aquarium, the tiny creatures paddled down to the bottom and swam about among the startled fishes. After more ecstatic exclamations, the family moved away.

Next I opened my foods, and was none too pleased to find that both dried flies and ‘turtle food’ consisted of the

same thing, i.e. small thin mussel-like bivalve shells, dried gnat larvae, and various other odds and ends. Still less was I pleased when the terrapins utterly ignored this mixture. They seemed determined to starve, refusing also the bacon I tried as a substitute for the raw meat I had been recommended. For 2 days they ate nothing, and I took them home wondering how much longer they would stay alive.

The Sunday joint was in the 'fridge, so I hopefully cut two strips and held them above the little miseries. To my astonishment and joy, one lifted its head, opened a huge triangular mouth underneath and engulfed the meat in its throat.

This solved the feeding problem, but soon I was worried about the temperature of their tank. It was 65°F (18°C), 10°F lower than it should have been, and the pair were very sluggish. They seemed to appreciate having only half an inch or so of water above their gravel, though; it made breathing easier.

### Home Improvements

The next day I decided to do something about their tank. The first thing they needed was heat, so I used my spare heater and thermostat for them. The water warmed up, but the reptiles were inclined to sit on the heater. I had read they could scorch their shells doing this, so the heater would have to be shielded. After some thought, I burnt a hole just big enough for the heater in the small end of a plastic sandwich box and put the heater in. This would keep the terrapins off, but I had to let the water circulate. To this end I made a metal knitting-needle red hot and punched holes all over the box. Then I put the heater back, securely enclosed but open to the water, which I had to make about 3 inches deep to be sure of covering it.

Next, I decided to put some rocks in the tank. I chose limestone, to make the water hard and alkaline so it would help build their shells. I put in first one slab, and then another to form a bridge between the first slab and the heater box. This anchored the heater box and gave the animals a chance to get out of the deeper water (a chance they never take—they spend all their time under this bridge!). I added a flat piece of stone to form a feeding table.

A few pieces of dwarf *Vallisneria* completed the set-up, which was found to be very satisfactory: the terrapins have now lived in it for some months.

### Diet

I soon found the terrapins will eat almost anything I feed to my fishes. They will attack and devour earthworms, or grab at *Tubifex* and suck them in, like undignified spaghetti-eaters. They fight over chunks of meat, and really appreciated the remains of a sprat I had dissected in a biology lesson. The only thing they refuse to eat is 'turtle food' in its original form, but they will even condescend to take this if it is mashed into a paste with Bemax and offered in small portions on the end of a wooden spatula. At nights they must eat large quantities of plants, to judge from the triangular nips taken out of the leaves, but I never catch them at this. The terrapins are very peaceful, however; the two live guppies I put in for them to eat thrived so well on the scraps that they have grown up and reared a healthy family of eight, and I do not believe the terrapins have once considered eating them.

Terrapins make the tank a lot dirtier than fish do, especially since they often shed their skins in little bits. The only way I can keep the tank clean is to remove them every week, catch the guppies, uproot the plants, take out the appliances, drain off the water, wash the gravel, scrub out the tank and then put the whole assemblage back with fresh water and (usually) plants.

### Talking Point

The terrapins are not only interesting as reptiles. They are a social asset. Visitors . . . a meagre dribble of conversation . . . then someone notices them, usually around tea-time when they are fed. Then come the familiar exclamations of delight, followed by my explanations and answers.

"Oh, yes, they're terrapins, like miniature tortoises only they live in water. Tarry and Pin, yes, that's what we call them. Look, Pin is the one trying to climb off my hand, he's always been active; Tarry is the quiet one. He's grown bigger than Pin though, he used to be quite a lot smaller."

By then the ice is broken and conversation flows. (No, we have not yet come across anyone repelled by them as "creepy-crawlies".)

So, in fact, my pair of elegant terrapins make charming and interesting pets, and are perhaps among the least demanding of reptiles.

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## Heather at the Pondsides

by JAS. STOTT

IT is rather surprising, as one goes about, to find how infrequently is use made of the hardy heathers in the planting of pond surrounds, even when this includes a rock section or crazy paving. Actually, once the plants are established no other form of planting is more trouble-free, for apart from a little annual trimming to keep the plants neat and shapely little else is needed. Not only are they attractive in bloom but after the flowers are gone the foliage on these shrubby, compact plants is also attractive. Furthermore, with selective planting, it is possible to have bloom for a considerable part of the year, even well into the winter, and that can be useful at the pondsides in the hind part of the year.

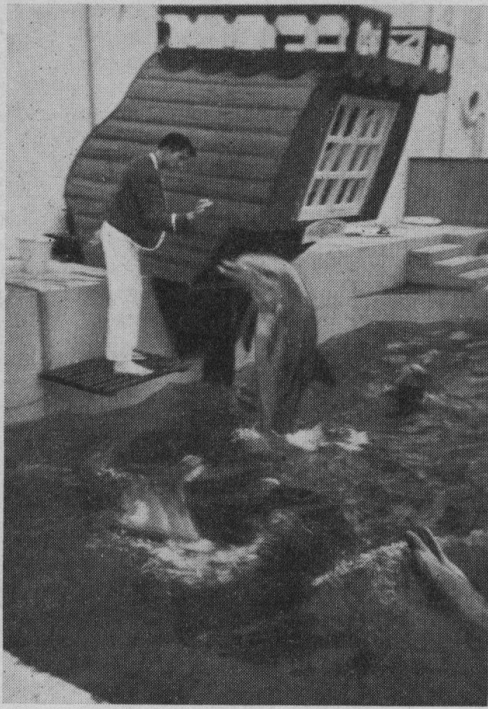
Most of the various heathers require a rather open, acid soil or a sandy soil in which is incorporated plenty of peat.

They do not thrive in lime soils in the main but there are one or two varieties which, luckily, can be grown where lime is present and they are the *carnea* and Mediterranean heaths.

A collection of heathers skilfully used as pocket plants with a paved surround of a formal pond can look extremely attractive and when used in conjunction with alpines, can be useful subjects in a crazy-paved surround. To obtain a prolonged period of bloom, however, discriminate and selective planting is needed. It is also a good idea to use three or four plants of each variety and one variety to each pocket or group. The best time for planting is from the end of October to the beginning of March, but, of course, choose a time during this period when the weather is open and without freezing spells.

For pockets in the strictly formal type of paving the following varieties are useful subjects. Flowering in the early months of the year is *Erica carnea* Springwood Pink, of vigorous growth and spreading habit. It is a pink form of the Springwood White and the two look well together.





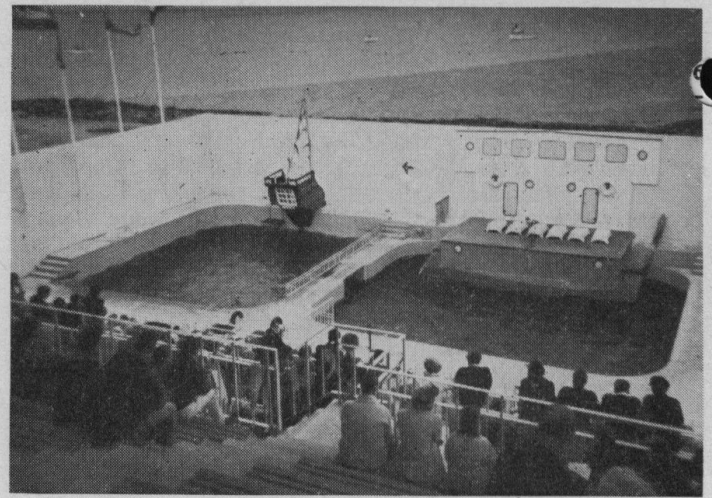
Mr. P. Williams and the dolphins at training

the dolphins and sea-lions in their respective pools, which are situated side by side but separated by railings. Both dolphins and sea-lions were, at the time of my visit, under training to do various tricks and, what was most interesting, the public performances given at announced, regular intervals during the day were, in actual fact, training sessions and therefore the audience were able to see how the actual training procedure is carried out.

The trainer of the sea-lions is Captain Fleming, who is Danish and, incidentally, quite a linguist, for he speaks six languages fluently. The dolphins are trained by Mr. Peter

Williams, who hails from London, and was very helpful when I made my visit. He explained to me how the sea water is pumped into the Oceanarium, where it goes into the settling and storage tanks at high tide and is brought into circulation through pools and marine tanks as required. Tanks and filter plant are situated under the forecourt of the outside enclosure between the dolphin and sea-lion pools and the auditorium. The general lay-out of this section of Marineland was, I thought, quite attractive.

The covered auditorium seats several hundred people, all of whom can see the performances easily from any position. Training of these creatures is, I understand, progressing satisfactorily and from what I could see quite a fascinating performance will eventually be offered. However, at the time of my visit, the actual process of training seemed to be just as interesting to the public as were those parts of the performance already established.



Marineland's outside enclosure and auditorium with dolphin (left) and sea-lion (right) pools

## Keeping Spanish Terrapins Out of Doors

by JOHN L. ADAMS

ACCORDING to many authorities the species of terrapin usually sold in this country is the European pond tortoise. However, I have found that the Spanish terrapin is more easily obtainable.

The Spanish terrapin (*Clemmys caspica*) has a brown shell, which is often rough and unattractive, but well marked in some specimens, and yellow-striped head and legs.

Although 1 inch long babies are sometimes offered for sale buy a specimen about  $3\frac{1}{2}$  to 4 inches long, as newly hatched terrapins are not easy to keep successfully and cannot be kept out of doors all the year round. A good sized terrapin will cost 7s. 6d. Try to buy a pair, as they seem to enjoy basking together. Terrapins can be sexed by a similar method to tortoises: the females have flat plastrons (under shell) and the males slightly concave ones.

Far too often terrapins are seen in small tanks, with no shade and only a few inches of water. The ideal accommodation is a garden pool.

A great deal of nonsense has been written about keeping terrapins in an outside pool—the commoner fallacies are that they will kill and eat goldfish, nibble water lilies, pollute the water and be for ever escaping.

The pool in which I keep my Spanish terrapins is stocked with fish (of various species and sizes from 1 inch upwards) and water lilies and other aquatic plants. The terrapins have done no damage at all.

Only three things are needed to keep terrapins well: sufficient food, water and a place to bask in the sun.

The last requirement may easily be met by constructing a small island in the pond. The simplest way to do this is to place a large rock on a pillar of bricks so that most of the rock is above the water surface. They may also have access to a rockery at the back of the pond.

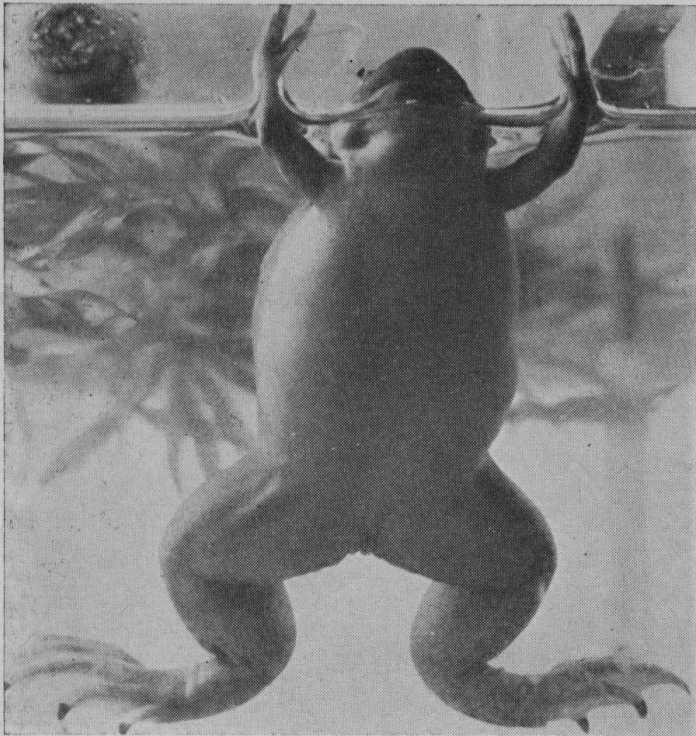
The pond itself should be 2 feet deep at the deepest part and have a layer of mud over the bottom if the terrapins are to hibernate naturally in the winter.

Three terrapins may be kept in a pond with a surface area of 48 square feet. This may seem a lot of room but terrapins are active creatures and like plenty of space.

When they are first put in the pool they are usually nervous and disappear into the mud at the slightest movement. It is only during the first few weeks that the reptiles may wander—and it is wise to put a temporary wire

Please turn to page 104

# Some Notes on Natural Spawnings



Undersurface of clawed toad 'up for air'

WHILST in Australia I acquired a pair of clawed toads (*Xenopus mulleri*), which I brought home with me, and another female I received as a gift from a friend I called upon in Colombo. Also, I purchased another male in London, which had been imported from E. Africa and later I purchased another imported pair in London.

Having studied these three pairs carefully for some time, I decided that they might be prepared to breed. They were first thoroughly conditioned with a daily diet of raw steak, with raw fish for a change on one day a week (though not necessarily on Friday!). The mating call was already heard frequently, resembling the loud ticking of a watch, and on this point I disagree with Boulenger, who states that this is the "love song" of the male; I am convinced that it is the "come hither" call of the female.

The *Xenopus* were in a coldwater aquarium, 36 in. by 15 in. by 12 in. and facing south-east, with water slightly alkaline and with pH 7.5, in April 1964. An immersion heater was introduced and the temperature raised to 75°F (24°C). At this temperature an old rotary pump was switched on for aeration. This instrument vibrated quite a bit, and these vibrations being transmitted to the water had the effect of further exciting the *Xenopus*. Within hours two of the males were in amplexus with the female.

The following morning I was delighted to find eggs deposited singly over the plants (*Vallisneria*) and on the sides of the aquarium, and I promptly removed the adults (this being easiest) and raised the water temperature to 80°F (26°C). Two days later the eggs were hatching, each tadpole resembling a small white leech about one-sixteenth of an inch in length, clinging by a sucker to the algae-covered sides of the tank.

Another 2 days and they were swimming freely. From then on growth was rapid, the tadpoles seeming to thrive on

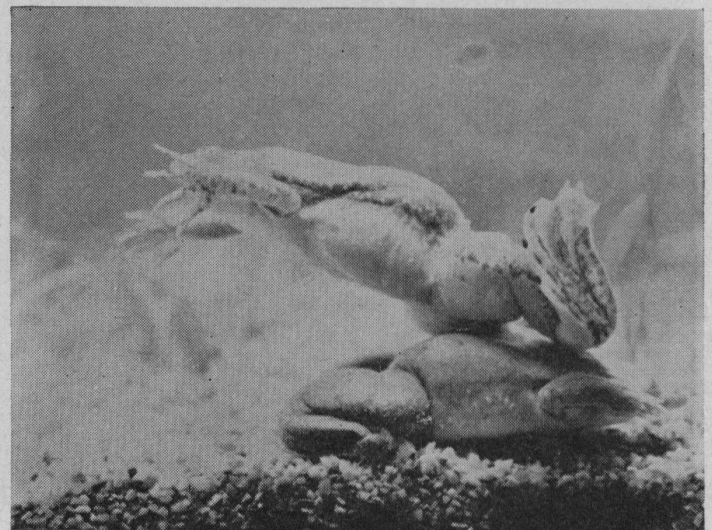
an algae suspension and ignoring *Daphnia* and *Cyclops*. Every morning I siphoned about a gallon of water from the aquarium and replaced this with an equal quantity of really dark green water, and by mid-afternoon the water was quite clear and the morning's performance was repeated. This procedure of changing the water twice daily was carried on for 6 weeks, and by this time my stock of tadpoles had gradually dwindled from about a hundred down to nil, in spite of several attempts to supplement the diet. This was a bitter disappointment, but, however, I had induced the *Xenopus* to breed naturally!

By this time they had grown to about 1 inch in length, swimming in a vertical position with heads downwards and with the tips of their tails quivering rapidly. A pair of barbules had appeared—one on either side of the mouth—at about the third week.

## Foods

I was sure that it was a matter of feeding, although various foods had been offered in addition to algae—*Daphnia*, *Cyclops*, raw meat and fresh blood; all had been refused. About this time I was presented with an adult female *Xenopus laevis*, a fugitive from a "pregnancy test" batch, and on being introduced to the *mulleri* family appeared to settle down gratefully and happily.

In August I was on the move again and once settled I decided on a second breeding attempt. The female *laevis* was removed and placed in another aquarium with a recently purchased male *Xenopus gilli*.



Side views of clawed toads in an aquarium

# of Clawed Toads

. SEARLE

by the author

This time two pairs of *X. mulleri* were in a tank 24 in. by 12 in. by 12 in. with a southerly aspect, water at 60 to 65°F (15 to 18°C), pH 7.00, and before any attempt was made to raise the water temperature, eggs were being deposited all over. Diet was then mainly earthworms.

Imagine my surprise and delight a few days later to find eggs also in the tank containing the female *laevis* and the male *gilli*. I crossed my fingers and was rewarded a few days later with another batch of tadpoles—hybrids!

Meanwhile the *mulleri* batch were growing rapidly, and having started them off again on an algae suspension, I was worried, not wishing a repetition of my earlier experience. I decided to try a well-known liquid product sold for fish fry supplemented every few days with another baby fish fry food and with these I was fortunate.



Tadpoles of the clawed toad at the stage when the hind limbs are appearing

Both batches thrived and in 6 weeks they were almost four times the size of the first unfortunate lot. Having reached some 3 inches in length they were showing signs of back legs and eating *Daphnia* and chopped *Tubifex* worms readily.

At 8 weeks old they had their four legs and the barbules and tails were withering. From then on *Tubifex* and very finely shredded raw meat were greedily devoured.

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## From Sinner to Saint

by P. E. PAVEY

UNEXPECTED success with my gentle-natured dwarf gouramis led me soon afterwards into buying yet another type of gourami—the opaline.

No gentleness here. At least not at first. Once away from his brothers and sisters, the male began to bully the female unmercifully. Rapidly I had to part them. Robbed of one victim, he promptly set about terrorising the rest of the community tank, contemptuously disregarding the fact that he was one of its smallest occupants.

### Aggressive Male

At feeding times he would become especially aggressive, for he was a very greedy fish. My only course was to put him among much larger fishes, and hope that his ego would then shrink to natural size. Four months afterwards I can report that, although still plumbful of confidence, especially on the one occasion he was entered in a show, his greed and bullying ways have completely gone. He is a most amicable fellow, and with his pale, highlighted blue body certainly an eye-catcher. And, although still growing, he is a father.

I had bought him in the September, and he had ensured that he grew rapidly. In November I half-filled a 36 in. by 12 in. by 12 in. tank with old water and topped it up with tap water (alkaline in this district). I then planted it

with lead-weighted *Vallisneria* and *Cryptocoryne*. No sand was used. Temperature was 78°F (25°C).

On the 21st November I put in the male and female, separated from each other by a sheet of glass. The female, remembering perhaps his past fierceness towards her, promptly disappeared into the small flower pot which I had provided for her protection. The male began building an enormous bubble nest, and then, aggravatingly, destroyed most of it.

On the 22nd, when I removed the dividing glass, the female was still lurking modestly inside the flower pot. The male did not change colour at once. In fact he only became darker—vividly darker—when he was actually chasing her. The female remained pale. Their skirmishes were spasmodic, breathtakingly swift. Always she darted into the flower pot, and while he was hanging impatiently outside the mouth of it, she would swim through the other (knocked-out) end and come up behind and nudge him. I increased the temperature to 82°F (28°C) and left a 5 watt bulb burning overnight.

### Spawning

They spawned eventually, during the night of the 25th. In the morning there were eggs all over the surface of the water, and, while the female remained within the pot, the male was dashing furiously around collecting them in his

# American Terrapins in Aquaria

by V. G. BREEZE

**A**LTHOUGH *Pseudemys scripta elegans* comes from the area around Texas, and *Pseudemys ornata callirostris* from Columbia, their requirements are very similar. *Pseudemys scripta elegans* has a yellow stripe on each of the plates of the carapace (upper shell), and the 'ear' is bright red. *Pseudemys ornata c.*, however, has an orange 'ear', and the markings on the plates of the carapace are more circular. The overall colour of both species is dark green.

The general shape of each species is almost identical, but the hind feet of *P. scripta e.* are more webbed than those of *P. ornata c.*, which is perhaps the stronger of the two.

## Temperature

Both species need a temperature of about 76°F (25°C), and about 8 to 10 hours of light (daylight if possible) per day. Very small specimens should have 2 inches of water: a tank 18 in. by 10 in. will hold two or three 1½ inch terrapins. The tank should have a slate ramp or rocks situated so that the occupants can climb out to sun themselves (this is done to speed digestion, and to kill leeches and skin parasites). About half an inch of gravel on the bottom is necessary if the base is made of transparent glass.

The animals should have as much space as possible, but the accompanying table is given as an idea of minimum requirements:

## Minimum Space

Size of terrapin (in.)	Number in tank	Size of tank (in.)		Depth of water (in.)
		length	width	
1.5	2	12	8	2
1.5	4	18	10	2
1.5	8	30	12	2
2	2	18	10	3
2	4	24	12	3
2	6	30	12	3
3	2	30	12	4-6
3	4	48	12	4-6
4	2	30	15	6
4	4	48	15	6
5-6	4	36	18	6
Larger than 6	4	36	36	6-7

Once the terrapins are larger than 4 inches, a heated fibreglass pool is more practical than a glass tank. As fibreglass construction is rather tedious, polythene can also be used. If polythene is preferred, any seams must be covered with a rock or slate, as terrapins will bite through polythene seams. For only one or two large animals, a big tank is probably easier to maintain than a pool. Hard water is preferable to soft, because it cannot in any way harm the terrapins' shell. If an immersion heater is used, it must be covered with a piece of stainless-steel mesh to

prevent the animals burning themselves. A filter may be necessary.

The best foods for small *P. scripta e.* and *P. ornata c.* are earthworms, lettuce, finely chopped meat and shrimp. Lettuce is essential, and I have found that small earthworms are favoured. Halibut oil and bone meal should be given periodically (at least once a week). These can be sprinkled over meat. Healthy young guppies may also be eaten. Larger terrapins eat meat greedily.

Terrapins smaller than 3 inches should be fed every day, with lettuce or vegetable matter at least once a week. Larger animals may only eat once or twice a week.

Well-kept terrapins suffer from few diseases, but soft shells and rickets are common. These indicate (i) lack of light, (ii) lack of calcium or (iii) lack of lettuce, and can be cured if discovered early. Algae growth on the shell does not seem to be detrimental. Fungus and bacterial diseases can be cured with methylene blue.

## Growth

With good light and food, a terrapin may grow 2 inches per year: under ideal conditions, 3 inches is possible. Rates of growth vary slightly from season to season.

*P. scripta e.* and *P. ornata c.* are probably the easiest terrapins to raise, but losses are inevitable. This is hardly surprising, considering the way they are handled during transport. Losses usually occur during the first few weeks of captivity. Once the young terrapins are over the 2 inch stage, they rarely look back. At this time, they are very lively. *P. ornata c.* is especially active; *P. scripta e.* is rather docile. If picked up, the former kicks with all four feet, and when replaced in the water, swims away rapidly, instinctively diving to the bottom.

When two or more terrapins are kept in one tank, fierce wrestling matches take place during feeding time. The food is snatched by one, who dashes off into a corner, where he proceeds to eat it. Then another comes across, grabs the morsel, and the fight starts. The two twist and turn, all the time seeming to be trying to tear their opponent's eyes out with the front feet. The skin around the face must be very tough, because the powerful strokes of the claws never seem to cause any damage. These fights should not be encouraged, but only should be stopped if one animal is being damaged. It is important to see that the weaker partner does not go unfed.

These two species, indeed all terrapins, make very interesting pets, being well suited to the aquarist who wants something different in his collection.

## Price of *The Aquarist*

It is regretted that because of increasing costs of production and distribution of periodicals the publishers of *The Aquarist* have to increase the price of the journal to 2s 6d, starting with the April issue. Subscribers will be notified of the new rates when current subscriptions come to an end.

# British Newts

by ERIC GILLINGHAM

OF our eight native batrachians (if we are prepared, somewhat arbitrarily, to include the recently introduced Marsh Frog, *Rana ridibunda*) the three members of the family caudata or urodela are the most readily overlooked in the field.

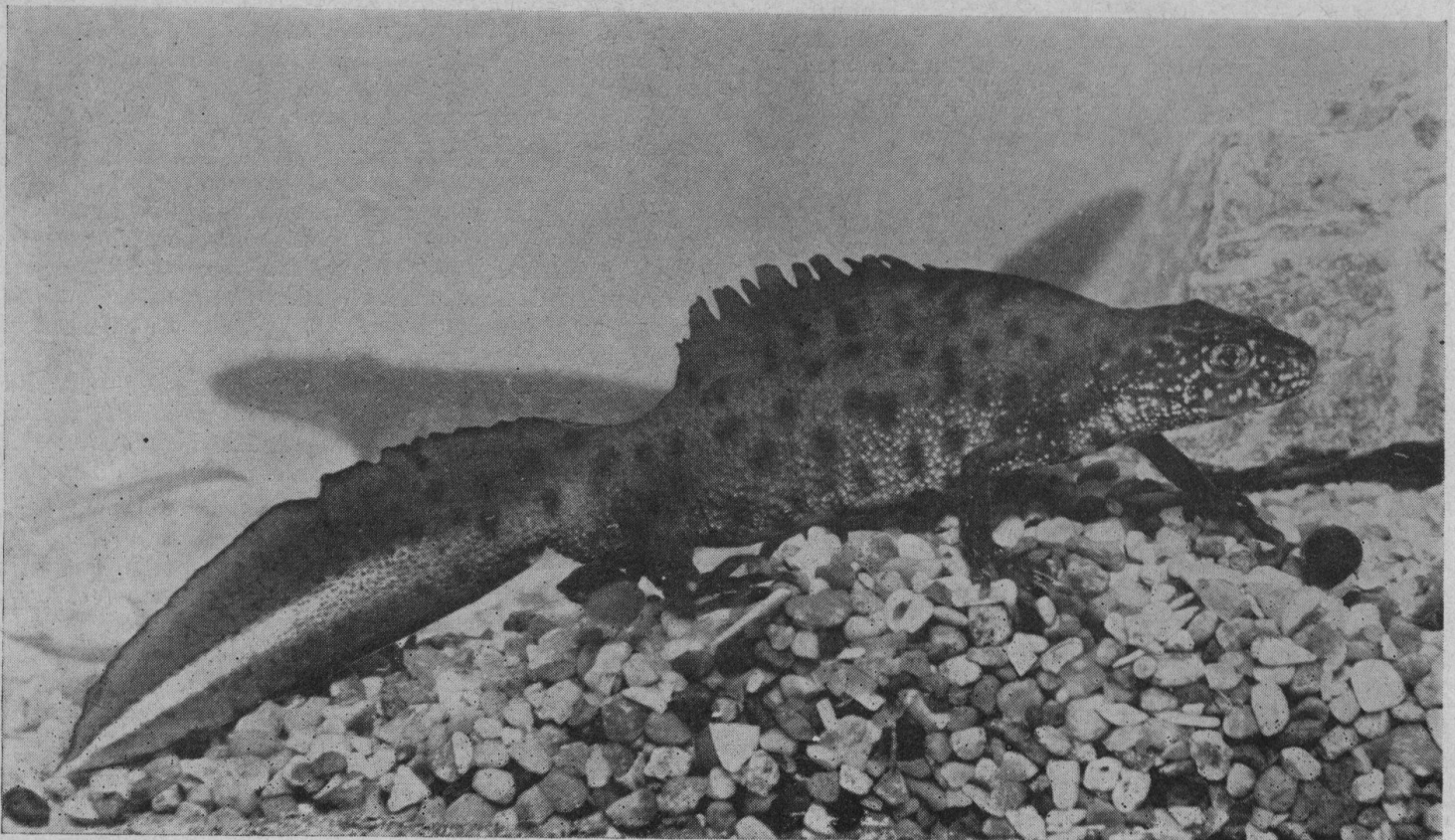
The presence of the Common or Smooth newt in the countryside of today is still fairly apparent early in the year when it gathers in some concentration in the shallower ponds and relatively slow-flowing dikes for the purpose of reproduction. Formerly known as *Molge vulgaris*, it is now referred to genus *Triturus*. I mention this in order to dispel the confusion that can arise on account of the taxonomic readjustments made in recent years. It is the newt with which most of our children are, at least to some degree, familiar as it is, even now, still quite commonly available in early April until late July in the waters quite close to large cities. It should not be inferred from this that individuals remain in the water for three or more months. What actually occurs is that, quite unlike the Anura (frogs and toads), newts do not repair synchronously to the breeding areas but there are always some sexually mature individuals of both sexes in breeding condition present in any suitable locality during these months.

The appearance of this newt is sufficiently well known to most people that I shall not herewith invoke the reader's

impatience by reiterating redundant material. What I would like to suggest is that a cursory appraisal of the known history of the whole group be attempted so that some long-flourishing misconceptions may be ironed out.

It is as well to bear in mind at the start that, from the viewpoint of ancient lineage, these long-bodied, flat-tailed caudate batrachians are very venerable folk indeed! The present writer, who is a plantigrade ape, is a very insignificant character, geneologically speaking, compared with a group of creatures whose ancestors were many millions of years old when the first reptile appeared. *Homo* (so-called) *sapiens* has a known history of something like one three-hundredth part of this tremendous time-total. Pre-Pleistocene man is totally unknown and the length of the Pleistocene is usually agreed to be one million years.

Now, way back in time, during the Palaeozoic era when the coal-measures were being laid down—in fact, quite early in the Carboniferous period—there were already present in the marshy swamp-lands that covered much of what is today called Europe, early batrachians known as Labyrinthodonts which, to be sure, were not particularly newt-like in external appearance but which reflect in their skeletal structure all the pertinent features of the modern batrachians. There are, it is true, some modifications of the thick, completely roofed skulls of the *stegocephalia* and



some improvements to the pectoral girdles of modern batrachians; also, their teeth lack that typical labyrinthine pattern from which the name of the early group has been taken.

Recent excavations from the Devonian levels in Greenland have disclosed the presence—even as early as that in the “Age of Fishes,” when the conquest of the territorial sphere was still progressing,—of *Phyllospindulous* ancestors—primitive “Branchiosaurs”—which, although formally accepted as mature amphibians in their own right, are nowadays accorded the ranking of larval forms of primitive labyrinthodont amphibia. The important point to be grasped here is the immense antiquity of this method of reproduction which is one of the diagnostic points of difference between the amphibia and the reptiles. Further points of differentiation, for the benefit of those who are not close students of matters herpetological, may be tabulated thus:

#### Batrachians

No foetal membranes. Eggs deposited either in water or in damp situation.

Gills functional during larval period.

Flattened tail where present.

No external ear.

Clawless digits, four front, five rear.

#### Reptiles

Amnion and Allantois present. “Dry”, shelled eggs.

Gills never functional after foetal stage.

Cylindrical tail.

Ear opening often present.

Clawed digits, five front, five rear.

#### Modern Batrachians

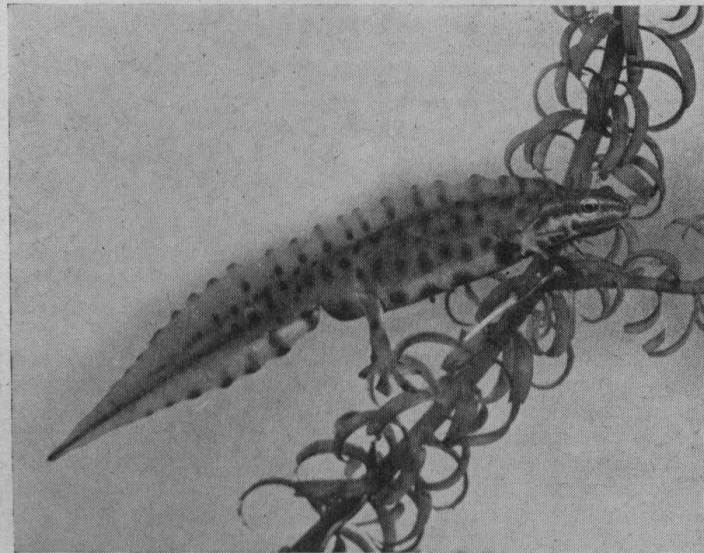
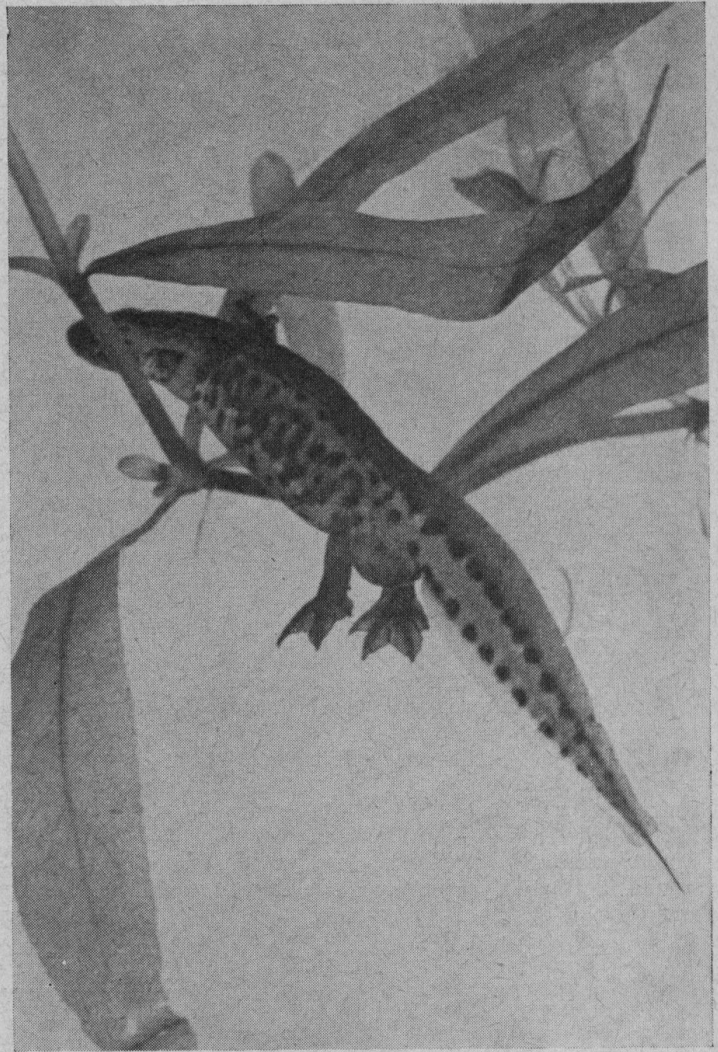
All possess naked skins.

Skins either scaly or horny.

All carnivorous in adult form.

Many herbivorous.

Although both groups are well represented in the tropics and in the temperate zones of both hemispheres, it is rather strange that there are no modern caudate amphibia



Male common newt or smooth newt

RIGHT—Palmate newt showing tail filament and showing webbed feet

LEFT—Male crested newt showing discontinuity of crest between body and tail

(salamanders) in Australia while the Anura (frogs and toads) are quite well represented there.

Now for a look at some of our own native Urodeles. We have already briefly mentioned the Smooth Newt. This is typically the newt of the northern, eastern, midland and south-eastern counties where it occupies territories which are sufficiently well-watered and shares these with the Great Warty Newt (*Triturus cristatus*). This magnificently caparisoned newt with its black (sometimes extremely dark brown) skin relieved, in the case of the male in breeding dress, by the characteristic silver flash in the tail, and its bright orange belly, is unquestionably our most picturesque newt. The term crested newt is sometimes misleading not because it is not true but because the males of all three of our native newts possess a prominent crest during the breeding season though that of the Palmate newt is less noticeable.

The Great Warty Newt appears to compete to a considerable extent with the Smooth Newt for *lebensraum* during the breeding season; certainly it will consume the larvae (tadpoles) of the smaller species. I have known a large female Warty Newt to seize and devour a well-grown Smooth Newt which I introduced to the same vivarium. It is, of course, our largest native newt and males approximate to 5½ in. with females exceeding this length by an inch. There is a very noticeable discontinuity between the dorsal crest, which is very serrated, and the tail crest. There is no such discontinuity in the case of the common

species where the crest is less denticulated and is continuous on both edges of the tail. Also, in the case of the Smooth Newt the usual disparity of size between the two sexes is less marked—in fact the males are often larger reaching just over 4½ in. in length with most females attaining about 3¾ in.

We now come to the last of our native newts, the Palmate Newt (*Triturus helveticus*). This, as far as the English variety is concerned, is essentially the western counties newt. In much of Devon, Cornwall and parts of South Wales it almost replaces the common species. There are, however, considerable areas in which overlapping takes place. Now the interesting thing here is what factors determine the segregation of the two species? There seems to be little or no difference in food preferences between them but it is very unusual to find individuals of the two species in the same pools at the same time. This is essentially one of those problems which might profitably interest those subscribers to *The Aquarist* who may be in a position to pursue field enquiries and who are prepared to make careful notes *at the time of observation*. However, this sort of activity is not likely to be practical for the majority who are probably restricted to the maintenance of aquaria or vivaria. For the benefit, or at least the encouragement, of the latter I will conclude with a few general observations relating to the conservation and propagation of Urodeles in captivity.

In the first place avoid overcrowding. This may seem so obvious a precaution as to be unworthy of mention. This is not so! The real effects of overcrowding are not immediately apparent. Aquarists are very apt to assume that the oxygen content of the water is the controlling factor—and so it is—with fishes (except for the Anabantids) but metamorphosed batrachians are independent of dissolved oxygen of course, except during the larval phase and this factor is relatively unimportant. No. It is very

easy to overlook another point altogether: simple starvation! Among batrachians, as indeed among fishes, there is always a certain number of extremely voracious individuals whose reflexes are faster than those of their companions. If you have a dozen or so specimens sharing the same tank and are gratified to notice the supplies of *tubifex*, *daphnia*, *enchytrae* and gnat larvae are being completely consumed, it is almost certain that you are, in effect, feeding no more than two or so extremely active individuals whose capacity to absorb provender is almost limitless at the expense of the other inhabitants.

Another phenomenon which has puzzled many an aquarist where newts in vivaria are concerned relates to their periodic escapes. Why, after living in apparent harmony for many months, does half the resident population of an established tank suddenly develop a Houdini complex? It is very easy to underestimate the climbing capacity of newts and salamanders. Tank tops should be *at all times completely covered*. If you do not already possess a zinc top to cover all of your tanks, a sheet of glass will suffice. Never assume that because a particular creature is slow-moving, clumsy (on land) and apparently too fat and heavy for gymnastics it therefore cannot climb out of a glass-sided tank. Whatever precautions against escapes are taken they will, in course of time, occur and on such occasions remember that the creature's greatest concern is to avoid desiccation. When the escape is first observed avoid treading on mats or carpets or you are likely to uncover the mummified remains of a very crushed newt which will resemble nothing so much as a fossilised relic of the Palaeozoic scene! When *any* batrachian escapes from confinement into a living room and cannot be located after careful searching, throw a saturated rag into any convenient corner of the room and examine it each morning. If the animal is still in the room you will eventually recover it by this means.

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## A Start with Marines

by T. HINITT

HAVING recently purchased a number of tropical marine fish, I feel that my findings will be of interest to those either beginning the hobby or those who feel it to be too complex for them to undertake.

Let me begin by stating that this branch of fish keeping does require rather more financial outlay than the setting up of an ordinary tropical aquarium. A large part of this is incurred in the necessity to purchase an Eheim power filter. These filters are supplied complete with a special Marine filter medium that removes the deadly nitrates and acid from the water. Also required is either a wooden framed aquaria, or, as I use, one with a dipped frame. This dipping is usually of nylon and is carried out before the tank is glazed, thereby completely eliminating any chance of salt coming into contact with the iron frame.

Now to the setting up of the tank. This is no more difficult to do than the preparation of a freshwater aquarium. However, attention to cleanliness is of paramount importance when dealing with marine species. The gravel that I use is ordinary aquarium gravel but it has every particle of dirt removed from it by meticulous washing. Any shells to be used should be soaked for a month to remove dirt from the spiral portion of the shell. Not wishing to wait

this long I boiled them twice and then knocked the end of each shell and flushed through with boiling water. This ensures that there can be no trapped dirt and, surprisingly, does not detract from the appearance of the shell. It is considered a good thing to use shells in a marine tank as it helps to keep the water alkaline, a factor very necessary to the well-being of marine fish. The salt water should be prepared by filling the tank with ordinary tap water after a thin layer of gravel has been placed in the tank, and adding Meersaltz to the water. This salt can be purchased in 4 lb. bags, this being the required amount to bring the water in a 2 ft. aquarium up to the correct density of .25. The density should be checked every 2 days by a hydrometer and can be adjusted either by the addition of salt (TO RAISE) or fresh water (TO LOWER).

The fish should be purchased from a reliable dealer who has had them in stock long enough to ascertain that they are disease-free. My 2 ft. tank is stocked with 6 Damsels and a Trigger fish. All of these get on reasonably well together but when choosing a selection it is best to go on the advice of the dealer as he will know which species he has in stock that will not quarrel.

My second tank of marine fish was set up on the same

# Amphibian antics

by RICHARD GUPPY

IN the course of a decade or so of experimenting with amphibians as pets, I have run into some experiences which may be interesting and, I hope, in some cases helpful to others who may follow the same hobby.

Most of my amphibian pets, including all frogs and toads, have been kept in outdoor enclosures; I have had no experience with saltatorial amphibia in indoor vivaria, but it appears that there is some risk, when the accommodation is small and low, of their inflicting serious damage on themselves by jumping against the cover. I have been able to observe this type of injury in a bullfrog, *Rana catesbeiana*. This amphibian, which is not native to British Columbia, nevertheless turns up here from time to time. The most probable origin of these strays is from tadpoles sold in pet shops. While I do not believe that these could complete their metamorphosis under the usual aquarium conditions, some may be turned loose to fend for themselves before too much damage has been done by unnatural confinement and inadequate feeding.

My specimen was caught by a young boy who, having no idea of the construction of a vivarium, put the frog into a 5 gallon crock with a piece of glass over the top. In a matter of 3 or 4 days the captive had started a raw place on the tip of its snout by jumping against the glass. The boy's mother, realising that the frog stood no chance of surviving under the circumstances, persuaded her son to make me a present of it. The injury evidently became infected, and the inflamed area spread nearly to the frog's eyes. This condition persisted for nearly 3 years; finally the end of the nose gangrened and sloughed off. Healing then proceeded quickly and the frog is now normal except for his truncated snout, which gives him a rather truculent expression.

I have several times come across written accounts of goldfish having been killed by male frogs grasping them as if they were female frogs. I can easily believe these stories though I imagine that the fish would have to be somewhat sluggish in order to allow the amphibian to take hold. I have myself observed several pairings nearly as strange: Pacific tree toad, *Hyla regilla* on red legged frog, *Rana*

*aurora*: red legged frog on bullfrog: Pacific newt, *Taricha granulosa* on great crested newt, *Triturus cristatus*. In every case the individual which was taken for a female was actually a male. It seems that the males of amphibian species which resort to amplexus while courting, will grasp any animal approximately their own shape and size. They are not, I think, attracted to anything smaller than themselves, but will tackle those that are quite a bit larger. The males of every amphibian of this type must be equipped with some means of warning other males that they have made a mistake but they naturally do not react to the signals of a different species. It is interesting to note that this failing in nature must limit, to some extent, the variety of amphibians which can occupy the same habitat. It does not seem possible that two species prone to mistaken pairing with one another could breed in the same body of water at the same time.

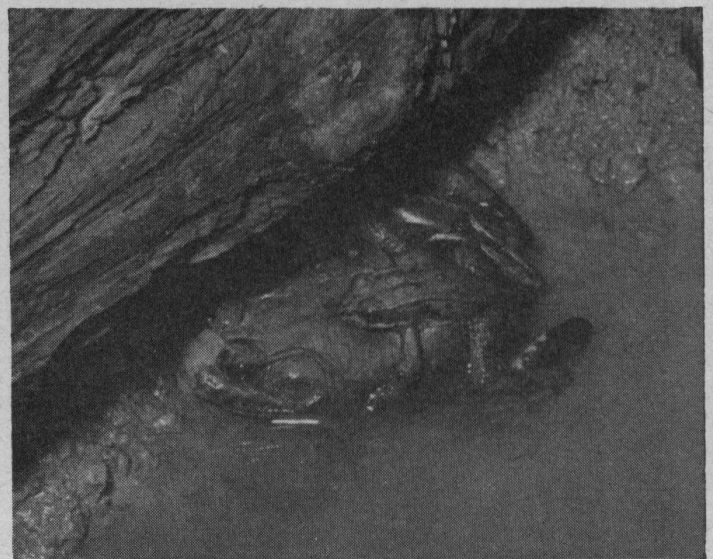
As an argument against the maintenance of mixed collections of amphibians in captivity, these mismatings need not be taken very seriously. Objections come usually from the soft-hearted observer but I doubt whether the victim ever suffers much harm. One experiment which might lead to losses would be the keeping of European newts together with the American green newt, *Diemictylus viridescens*. The latter species uses a peculiar style of amplexus. The male grasps the female by the neck with his hind feet. It certainly looks as if he were going to choke her to death and it seems possible that she has some special adaptation to prevent this outcome. I have not had much luck in breeding these newts, so whether the *Triturus* species, which do not resort to any kind of amplexus, could survive the *Diemictylus* treatment, is still an unanswered question—so far as I am concerned.

For quite a different reason, the keeping of bullfrogs with any but the largest of amphibians, is certain to lead to disaster. Quite by chance, I had possessed my bullfrog for several years before I learned of his cannibalistic tendencies and incredible swallowing capacity. I happened to put him into a pen, built primarily for terrapins, which was covered only with wire netting of one inch diameter



Bullfrog showing extensive infected area on snout

Red legged frog in amplexus with American bullfrog





mesh. Since most amphibians could easily squeeze through this, only the very largest went in with the terrapins. Besides the latter, the bullfrog's only pen-mates were three full grown western toads, *Bufo boreas*, an amphibian much like the common European toad, *B. bufo*. These he did not manage to ingest, but I now feel sure that he was responsible for the disappearance of the smallest of the terrapins. At the time I supposed that it had escaped.

On moving to a new location, I built a 12 ft. x 6 ft. pen into which I introduced the bullfrog along with my 6 large terrapins, 5 red legged frogs and 5 western toads. The two latter species ranged in size from half-grown specimens to adult females. This was a bit more of a concentration than I would usually allow but it was necessary to make do until I got more accommodation ready. Bullfrogs are warmth-loving animals, sluggish when the water temperature is below 50 degrees F., while red legged frogs normally breed when the temperature is only a little above freezing point. These facts account for my red leg getting away with what could have been a fatal mistake in attempting to use the bullfrog as a spawning partner. Later in the spring events took a different turn. There was a good deal of cover in the pen and when I could not always spot all my pets I easily deluded myself into thinking that they were hiding. The horrible truth I learned when I saw the bullfrog squatting calmly with the hind feet of a frog protruding from his mouth. This was a large female red leg, much bigger than the small male shown in the photo. A check showed that all the frogs and toads, except the two largest *Bufos*, were gone.

One would naturally suppose that such a voracious beast would be death to goldfish. As it happens goldfish shared a pond with this bullfrog for several years with no casualties. I never saw him attempt to take food from the water but it seems that his actions while under observation may be misleading. The difficulty he experiences in seizing the larger pieces of food offered him on land certainly imparts to the observer the idea that he could never grasp and hold on to a lively, struggling victim half as large as himself. Stebbins (1951) gives an impressive list of food items taken from the stomachs of dissected bullfrogs. These include fish as well as small birds, baby alligators, and a venomous

snake 17 inches long. The frog which engulfed that last item must have been much larger than mine, since to be measured the evidence must have been complete inside him. He could not have dealt with it in the way that my bullfrog managed his larger meals, swallowing them bit by bit as the part that went down first became softened by the digestive process. All things considered, I would not advise trusting any bullfrog with pond or tank mates of lesser size than himself, whether they be fish, amphibian, or reptile.

Literature cited: Stebbins, 1951, "Amphibians of Western North America." University of California Press.



American bullfrog

## Fish diseases (24) Pox disease

by R. E. MACDONALD

**P**OX disease can be diagnosed on the appearance of hard, greasy, white spots that grow considerably in size until they finally merge with each other to cover a fairly large area of the body. On mentioning the manifestation of "white spots" it should be made quite clear that this disease has no connection with the well-known Ichthyophthiriasis (white-spot) infection; it is quite easy to recognise the difference in practise.

It may be noticed that when large areas of the body are covered with the pox, sections of the encrustation may dislodge itself; this should be taken as being part of the natural course of the disease.

Pox disease does not appear to be contagious or fatal nor does the victim appear to suffer much discomfort. The disease apparently seldom attacks anything other than cold water fishes and can be cured quite easily by (a) promoting

excellent living conditions, (b) feeding with a good varied diet, and (c) by ensuring a constant supply of clean, aerated water.

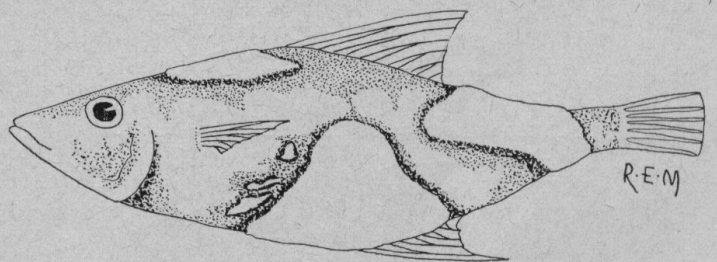


Illustration showing advanced stage of pox disease

# The European Tree-frog

by ERIC GILLINGHAM

**I**N the February issue we embarked upon a brief survey of our native *Urodela*. I now propose that we forage for a while among the *Anura* or tailless batrachians.

As far as the British Isles are concerned, our choice would be limited to five species, all of which are a little on the large side and are inclined, on this account, to be by-passed by practical vivarium keepers. For those fortunate enough to be able to maintain garden ponds or at least outside enclosures, all of these (with, perhaps, the partial exception

of the more recently-introduced *Rana ridibunda*) are quite easily maintained, of course. However, for the benefit of those who contemplate keeping frogs and toads in vivaria under living-room conditions, it may be advisable to concentrate rather upon the smaller and more readily obtainable of the European varieties.

The first one of these which springs to mind is the ubiquitous little European tree-frog, *Hyla arborea*. This cheerful little batrachian is always on the market at this



*Hyla arborea* (female)

time of year and is generally inexpensive enough to tempt beginners. The bright, pea-green colour of the upper body and the obvious black eye-stripe which continues along the side of the head, through the tympanum and along the body length until it reaches the thigh, are so characteristic of these little toads that surely no-one could fail to identify them.

"Toads?" Yes. That is what you may call them. 'It all depends on what you mean by toads'—as the late Professor Joad would have said. If your concept is that of the taxonomically innocent, you will insist upon a warty skin, relatively short hind limbs and a total absence of teeth; if you are unusually observant you are likely further to insist upon noticeable parotid glands behind the eyes and only a fringe of webbing to the hind toes. Good! We are now describing a classical *Bufo*. But there are many other contenders to the title "Toad" which has, I am afraid, no very reliable and precise significance in the strictly scientific sense. Whilst we are all apt to assume that as *we* know what we mean whenever we employ the term, our hearers will likewise share a mutual area of comprehension, it is by no means certain that they will. Americans include (in popular parlance) a genus of desert lizards containing no less than seventeen species, which inhabit the arid portion of western North America and Mexico. These are the "Horned Toads" of the genus *Phrynosoma*. These iguanid lizards revel in conditions under which no batrachian could flourish.

This temporary diversion from our survey of the ecaudate batrachians of Europe was prompted by my recollection of the dismay that I experienced as a keen youngster when confronted by references to *Xenopus laevis* as the Smooth-clawed Toad, Smooth-clawed Frog, African Water Toad, Aquatic Frog and many other similar confusing references inspired mainly by dealers' lists. As in the classical case of "Cowboys and Indians", there are always likely to be a few individuals on the 'other side' and it may take a spell of patient adventuring among the reference books before peace comes to the troubled soul. Just as long as you are dealing with *Bufo*ids and *Rana*ids, you are on taxonomically sound soil—Toads and Frogs respectively, but don't expect them all to behave like Toads and Frogs respectably any more than you really expect all men and women to behave like ladies and gentlemen! There are, in fact, a few genuine *Rana*ids of such moral depravity as to behave like *Hylidae*; that is to say, they compete ecologically with the genuine tree-frogs which, as we have discovered are more reasonably to be considered as toads.

Now, to revert to our little European Tree-Frog who is, indisputably, an honest *Hylid* and therefore a member of a large and respectable family comprising some two hundred species with a world-wide distribution. Remember that, although we propose to regard him as a 'Toad' he is not a *Bufo*id for he is equipped with teeth in the upper jaw—a characteristic to which no decent *Bufo*id would subscribe. He has, in common with the rest of his family, suckorial pads on the tips of his fingers and toes which enable him to cling to foliage and, incidentally, to escape, of course, from any incompletely covered aquarium without effort. This

faculty will inevitably endear him to your wife, if any. Note that the serious keeper of batrachians and reptiles does not keep a wife—they are mutually incompatible.

Be this as it may! If you are fortunate enough to possess a greenhouse you will be able to keep a colony of these attractive little creatures quite easily and if you have carefully over-wintered them in the manner which I propose to discuss, you are very likely to succeed in breeding them; but if you take the trouble to do this, please don't try to maintain all your recently metamorphosed larvae.

The cost in time and the expenditure of energy required to capture, let alone maintain, thousands of small dipterous insects, aphids, plant-lice of all kinds and all of the smaller spiders that you can lay your hands on, will be altogether prohibitive if you succumb to the temptation to attempt the conservation of more than, say a couple of dozen tadpoles once they have reached their maximum size. However, as you will not, in fact, have any tadpoles with which to deal unless you are successful in promoting the deposition of spawn, it is important to remember that without the quiescent period during the winter months (in northern Europe *Hyla arborea* truly hibernates) maturation of spawn and the development of ripe spermatozoa do not take place or, if either does, the two activities are not synchronous and therefore mating does not take place.

In living-room conditions, whilst it is perfectly easy to keep these creatures active all the year round, it is not possible to induce them to spawn in the second half of March or the first weeks of April without first giving them the conditions in which the males are "triggered" into the amplexus reaction. Claspings will never take place among individuals which have remained active and are still willing to feed in the early spring. In fact, if you observe any individual take prey at this time you can be reasonably certain that it is immature and that, in any case, it is not in breeding condition. Consequently, if your ambition is to promote successful reproduction, you must be patient and resourceful as it will be necessary to imitate the external conditions proper to the cycle of the seasons.

In this country the month of September is peculiarly favourable for the feeding-up of frogs and toads prior to the impact of the frosty weather. A visit to almost any lawn will provide crane-flies and harvestmen in abundance if the grass has been left uncut. This is also the month in which the common geometrical spider is in its greatest numbers in the shrubberies. Some of the largest female web-spinners are larger than a tree-frog's head; nonetheless, you will be amazed at the way in which a female tree-frog with a total body-length of say two inches can pack them away at this time of the year.

Having fattened up your selected pairs you are now ready to cool them down for the winter. For the benefit of those people who are not very familiar with the *Hylidae* I should, perhaps, mention that distinguishing between the sexes presents little difficulty. Any specimen approaching  $1\frac{1}{2}$  inches in length is almost certainly female and, in any case, the throats of the males are almost always darker in colour underneath and the twin vocal sacs can be easily seen from a

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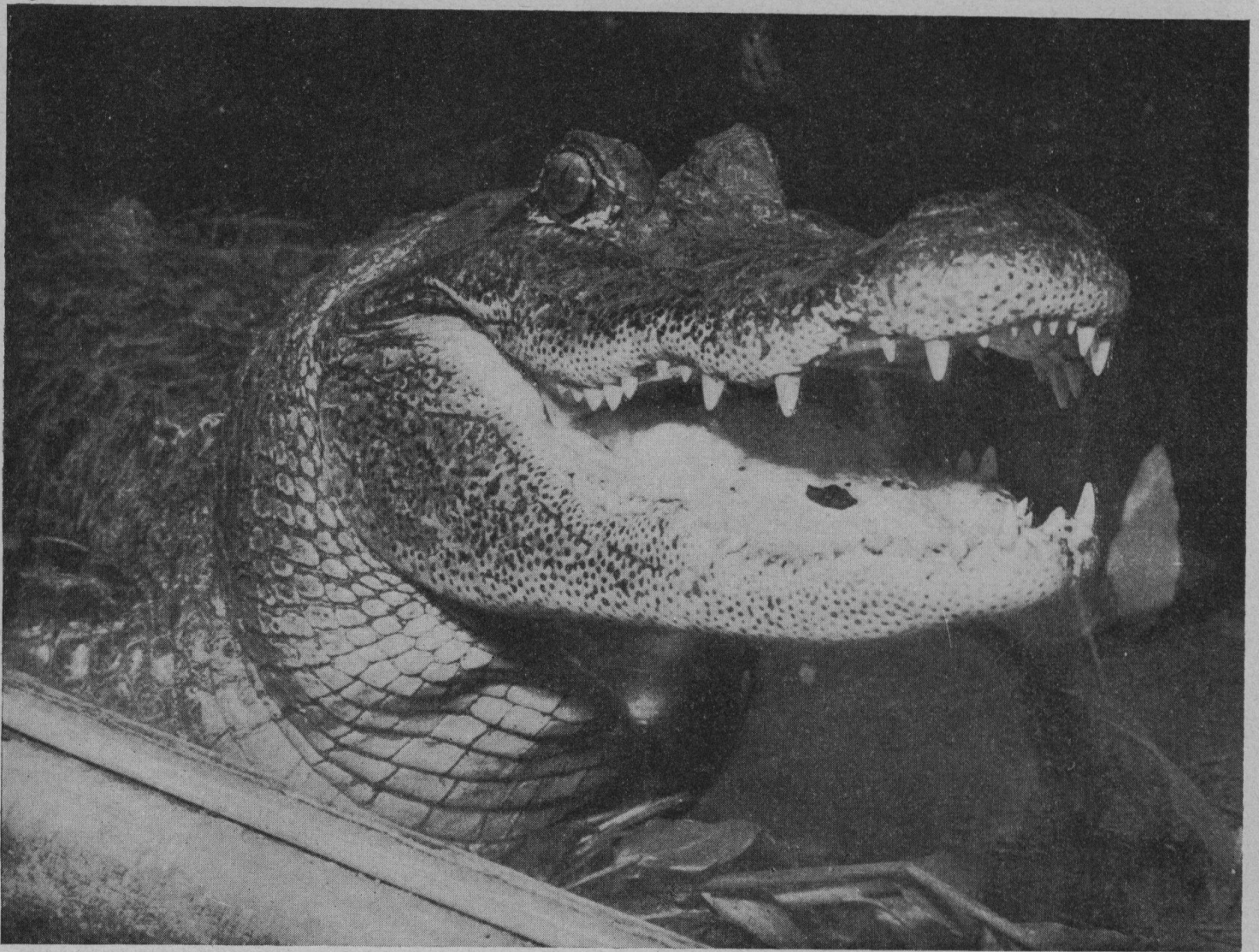
# Mating behaviour in the American alligators at Belle Vue Zoo Park, Manchester

*by* R. E. LEGGE

**L**AST year a pair of American alligators aroused considerable interest by mating, constructing a nest pile and laying eggs in the tropical jungle pool section of the new Reptilium at Belle Vue Zoo.

Although it is understood that alligator eggs have been

sent over from America and successfully incubated in Europe, and that eggs have been dispelled by a female alligator brought over in a gravid condition, to the best of our knowledge this was the first incidence of mating in captivity. Unfortunately the eggs proved to be infertile.



Since January this year, the pair have again exhibited remarkable mating behaviour, much of which has been recorded on 8 and 16 mm film. The special basking areas of the alligator pool enclosure had been provided with a quantity of dead leaves and decaying vegetation in which it was hoped that the eggs would be laid. On the 22nd May, several weeks earlier than last year, the female chose to lay a clutch of two dozen or more eggs in a most unexpected and unsuitable site, a narrow plant pocket in a rocky ledge immediately behind the armour-plate glass of the safety barrier. This was quite inadequate to hold all the eggs for, in spite of the fact that she had torn out the plants and scraped a hollow in the soil, a number of the eggs had rolled down the rocks into the water where the male was seen to devour several of them.

Any human approach evoked the most fearsome defensive display, the female leaping at the glass barrier, hissing loudly and snapping her jaws. As the site chosen was so close to the public pathway, anyone leaning over the barrier would have been in considerable danger. Moreover the eggs were in a vulnerable position, several having been broken by the alligator's efforts to protect them. It was therefore decided to remove them to one of the specially prepared sites nearby. By holding the reptiles off with broom staves, the transfer was eventually effected, some of the eggs being retained for artificial incubation. However, the female continued to guard the empty hole and it was therefore found necessary to erect an additional temporary barrier to protect the public and to blank out the glass to screen the approach of humans, thus giving the female alligator some respite from her defensive activity. Finally a number of eggs were returned to the original nest hole and covered by leaves and soil.

The total clutch is now divided into three separate incubation possibilities and we understand that in the wild state the incubation period is approximately 10 weeks.

Since *Alligator mississippiensis* has been exhibited in countless zoological establishments for well over a century, it is interesting to speculate why the events described have not been widely observed and recorded before now. We would like to think that our meticulous attention to ecological considerations have contributed largely to their condition and behaviour pattern, but we are well aware that other establishments have been equally anxious to provide appropriate settings without finding the reptiles so obviously ready to breed.

The direct relationship between temperature and metabolic activity in reptiles is common knowledge of course, and in most Reptile Houses the atmospheric temperature is kept high enough to ensure a reasonable degree of well-being, but it is perhaps debatable whether the water is kept as warm as these reptiles would like.

To ensure that a sufficiently high water temperature is maintained at all times in our Reptilium, a circulation system has been arranged in which the flow from the pool

passes through pipes of a reservoir where it is screened to remove gross suspended matter and pumped up through an oil-fired, boiler-heated callorifier to a shallow gravity tank situated on top of a rocky escarpment from which it tumbles in a waterfall back to the pool below. In this way a temperature ranging between 78° and 88°F. (25° and 31°C.) is maintained. Should the boilers fail at any time, auxiliary thermostatically controlled electric heaters beneath the pool will cut in. The continually flowing water, plus an optional mist spray apparatus high in the roof, ensures a high degree of humidity at all times.

These factors, together with the gradually sloping rock strata permitting the reptiles' ready access to the electrically heated basking areas, appear to have provided conditions that permit a far higher degree of activity, a voracious appetite, an unusually pronounced degree of aggressiveness and a very obvious reproductive urge.

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## Fine-leaved willow moss

by B. FRY

THIS scarce plant (in the wild state as well as in cultivation) is indigenous to Britain and is believed to be a variant of the common willow moss (*Fontinalis antipyretica*) that is usually found growing from wood or stone structures or debris, inches—or even feet—deep under running water. But whereas *F. antipyretica* removed from its natural setting seldom lasts very long in the unheated or heated aquarium, *F. antipyretica* forma *gracilis*—to give the fine-leaved variant its technical name—settles down very well in any cold or tropical tank provided algal growths and swirling sediment are kept in check. Light shade, furnished by towering thickets of other plants, and soft and acid water aid immensely in inhibiting algae. As for swirling sediment, this should never become a problem in a properly cared for aquarium stocked with fishes not addicted to turning over the compost.

In appearance, *F. antipyretica* forma *gracilis* is merely a miniature and paler green edition of the type. It grows very quickly at a temperature in the upper sixties to middle seventies (°F), and in a short time forms a pyramidal or fan-shaped bush upward of 12 in. in height. Apart from its decorative value, fine-leaved willow moss is a useful plant to have in a single species aquarium where free-breeding egg-scatterers such as White Cloud Mountain minnows or some of the oviparous tooth-carps reside. A good bunch spread horizontally over the bottom and weighted down with stones, or tied to a cork or feeding ring and allowed to float at the surface in shallow water can hardly be bettered for cradling and protecting adhesive and non-adhesive eggs. More than that, newly-hatched fry will find plenty of safe hiding places in the myriad tangles of foliage.

# Breeding slow-worms in confinement

By H. G. B. Gilpin

**I**N an attempt to breed these interesting and attractive creatures under indoor conditions, a male and two females were kept together for several months. I obtained the male about a year and a half ago and the first of the two females in the early spring of this year. The second female was introduced in June. All three were fully adult, in fine condition and averaged around fourteen inches in length.

They were placed in a standard, commercial type metal sided vivarium with a sloping, sliding glass top. Holes covered with perforated zinc in the sides provided ventilation. Its overall dimensions were twenty-four by fourteen inches, rising from three and a half inches in front to seven inches at the back. A loose hard-board shield, six inches wide, was laid on the glass to ensure that at least a part of the vivarium was permanently shaded. The position of this shield could be varied so that by moving it from time to time the vegetation could receive an adequate amount of light.

The vivarium was placed in front of a West facing window. Its floor was covered with coarse sand over which was laid an inch of soil. A few relatively large stones were scattered here and there, their rough edges being of assistance to the animals at such times as they were changing their skins. Two flat stones placed together to form a "tent" supplied the slow-worms with a retiring place. They used this freely and also buried themselves under the stones when in need of seclusion.

A few plants, including small cacti, succulents and a

piece of turf were introduced. At first I was hesitant about the cacti in view of the sharp spines covering them. In actual practice these fears proved groundless. The slow-worms remained in excellent condition and avoided damaging their skins on the innumerable points. Water was provided in an earthenware pot, four inches in diameter and three quarters of an inch in depth. A few daphnia were put in the water to keep it clear, thus avoiding too frequent changes and disturbance of the slow-worms in the early stages.

The slow-worms were not difficult to feed. They were given small earthworms, gentles and slugs, the latter ranging in size from the smallest available to a maximum of not more than three quarters of an inch in length. Ants and woodlice were also offered but these disappeared slowly. The slow-worms rarely ate the gentles and many of them pupated and later emerged as blow flies, at which stage in their life history they had a greater appeal for the slow-worms. Slugs proved to be by far the most favoured item of diet. The slow-worms seized them readily and swallowed them with slow deliberation.

During the last week in August the female, which had been caught in June, died. A post mortem disclosed the presence of a fully developed young one. A few days later the remaining female produced ten babies, five of which were left with the parents and five transferred to a nursery cage, smaller than the breeding cage but similarly furnished. They were beautiful little creatures, black on the underparts

*Continued on page 197*

A picture of a slow-worm wriggling its way through the grass



# Great Silver Beetle

by F. Wilmott

**T**HIS fine insect has been given its popular name because a large area of its under-surface is closely covered with very short hairs which it uses to entrap a layer of air, and this layer looks like a bright silver breastplate if it catches the light when the beetle is submerged.

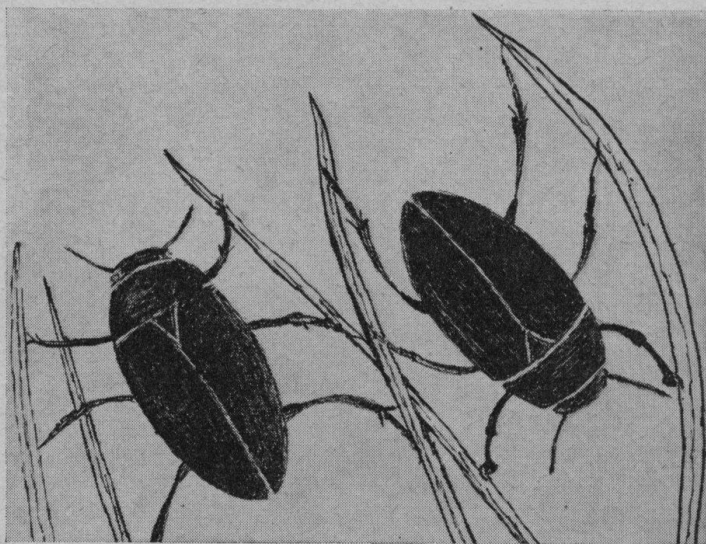
The Great Silver Beetle can attain a length of nearly two inches but it is, unfortunately, by no means common in this country now. The only British beetle which has a greater length is the male Stag Beetle, but even so the Great Silver Beetle (both male and female) wins easily on bulk, and can be said to be the slow, peaceable elephant of British insects.

This beetle moves its legs alternately when it swims instead of working them in unison, and this action combined with its bulk makes it a slower and more awkward-looking swimmer than are some other aquatic beetles. Also it tends to clamber amongst the water plants on which it mainly feeds in preference to swimming.

The clubbed portions of this insect's antennae (which it keeps tucked away under its thorax), the under-surface of its thorax, and also part of its abdomen are thickly covered with short downy hairs. These down-covered areas serve as air passages connecting the antennae with an air space between the wing-cases and the upper surface of the insect's body.

The way in which the Great Silver Beetle "fills-up" with air is most interesting. For firstly it rises to the surface of

the water and pushes the clubbed portion of one antenna through the surface-film. It then moves its wing-cases in a bellows-like movement which causes its whole body to rise and fall in the water as new air is drawn in and "used" air expelled. After repeating these breathing movements several times this remarkable beetle, presumably refreshed descends with an abundant supply of air ■



*Hydrous piceus* (male on right)

continued from page 190

## Breeding slow-worms in confinement

with a gold dorsal surface divided down the middle by a fine black line.

When born on 28th August, they were about two inches in length. They were extremely agile and during the first week of their lives no less than three of them managed to escape from the breeding cage through a minute, previously undiscovered, space between the glass cover and the metal-work of their cage. Fortunately they fell on to a polished surface which limited their movements to such an extent that they were recaptured before they had travelled any great distance.

At first, feeding the tiny animals presented a problem. To begin with they were kept alive on fruit flies but supplies of these were limited and an alternative diet soon became necessary. The difficulty was resolved by the discovery that a pile of spent mushroom manure, stacked in the garden until such time as it should be needed by the gardener, was simply crawling with minute forms of animal life. A couple of handfuls of this medium placed in the cage every other day, supplied the baby slow-worms with a completely adequate diet and they soon began to increase in size so that by 5th September they averaged three and a half inches in length.

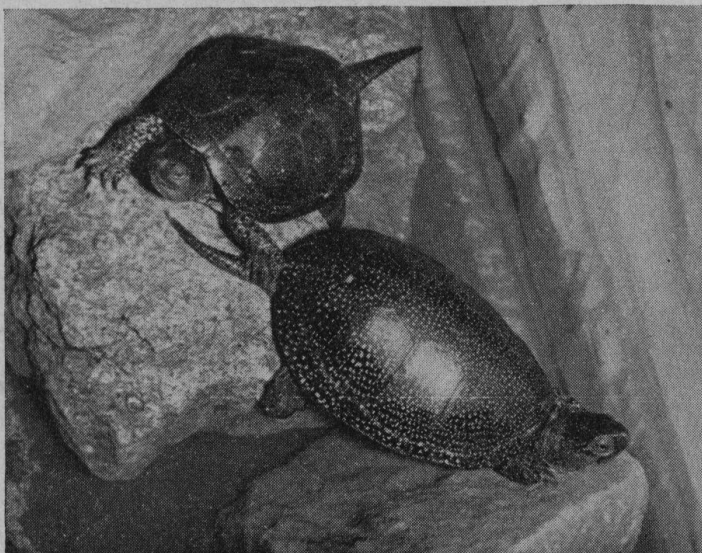
Towards the end of September one of the adult slow-worms was discovered in the act of eating a young one. Only a little of the tail of the victim remained protruding

from the adult's mouth and, in a matter of seconds, even this last trace of the unfortunate animal disappeared. To prevent a repetition of this cannibalism the rest of the babies were hastily caught up and moved into the nursery cage where at the time of writing they continue to flourish.

The young slow-worms are voracious little animals. Not long ago one, no more than four inches long, was found attempting to eat an inch long slug much thicker in diameter than itself. The tiny mouth of the slow-worm was firmly clamped on its prey which it made vigorous attempts to swallow. Finally, however, it seemed to realise that the stout, tough body of the slug presented insurmountable difficulties and it reluctantly gave up the attempt.

Apart from supplying a rich source of live-food for the young slow-worms, the spent mushroom manure provides an excellent covering for the floor of their cage. It is a warm medium and sufficiently loose in texture to enable them to burrow into it without difficulty. Although they are frequently seen moving over the surface during the day, they spend much of their time coiled up beneath its protection.

It seems that slow-worms are not difficult to breed in captivity. Most probably the female introduced in June was already carrying young at the time she was captured but this is unlikely to have been so in the case of the earlier caught female ■



# The Junior Aquarist

European terrapins (*Emys orbicularis*),  
see article below

## Terrapins as pets

by Ian Coggins (13 yrs)

**T**HE species of terrapin most commonly seen in pet shops is the Red-Eared or Elegant Terrapin (*Pseudemys scripta elegans*). This beautiful North American terrapin is a vivid apple-green colour, with a red mark on the side of its head, hence the name Red-Eared Terrapin.

Unfortunately these charming creatures are very hard to keep in our British climate, and very few of them survive the first year of captivity. Most of the specimens in shops are no more than babies and are no bigger in circumference than a half-crown.

### Housing

The ideal enclosure for these small turtlets is an average size aquarium with one to two inches of water in it (or more). In the water should be placed one or two large, flat stones on which the terrapin can bask in the heat. The most satisfactory heating in the tank is that of a lamp bulb which can be rigged up in the hood of the aquarium. A lamp bulb is essential as it gives the necessary heat and light in which terrapins can "sunbathe." If possible the temperature of the tank should be maintained at approximately 75°F as the chances of survival are far more likely in that heat.

### Feeding

The terrapin's diet should be as varied as possible consisting of very small pieces of raw meat, earthworms and, if possible, water insects. Quantities of grated cuttle-bone should be sprinkled on the raw meat to provide calcium which is vital for the strengthening of the bones and shell.

As mentioned before, the Red-Eared terrapin, although being very attractive, is very difficult to keep alive for long and is not really the terrapin for a beginner. However, there are three species which are very hardy and if kept properly can live up to about 25 years. These are the European Pond Tortoise and the Spanish and Caspian Terrapins.

The European Pond Tortoise (*Emys orbicularis*) which can grow up to over a foot in length is best housed in a garden pond. In the winter it should either be allowed to hibernate or brought indoors and put in a large aquarium. In colour it is dark brown or black with a covering of small yellow spots. It is found in N.W. Africa and Central and Southern Europe. The Caspian (*Emys caspica*) and Spanish (*Clemmys leprosa*) Terrapins are closely related and can be treated similarly in captivity. A fairly large tank is needed and this must be filled with about 5 or 6 inches of water. A tall stone is needed for basking in the heat of the lamp bulb and plenty of water for swimming and exercise. The diet for these terrapins and the European Pond Tortoise is the same as the Red-Eared's but in larger quantities.

Nearly all terrapins spend about half their time bathing in the heat and light of the bulb provided and this is a very necessary feature of the tank ■

## The Black Widow

by Michael M. Clark

**T**HE Black Widow (*Gymnocorymbus Ternetzi*) is, without doubt, a firm favourite among would-be breeders. These fish are extremely attractive when given suitable surroundings but they should not be overcrowded. The body of the fish is silver with two striking lines of black running vertically across it. When the fish is scared, these are apt to fade, but when the fish is stimulated, the bars deepen in colour. The anal fin, which is very long, the dorsal fin and part of the tail fin, are also black in appearance.

The Black Widow is fairly peaceful but when breeding these fish, it is advisable to spawn just the single pair at one time as they are likely to attack each other in community.

The male fish appears longer in body than the female and, if one disregards the fins, this should be quite noticeable.



# Terrarium terrapins

by Eric Gillingham

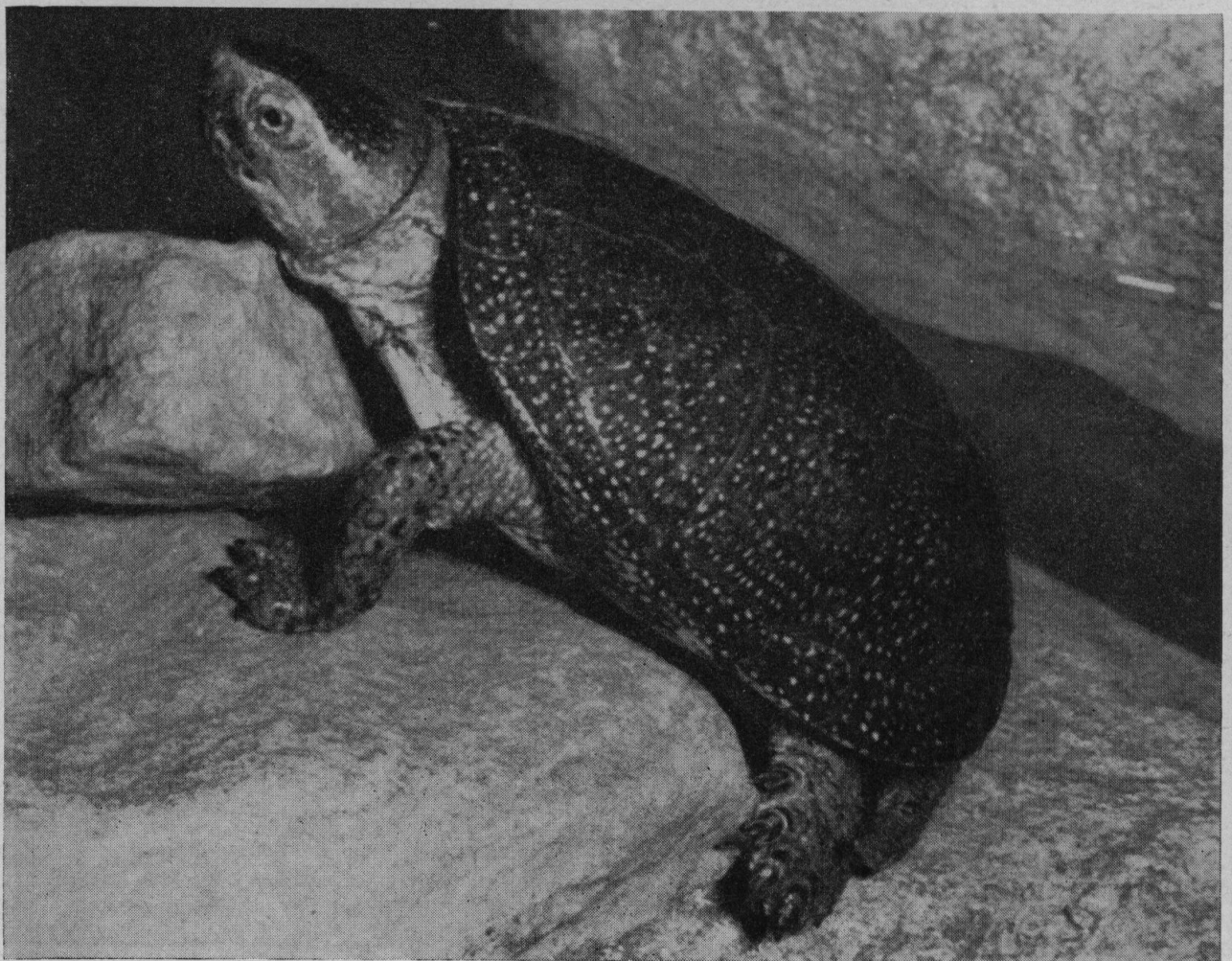
**O**F the misconceptions current among aquarists today, the most popular is, perhaps, the prevailing conviction that exotic terrapins are for the most part, delicate creatures dedicated to the practice of self-immolation.

Whilst it is, unhappily, true that of many thousands of these unfortunate animals which are imported into the United Kingdom annually, less than 1 per cent. survive the first year, this is no indication of inherent frailty but rather serves to indict the purchasers for their inherent stupidity.

Allow me, at the outset, to point out that this tirade is not directed at the enlightened subscriber who, *Aquarist* in hand, is in the position of the medieval abbot with his flask of holy water ready to fling it into the face of the Devil. And who is the Devil? Alas! I am afraid that it is a very impersonal Devil. The diabolical consequences are the outcome of a concatenation of circumstances which it is impossible to prevent whilst bulk-importation is still permitted.

Let me say at once, that the established dealer is not the villain; he rarely loses his stock, partly because it is still vigorous on arrival and, much more to the point, mainly because the weight of his financial involvement compels him to undertake a fairly extensive study of the conditions necessary to promote survival. However, on account of expensive freight charges, particularly in the case of air-transport, the common practice is to pack as many recently-hatched terrapins as close together as possible in some relatively light packing medium—usually sphagnum moss.

Now, this does not inconvenience the little travellers over-much, but it does result in the simultaneous arrival of thousands of hapless infant terrapins in the United Kingdom. The several separate, large-scale importers now seek to disseminate their charges amongst the smaller fry—the “pet shops”—many of whom are experienced, practical reptile-keepers; some however, are not. The outcome of this process is that many hundreds of luckless reptiles end up in various “dry-stock” shops whose main concern is with the sale of bird-cages, budgerigar seed,



European  
terrapin  
(*Emys  
obicularis*)

bonemeal, garden fertilizers and tools.

In the midst of this agrarian assembly and usually afforded pride of place in the centre of the window display, can be seen a couple of dozen wretched "American turtles"—most of which are destined to perish from sheer starvation within a few months. The fortunate few who escape this fate are, in fact, purchased by aquarists and vivarium-keepers, but what of the hapless residual victims? These victims are most commonly the Florida painted terrapin (*Chrysemys picta*), and the elegant terrapin (*Pseudemys scripta elegans*) whose attractive appearance with bright grass-green carapace and scarlet "ear" spot, is directly responsible for its misfortunes. Let us pursue to the end the dismal litany. Once again the diabolic influence is strictly impersonal.

"Mum, can I have one of those?" If mum or dad is in agreement, then a sum of money, rising upon the surge of the financial tide—say something between three and five half-crowns at the time of writing, will be expended toward securing the miserable extinction of one of the more worthy remnants of American development.

"What do they eat?" earnestly enquires the child who, incidentally, is probably the least diabolic link in this mephitic chain of events.

"Oh! Anything—we sell packets of turtle-food."

Once again, the proprietor or the assistant is merely stating what he or she believes to represent the facts. May we, perhaps, forgive them for not having encountered these facts? Desiccated *Daphnia* and dried flies are about as useful for maintaining healthy terrapins as a diet restricted to cornflakes would be to the child. "Baby" terrapins thrive upon a diet of *living Daphnia*, together with small water-snails, water-boatmen, caddis-fly larvae, corixid bugs, dragon-fly larvae, may-flies, gnat-larvae, freshwater shrimps and tadpoles. They will also accept most smooth caterpillars and crane-flies.

These are, of course, purely natural resources which are not readily available to city-dwellers. Substitutes are, however, generally to be found; but do, please, beware of relying too extensively upon *one* particular food-form to the exclusion of all others. The weekly expenditure of a shilling will, I know, procure a writhing mass of *Tubifex* worms but this in itself is not the answer although it is an excellent stand-by.

The recommendations which follow may be taken as applicable to all young specimens of the aquatic chelonians, excepting the marine forms—the true turtles.

### General Considerations

(1) Avoid over-crowding; two or three vigorous, healthy, individuals will provide adequate enough return for your care and attention; a dismal, dwindling dozen, too competitively engaged in scrambling for the choicest morsels to permit the survival of the least successful, is no credit to any enthusiast.

(2) Depth of water: The requirements of species vary a little in respect of this factor but the main consideration here is not to over-do it. All very small terrapins like really shallow water and are perfectly content with an inch or two.

(3) Temperature: This is a factor which varies more

widely and for this reason it will be referred to again under the specific notes which follow, but it may be generally observed that if the specimens have been feeding well upon a judiciously varied diet, no very high temperatures are required.

Healthy terrapins—even from really hot localities—customarily withstand considerable variations in temperature largely because many of them inhabit extremely shallow water; but immature specimens can never survive frost. Therefore, attempt to maintain an average temperature of around 70°F., but do not panic if the vicissitudes of the local electricity board defeat the capacity of your heater to cope with a sudden temperature drop. It takes quite a long exposure to water below 50°F. to harm well-fed active terrapins—even those from Florida and South America.

Apart from simple starvation, the most formidable killer in this country is pneumonia. The first indication that you may perceive of this infection is "bubble blowing". Of course, all aquatic reptiles blow bubbles from time to time when swimming under water, particularly when approaching the surface, but when a specimen reclines upon the "land" and continually produces mucus bubbles from the nostrils, then the prognosis is grim and immediate steps must be taken to deal with the invading pneumococcus.

This condition is contagious and calls for isolation and any individuals who are involved must be removed *at once* from the primary tank and placed into one in which the temperature may be conveniently raised to 80°F. or even more, if necessary. If the afflicted creatures are not already moribund and were, prior to the attack, active and vigorous, you have an excellent prospect of effecting a cure.

Recovery from such an attack is often facilitated by oral administration of penicillin, but this calls for a considerable amount of persistence and manual dexterity in order to ensure that the pill actually finishes in the oesophagus and not in the trachea. The smaller the subject, the greater the difficulty which will be encountered in restraining the creature from retracting the head within the shield of the carapace and plastron and if the patient is sufficiently resistant to this enforced dosage, I usually conclude that it has enough strength left to fight off the encroachment of the pneumococci without recourse to these emergency measures.

The group that is most subject to respiratory ailments is that one which is known to the Americans as "sliders". The most commonly-imported of these being the already mentioned Painted Terrapin (*C. picta*) which, together with two nearly related genera, the map turtle (*Graptemys geographica*) and the false map turtle (*G. pseudogeographica*) are all very similar in their requirements. (Note the American habit of grouping all non-terrestrial forms under the all-encompassing term of "turtle").

Whilst we are dealing with the most freely obtainable of the new-world forms, it will be cogent to mention that these American terrapins customarily include a fair percentage of vegetable matter in their diets. They all take duck-weed and, for that matter, sometimes even lettuce!

# The green toad

by Jack Hems

*Bufo viridis*, popularly called the green toad, or the changeable toad, ranges in the wild state over most of Europe (excepting the British Isles, France and Spain), North Africa and temperate Asia as far as the land of the Mongols. It is an inhabitant of dryish rather than wettish places but seldom strays far from easily accessible water in which it likes to bathe. This it does quite frequently during warm, dry weather.

The female attains a length of about 3½ in. and is the larger and handsomer of the two sexes. Her colours are a jumbled pattern of green and grey, or olive, or pinkish beige. The green, sometimes light and sometimes dark, is distributed over the flattened warty back and sides in irregular-sized blotches and spots. The smoother underparts are milky to creamy white.

Races of *B. viridis* occur in which the body is well marked with reddish brown and yellow as well as green. In both sexes the large eyes have lustrous jet pupils set in rims of greeny gold. The male inclines to a more uniform yellowish to olive coloration. It is to be remarked, however, that any change in the weather affecting the environment of this toad will be reflected by a darkening or a lightening of its coloration.

When removed from its natural haunts the green toad often develops an indifference to food. Fortunately for the vivarium keeper, this partial, or total, annihilation of the appetite is usually of short duration provided a wide variety of live food, from tender young gentles (anglers' maggots) to woodlice is offered daily.

Because a happy green toad is by nature a roamer and an ardent hunter—hopping, crawling, scrabbling and running after its prey—at dusk and after, it needs sufficient room to move about in comfort.

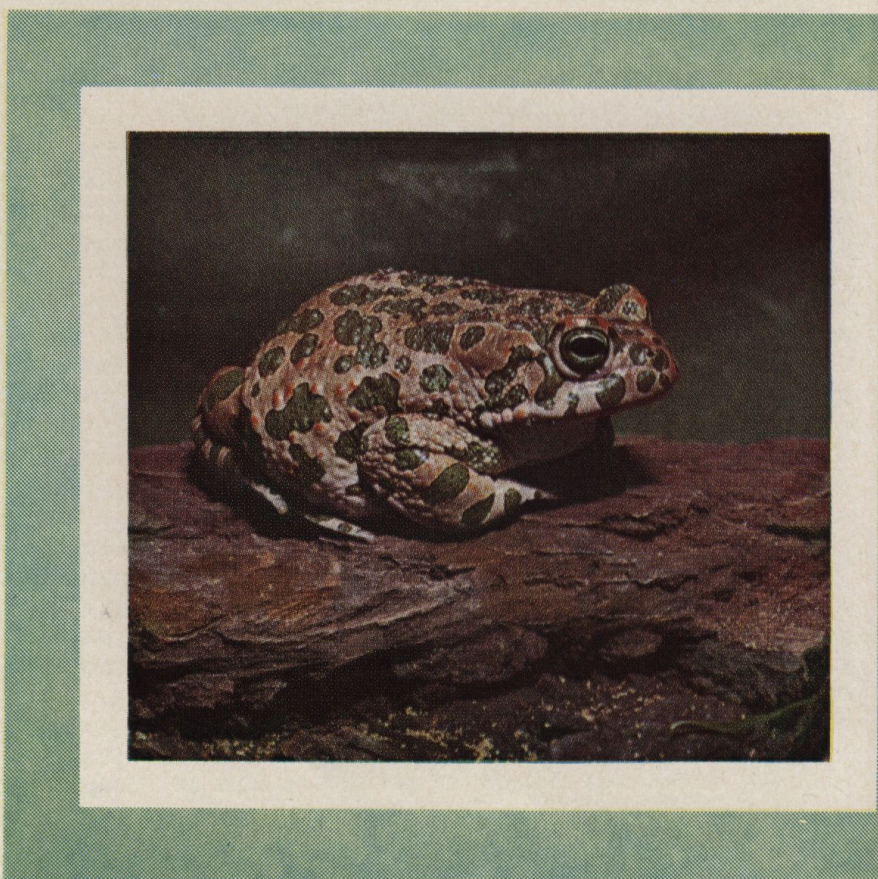
The ideal home for a green toad in captivity is an outdoor enclosure (*B. viridis* is perfectly hardy and will come through the English winter safely if it can get well down away from cold under a pile of masonry erected on top of a well-drained mound of dried leaves and gritty soil), but a vivarium with a floor measurement of, say, 24 in. long by 12 in. wide will make a comfortable home for a pair and a pair of common toads or natterjack toads, for extra company.

Nothing special in the way of furnishing is required but essential needs are a 3 in. deep layer of sandy soil mixed with some pea gravel on the bottom, a retiring place under a piece of bark or stone, and a dish of water—never allowed to dry out—for bathing.

A position near a window, but out of the way (except, perhaps, for one corner) of

direct sunlight is satisfactory. (A light bright enough to grow a potted fern or ivy, which might indeed be included in the set up, is about right). And one more point. As the green toad is an accomplished, and at times, persistent climber it is important to ensure that its vivarium is properly covered. A sheet of glass raised slightly off the top serves its purpose very well. But a better idea is to equip one half of a lipped wooden frame (to rest on the top of the vivarium) with glass or transparent plastic sheeting (to maintain the right sort of micro-climate) and the other half with mesh screen. A hole, closed by a bung, may be cut in the screen to allow for the introduction of winged livefood.

Pairing takes place soon after the green toad comes out of hibernation; that is to say, sometime in March or April. A large female may deposit upwards of ten thousand eggs in gelatinous strings which are draped intentionally, or unintentionally, around submerged vegetation or debris. The eggs incubate within a few days and the tadpoles metamorphose in about three months. A baby *B. viridis* is muddy coloured above and pale below. It feeds on the tiniest of insects. It does not make much growth in the first season of toadhood but lengthens and grows podgier in the second year. In the third or fourth year the green toad is ready to breed.



# British bufonids and some others

by Eric Gillingham

**B**Y the time that you are able to peruse these notes, it is extremely probable that the bathing-season of the British toads will be in full-swing.

Like the "common frog"—now, alas!, anything but common in many of its former haunts—the toads react to the stimulus offered by the first of the signs of the Zodiac—which is Aries the Ram, and they resort to the ponds and shallow lakes with that same apparent witless enthusiasm for astrology which is characteristic of many of the spellbound followers of the popular press; unfortunately these latter folk do not actually "jump in the lake!"

Be this as it may, the fact is that within ten days or so of the spawning of the common frog (*Rana temporaria*)—which event is controlled to some extent by the vicissitudes of our recalcitrant climate—the toads "take the plunge" sometime between the last two weeks of March and the first two of April, in accordance with the prevailing weather conditions.

Protocol seems to demand that the frogs take priority; but despite the fact that both often share the same sheet of water, it is noticeable that the actual deposition of spawn takes place in different localities, and that the growing tadpoles seldom intermix.

Toad tadpoles are readily distinguished from those of the frog by their sooty-black colour and their smaller size; they are also much more gregarious in the later stages of their development and are, of course, far easier to catch with a net than the relatively fast-swimming frog tadpoles; I am referring specifically to the well-grown larvae as both kinds are not at all mobile for some five or six days after hatching.

During most of the year, the prevailing imbalance between the sexes of the common toad (*Bufo bufo*) is readily overlooked but at this time one can scarcely fail to remark the large number of superfluous males. These are recognisable by their slender outlines, small size, light greeny-buff colouring, and by the mere fact that most of them are single. Any female actually taken from the water at this time, will almost certainly be in amplexus with a successful male, or indeed, males—I have known healthy gravid females to perish miserably beneath a heaving mass of excited males, whose clinging-reflex is at this time so strongly marked that they will often pile on to one wretched female, or sometimes even on to one another, and half-a-dozen, obstinately refusing to relinquish their hold, can quite easily exhaust the more stoutly-built female, and in the end, she dies, it would seem, from drowning! I have seen this occur but in fairness to the actuarial analysis, it should perhaps be mentioned that the balance tends to be restored by the puzzling fact that literally scores of unattached males are found dead in the water every April. These pitiful cadavers are usually rather

emaciated in appearance but are otherwise totally undamaged; and here, surely, is something for the field-workers to get their teeth into—it seems to me not unlikely that this phenomenon is in some way related to the sex-changes which have been frequently observed to take place in developing toads, subsequent to metamorphosis, and often between the third and fourth years of life.

The common toad differs in some respects from several of its nearest relatives, in the possession of two oviducts which, naturally, give rise to double strings of gelatinously-coated black eggs, and the male and female both lack the sub-gular vocal-sac which is employed by some male bufonids in order to practise "singing". However, both sexes are able to produce a quiet croak which sounds somewhat like an embarrassed diner endeavouring to suppress an involuntary eructation. As far as Europe is concerned, the common toad is probably the most successful of all the anura. Except for the frigid areas of the extreme north, it ranges throughout the palaeartic region but it is surprisingly absent from Ireland, Corsica, Sardinia, and the Balearic Islands.

In the case of Ireland it is replaced by the Natterjack (*Bufo calamita*) which is to be found only in County Kerry in South-Western Ireland, but there seems to be a strong argument in favour of the supposition that this occurrence is the result of deliberate introduction by some unknown enthusiast.

Whilst we are dealing with the "rush toad", sometimes called "running toad", it would be as well to compare this lively little member of the genus *Bufo*, with some of its continental relatives. But first let us take a brief look at its distribution in modern England.

Nowadays, the Natterjack is largely a Midland and Western-County toad although formerly it was quite common in certain southern localities (it is still to be taken locally in Surrey and Sussex, but you must know the spots).

I possess a copy of a book published in 1839 from the pen of one Thomas Bell, F.R.S., entitled "British Reptiles", in which the author quotes the Natterjack as "common on Putney Heath" and "abundant on Blackheath and around Deptford"! Today, one would scarcely expect to encounter anything more entertaining than a few hundred pairs of voters in these localities. However, it really is abundant in parts of Lancashire. I have secured more than a score on the Ainsdale golf course—just outside Southport, within the hour and I should mention that thereabouts the common toad is equally abundant.

Closely allied to the Natterjack, but not to be found in Britain, is the green toad (*Bufo viridis*) (see *The Aquarist*, March 1967). If you are in any doubt about the identity of any specimen caught on the continent (i.e. whether

Natterjack or green toad) east of the river Rhine and anywhere from Southern Sweden to North Africa, have a good look at the undersides of the fore-legs: if the sub-articular tubercles at the conjunction of the digits on the feet are *one* single row, then the subject is a green toad—Natterjacks' tubercles are paired, that is to say they form two rows. Both these toads prefer to live in sandy surroundings and will thrive on a diet of almost any *moving* insects; once again do *not* rely exclusively on mealworms or indeed, upon *any* one particular dietary item.

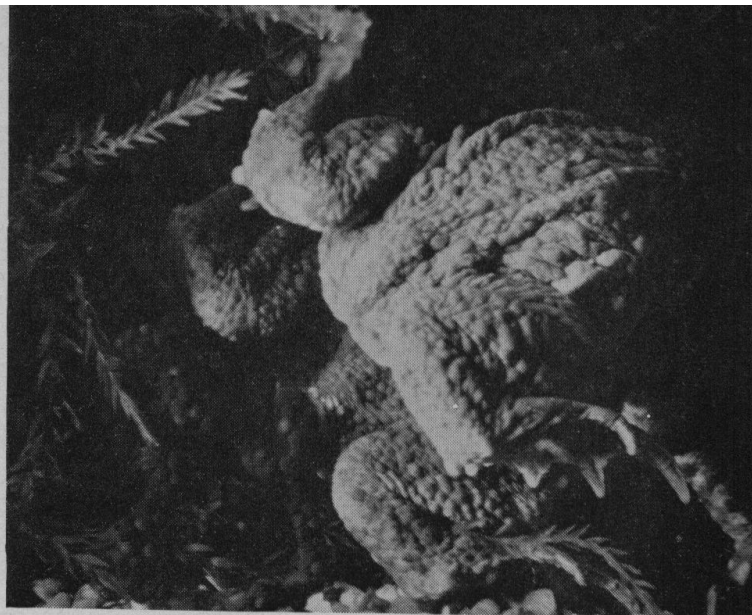
Two more sand-loving toads that appear from time to time in the dealers' lists are the Moorish toad (sometimes called the panther toad (*Bufo Mauritanica*)) and the Abyssinian toad (*Bufo regularis*).

The former is from North-West Africa—Algiers to Morocco, and may easily reach 4 inches in length. The males have a well developed sub-gular vocal-sac, and are inclined to be noisy in the early part of the year.

This one may be distinguished from the rather similar Abyssinian toad by means of close observation—it lacks the tiny spines on the warty tubercles of the dorsal surface and (usually) lacks also the faint yellow median line running along the vertebral column. West African specimens of *B. regularis* are inclined to be much smaller than similar aged examples of the Moorish toad; but on the contrary, individuals of this species (*B. regularis*) from the Cape area occasionally run to five-and-a-half or even six inches.

Both these toads tend to reject large earthworms, and

Toad spawn festooned among water plant

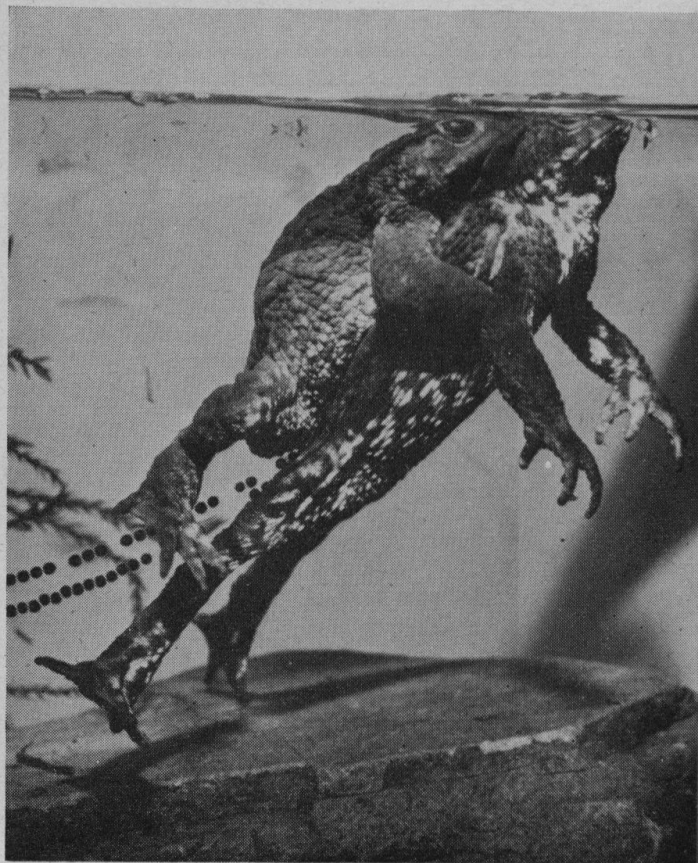


Rear view of toads in amplexus showing spawn being exuded

often adopt the defence-position, standing with abdomen fully inflated and limbs straight up from the ground like props, and it seems to me that they fail to distinguish between large earthworms and snakes!

Of course, if you really care for the genus *Bufo*, the daddy of them all is, without doubt, the so-called marine toad (*B. marinus*) from the Neo-tropical region. Originally found from Mexico to the Argentine, it has now been introduced into Cuba and Florida, apparently because,

Note double string of spawn

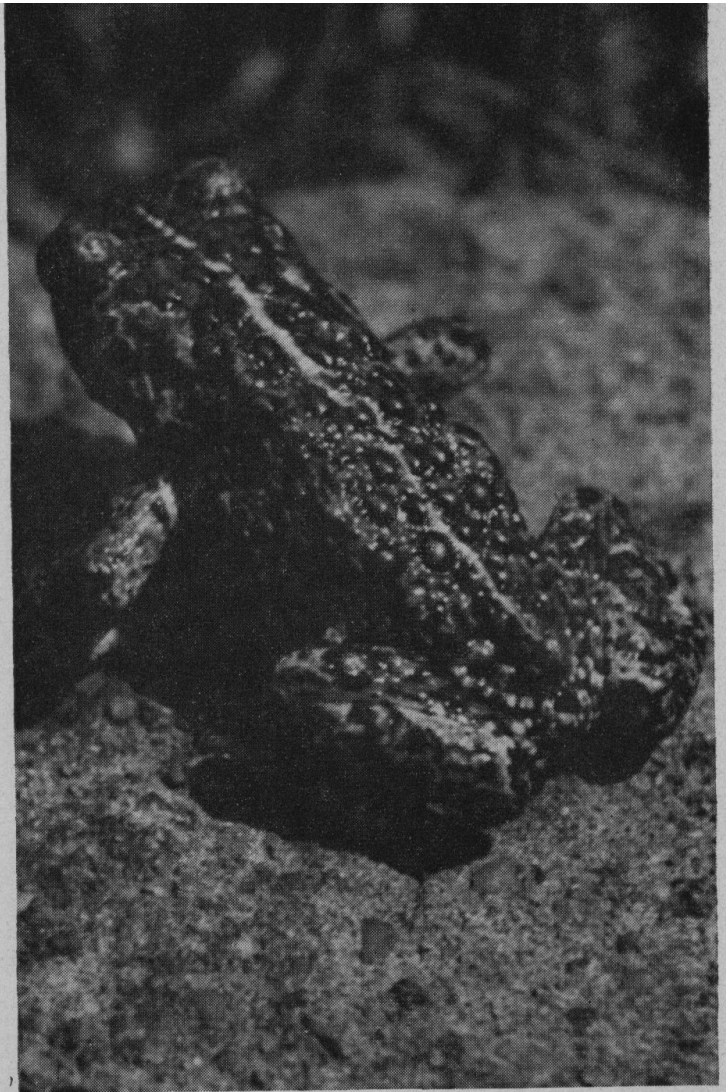


despite its immense bulk, it is ready to consume mosquitoes!

It is strange, indeed, that this monster customarily hops when you would expect it to crawl, and seems to prefer small insects to larger prey. One that I kept, refused to have anything to do with mice—even little “pinks”, and subsisted entirely upon bluebottles, woodlice and meal-beatles (*Molitor*) whereas a very large common toad from Southern Italy, measuring about four inches in length and weighing less than half of the marine toad's bulk, eagerly swallowed short-tailed field voles when ever the opportunity afforded. By the way, these giant toads from South America are coming on to the market more freely just now and if you are tempted to purchase one, please remember that those huge parotoid glands are *functional*. Although the big toads soon settle down and seldom appear to resent handling, they do occasionally exude an extremely noxious, white sticky fluid from these prominent glands and if perchance you have a quite small cut or minor abrasion on your hands you will suffer accordingly. In these circumstances there is no danger of fatality, but there is the probability of acute and continuous discomfort; you have been warned!

A very common misconception regarding the nurture and culture of toads, is that the larger the subject the greater the area to be provided. Now this idea, at first sight more-or-less self-evident, can be completely misleading; it all depends upon the specific requirements of the creatures involved. For instance, most of the larger

Continued on page 21



Natterjack toad  
showing median  
line on back



*Bufo marinus*—  
grand daddy of  
them all

# British bufonids and some others

bufonids spend all day concealed in some chosen spot, emerging at night only for the purpose of satisfying their appetites and are well satisfied if they do not have to move far in order so to do. On the other hand, many of the very active small members of the allied genera (particularly those such as the little discoglossid toads, which are almost completely aquatic in their behaviour—though they do *not* need much water—being well content with an inch or two) require upon the whole relatively greater areas to exploit.

Whenever you contemplate the purchase of imported specimens of any of the tailless batrachians, particularly of the larger toads, please examine the eyes and the nostrils closely. There are at least two kinds of parasitic flies which are accustomed to laying their eggs in the external orifices of the nostrils. The two most common offenders are *Lucilia bufonivora* and *Calliphora silvatica* both of which are to be found here but are much more commonly found on the mediterranean and North African terrains.

The attack results in the tiny maggots eating their way, via the internal nostril into the brain of the host and blindness is often a terminal feature, but a close scrutiny will reveal characteristic swellings on the top of the head and often the eyes are occluded completely; the prognosis

of any specimen so afflicted is grave indeed!

To the family Discoglossidae (note that despite their external appearances they are not Bufonids) we have already made a passing reference, and indeed for the adventurous beginner in vivarium-keeping, these very active little batrachians are an obvious temptation.

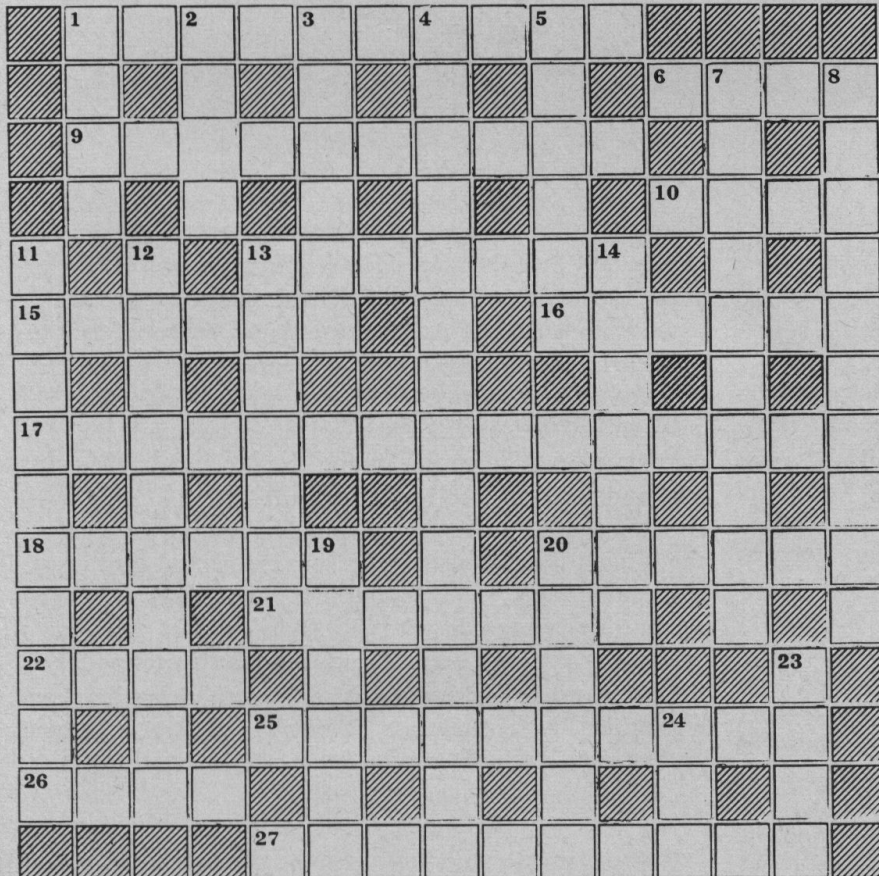
In the first place, they are nearly always available from dealers' lists, and secondly, they are relatively inexpensive.

The two which spring most readily to mind are the fire-bellied toad (*Bombina bombina*) (formerly *B. igneus*) and the yellow-bellied toad (*B. variegata* formerly *Bombinator pachypus*). Both of these remain in, and around shallow water all their lives and for this reason alone make excellent vivarium tenants. They are easy to sex, as the male alone has the toes webbed right up to the tips; he also develops the usual dark, horn-like projections on the inside of the fore limbs.

In the case of the fire-bellied toad the male possesses an internal vocal-sac, and the throat inflates noticeably when he is calling.

With the yellow-bellied toad there is no vocal-sac—although, like the common toad he manages to croak, and during the mating-season the rough tubercles appear upon the third finger and also upon some of the toes.

## The AQUARIST Crossword Compiled by L. BRADLEY



### CLUES ACROSS

1. Produced in the artificial culture of infusoria (10).
6. Bird found in the crib is similar to the one that brings the baby (4).
9. Type of fish not reaching first or second place at the show (5, 5).
10. — of Roses (4).
13. Canned fish? (7).
15. Fairness (6).
16. Spread out (6).
17. Fanwort (7, 8).
18. Daughters of one's sister or brother (6).
20. Arithmetic that can be done in one's head (6).
21. Precedes, removes quietly and withdraws (7).
22. The goat to be found among nine (4).
25. Larva of the water beetle (5, 5).
26. Despise the heat change (4).
27. Put together again (10).

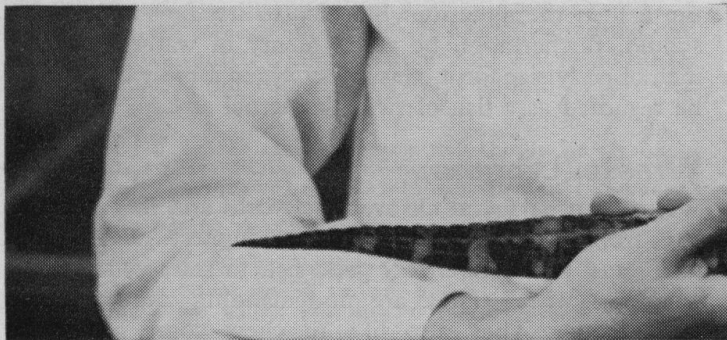
### CLUES DOWN

1. Quietly change head gear and tread on it (4).
2. Artist in the wet (4).
3. Twelve noon (6).
4. Bronze Catfish (9, 6).
5. Not tied up (6).
7. Act a pet bit (Latin anag.) (5, 5).
8. Livebearers having weapons in their caudal fin (10).
11. *Hemigrammus ocellifer* (6, 4).
12. Home of *Anabantid* Fry (6, 4).
13. Wicket keeper (7).
14. Breathes out (7).
19. Seated (7 anag.)
20. Courage (6).
23. Genuine (4).
24. Diminutive of large rock (3).

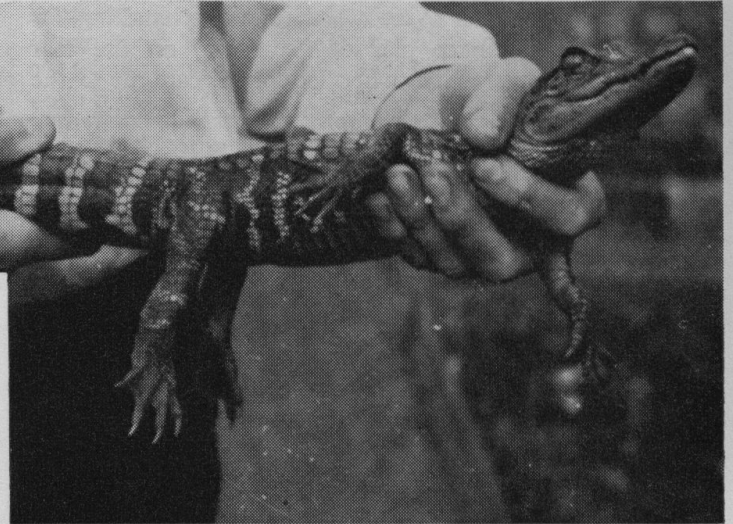
Solution on page 26

# Rearing young Caymans

by M. Peaker, B.Sc.



A Mississippi alligator—a relative of the caymans



SINCE measures were taken to protect the Mississippi Alligator (*Alligator mississippiensis*) in the U.S.A., the most commonly imported crocodylians are the South American Caymans particularly the Spectacled Cayman (*Caiman crocodilus*) which was for many years known as *C. sclerops*. It is so-called because the eye sockets appear to be connected by a ridge giving the owner a bespectacled appearance. Incidentally, the correct plural of cayman is caymans and not caymen as is so often seen. To the pet-trade they are usually simply "alligators" but this title is reserved for the Mississippi and Chinese species although caymans do belong to the same family—the Alligatoridae. The size of imported specimens varies from about eight to twelve inches but the fully-grown length of this species is from five to six feet and it is well worth remembering this before buying these animals. Several years ago there were far more medium-sized ones than could be accommodated in zoological gardens and many owners had difficulty in finding a home for their animals when they became too large.

It is unfortunate, if not criminal, that a great many of these delightful reptiles find their way to pet-shops whose owners know little (and in many cases are willing to learn less!) of their requirements and that many are then purchased by people in a similar ignorant state and who can get little advice on their care. It is hardly surprising that many fail to survive for more than a few weeks. Most deprecable, I think, was a notice that I saw in an East Midlands pet shop several years ago stating that room temperature was satisfactory for these animals and that they were guaranteed not to bite. They were housed in a tank without heat and containing far too much water. In consequence, they were floating on the surface in a semi-torpid condition. Reliable animal dealers usually have healthy caymans.

I think the best way to keep young crocodylians is in an aquarium tank until they reach a length of about two feet or even less when a similar arrangement to that used in many zoological gardens would be more convenient; that is, a heated pool with a beach for basking under the sun or a lamp. This, of course, would be more expensive to

set up and keep at the necessary temperature.

A tank two or three feet in length and fifteen to twenty inches wide is suitable for several specimens until they outgrow their quarters. One third of the space should be land and the remainder should contain only a few inches of water as they appear to like the feel of their feet on the bottom (this is probably a protection against predators which lurk in deep water). I have used pieces of sandstone for the land area but firmly fixed wood is often suggested and would doubtless prove satisfactory. Heaped gravel is most unsatisfactory as it is difficult to clean and is soon pushed into the water area. Rocks usually remain where they are put and are fairly easy to clean especially if two sets are available and are alternated at each cleaning-out. The dirty ones can be scrubbed and left in the sun until required again. The water level will often need to be brought back to normal owing to the high evaporation rate.

An ordinary aquarium heater and thermostat (I prefer the combined type) can be used to regulate the temperature to 80-85°F during the day although the night temperature may fall to 65°F. The tank should be covered—partly by glass to retain heat and a high level of humidity and partly by perforated zinc to allow air to enter and prevent escapes. Floating plants may be placed in the water as some specimens may prefer to hide under vegetation just leaving their nostrils and eyes above water. During winter days or if there is no access to direct sunlight, an electric lamp may be carefully suspended over the animals for several hours each day. Similarly an ultra-violet lamp can be used but only for a few minutes daily. In both cases I am inclined to give some form of shelter that the animals could use if they desired. The heating equipment should



# Book

# Review

be installed and checked several weeks before the arrival of specimens as I have lost several in cold weather owing to the thermostat sticking in the "off" position and in future alarm systems will be installed to give warning of falling temperatures. The heaters should be protected against knocks by wrapping them in perforated zinc or enclosing them in a wooden frame before being fastened to the side by suction holders.

Feeding presents few problems and although it is often stated (perhaps erroneously) that fish is the main food in the wild, mammalian food is preferred in captivity. Mealworms are often rejected but earthworms, large insects, tadpoles etc. are taken. Ours are usually fed on a variety of food with meat as the main part of the diet. This is cut into small pieces and fed to the tame specimens from forceps or placed at the water's edge. Provided that the temperature is sufficiently high, little difficulty should be experienced in feeding. Small dead mice are very good as they contain many essential dietary factors. A few small round pebbles should be provided as they are often swallowed by crocodilians perhaps to aid in the grinding of food, perhaps as "ballast" in swimming. My Mississippi Alligator was seen to swallow stones and soil during his first few weeks with us.

A little cod liver oil should be added to the food at regular intervals either as liquid, which tends to be messy, or as capsules which can be pushed into the meat. Powdered calcium phosphate or a proprietary calcium additive should be sprinkled on to the food at the same time that cod liver oil is given. This oil containing vitamin D aids the absorption of calcium from the intestine thereby preventing rickets to which many young animals are particularly susceptible. A multivitamin preparation, "Abdec" (Parke-Davis) for example, can also be given on the food—a few drops each week.

Green tanks are beneficial to health as the algae taken in with the food is a valuable source of many vitamins and their chemical precursors. There is, however, a difference between a green tank and a dirty tank containing putrefying meat and faeces. Occasionally the animals should be scrubbed clean for which purpose a tooth brush is ideal. Their teeth and mouth should at the same time be brushed gently with weak salt water.

I know of only one person who has tamed a cayman sufficiently well to handle without it biting (they are far more difficult to tame than Mississippi Alligators). Even then the specimens were handled daily. It has sometimes been said that excess handling is injurious to health, so obviously the keeper must use his own discretion. If treated properly a young cayman may well increase in length by fourteen inches per year.

A young cayman should cost from twenty-five to thirty-five shillings depending on the time of year, size etc. but it is inadvisable to transport them or have them sent during cold weather as they are extremely susceptible to a sudden decrease in temperature and death may easily result.

These young crocodilians are extremely good tropical reptiles for the novice to keep and are easily cared for once a few basic facts are known. They should be of great interest to their keepers.

**'Diseases of Aquarium Fish'** by Gottfried Schubert. Translated by Gwynne Vevers. Studio Vista. 10/6d.

DR. SCHUBERT'S contribution to the Aquarium Paperbacks series will certainly prove a valuable addition to the serious aquarist's library. After a brief run-through of the tools for the job (nets, the basic equipment for dissection, lenses, measuring cylinders and so forth), followed by some useful information on compiling a file of case histories for future reference, and the painless destruction of fish (for humane reasons or to stop the spread of infectious disease), the author, by the inclusion of a chart called "A guide to diagnosis", and a table of recommended drugs, makes conveniently possible the easy recognition and treatment of many of the major and minor illnesses that trouble captive fish. Between the chart dealing with diagnosis and the table of drugs are interestingly written sections devoted to parasitical and non-parasitical diseases. There are, too, sections covering the preparation and use of drugs, and the steps to be taken when no diagnosis can be made. Preceding the adequate index is a section headed "Prevention is better than cure". This part of the book should prove of especial benefit to the beginner.

One may not agree with all that Dr. Schubert writes (for instance, while on the subject of the danger of collecting live food from ponds he says: "Tubifex is a problem, for without it an aquarium could scarcely be kept through the winter". The reviewer, like thousands more, makes do very well with scraped red meat, whiteworms and a top-grade dried food), but one cannot fail to be grateful to the author for the research he has undertaken and for his skilful presentation of the subject. 27 fine line drawings and four photographs illustrate the text.

**'Aquarium Care'** by Guntha Sterba

ALL aquarists who own *Freshwater Fishes of the World* by this author will waste no time in possessing themselves of this indispensable companion volume which is produced in the same superb style with exceptional colour and black and white photographs.

The two volumes of the original German edition have been compressed into one volume which is basically divided into three parts. The first of these covers the technicalities essential to the aquarist who aims at successful management of his tanks and also embodies an introduction to basic biology to assist him in his investigations within this field.

The second part deals with fish diseases, their causes and visible symptoms; how to examine ailing fish and the measures to take for the avoidance of disease outbreaks.

The final section comprises a systematic and thorough account of all the marsh and aquarium plants that have been introduced into the aquarium world with detailed descriptions of conditions necessary for their cultivation.

Over five hundred pages of reliable and necessary information presented in a fashion which makes this book a joy to browse through.

# An outdoor reptile collection

by M. Peaker, B.Sc.

## 1. The Snake Pit

IT is the ambition of most amateur keepers of reptiles and amphibians to own at least one outdoor reptiliary on the lines of those seen in zoological gardens and research establishments. The construction of outdoor enclosures and the maintenance of their inhabitants is a fairly simple matter and in a series of articles I shall attempt to describe how enclosures may be constructed and furnished to house snakes, lizards, terrapins, tortoises and amphibians.

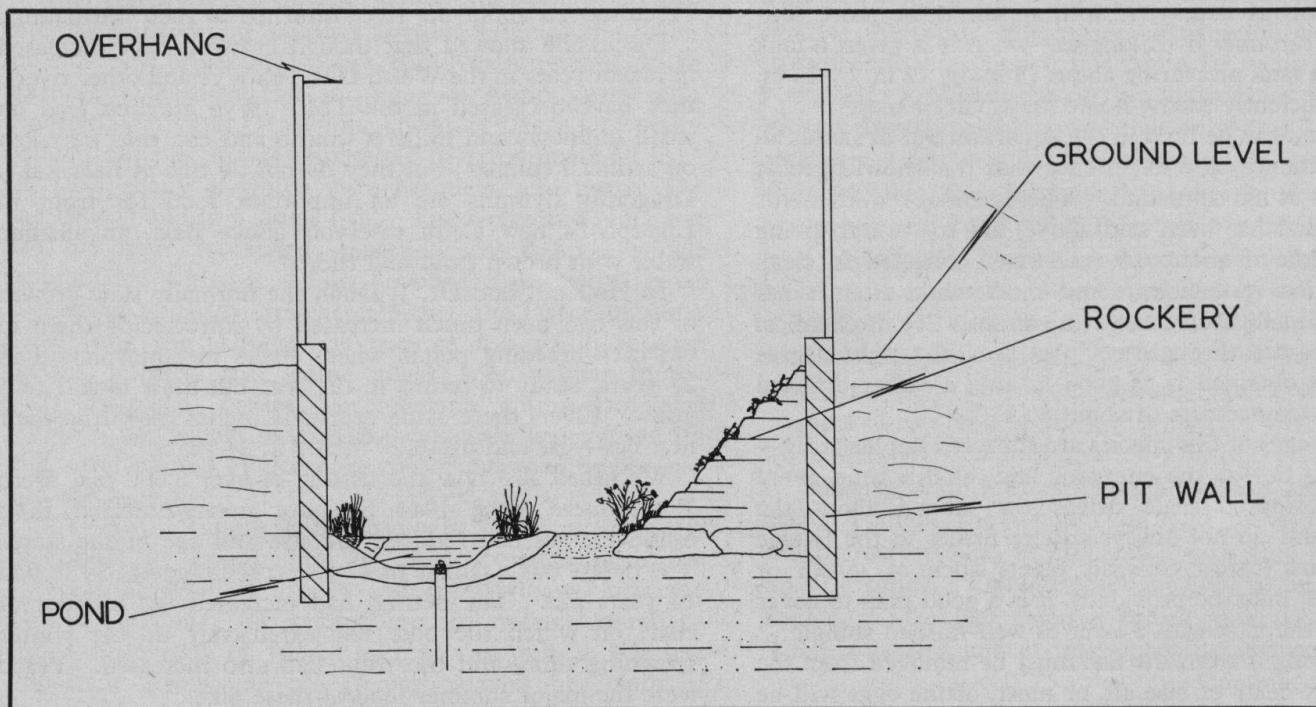
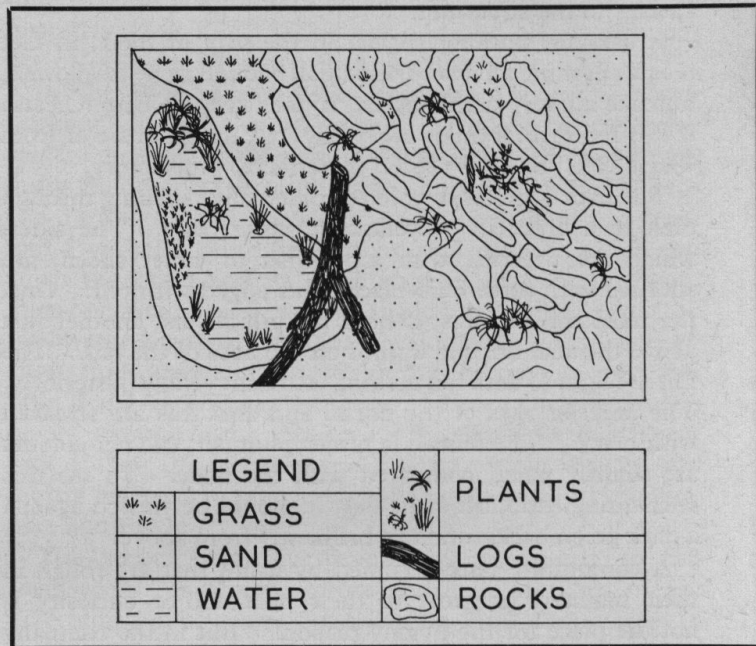
A typical design for a snake-pit type of reptiliary is shown in the diagrams. I strongly suggest buildings as large an enclosure as space and funds will allow so that the interior may be laid out to form a 'natural type' of rockery facing south. Plants can be grown so that in several years the whole construction has a weathered appearance. The first reptiliary I built was three feet by four feet which was rather small. A second (seven feet by four feet) was more suitable but I would have preferred one that was even larger. A point to bear in mind when choosing the site is that a well-drained area should be chosen so that dampness can be avoided.

### Construction

The most strenuous part of the job is excavating the pit to a depth of three feet or more. A further area should then be dug out and filled with rubble to make an effective soak-away for the pond. Over this a shallow concrete pool can then be constructed in the usual way. A drain from the pond into the soakaway is essential for ease of cleaning.

When the pit walls have been built of concrete, breeze blocks or bricks and mortar, the whole pit can be covered with a five inch layer of ballast for drainage. I cannot over-emphasise that the walls must be snake-proof and this means checking and doubly-checking that every crack is filled with cement.

The rockery can be built of any rock preferred. I have always used sandstone and left large soil-filled gaps in





The grass snake—*Natrix natrix*

which plants can grow and thrive. Logs can be positioned and small shrubs can be planted in the centre of the pit but all plants should be kept trimmed down to prevent the inhabitants using them as a ladder to scale the wall.

I strongly suggest building the pit in late summer or autumn, allowing the concrete of the pond to mature and the plants to settle. In the following spring the first inhabitants can be introduced after the upper walls have been built. For the walls I have always used hardboard securely fastened to wooden frames. With sufficient paint I have had walls still in use after seven years. The shiny surface of the hardboard should face inwards and an effective seal should be made between the bottom of the frame and the pit walls. I suggest that the height of the walls should not be less than three feet six inches. An overhang is useful not only to keep the inhabitants in but as a ledge to support a wire netting-covered frame—to keep the neighbourhood cats out.

#### Other Features

Depending on circumstance it may be desirable to build hibernation chambers into the rockery. They should be frostproof and therefore at least a foot below the surface and must also be in a very well-drained position. The entrance via a drain-pipe should be protected so that rain cannot run in. I prefer the chamber to be made of thick concrete with a heavy close-fitting lid which will very rarely need to be removed. Thick layers of moss can be left over the entrance in winter to reduce but not prevent the turn-over of air inside.

Another useful feature to observe specimens which are active at dusk or by night is a blue light over the structure which can be switched on at will. The lamp and the fittings should, of course, be suitable for outdoor use.

In the second article I shall describe and discuss some of the species available which are suitable for this type of structure.

## More fish on stamps

continued from page 129

included the small Egyptian Mouth-breeder *Haplochromis multicolor*; *Ctenopoma acutirostre*, the African Climbing Perch, which in the wild often leaves the water (although not to the extent of climbing trees as is sometimes related); *Channa obscura*, another walking fish; the six-banded Panchax; Gunther's Fundulus; and *Nannaethiops umitaeniatu*s, the African Tetra, an excellent aquarium fish of small size and hardy disposition, attractive and friendly, which breeds easily and eats almost anything.

On the Arabian Gulf, the little sheikdom of Umm Al-Qiwain has this year also catered for collectors with an even longer series of 27 multicoloured labels illustrating a variety of tropical fish of the local waters—too many to consider here. More modest in their output were the authorities of the French Somali Coast among whose stamp subjects last year were the graceful and brilliant Regal Angelfish, *Pygoplites diacanthus*; the damsel or clown fish *Amphiprion ephippium*; the squirrel fish *Holocentrus spinifer*; a Surgeon Fish and the colourfully fearsome lion fish, *Pterois lunulatus*, whose sharp dorsal spines contain poison.

Across in South America, Colombia's contribution to our theme last year included miniatures of an angel fish, *Holocanthus isabelita*, while Venezuela issued a set of six stamps, colourfully printed in Berlin, showing freshwater fishes of the region. Those depicted were the Chocolate Cichlid *Astronotus ocellatus*, known also as Peacock-Eye, an attractive fish but one whose size (12 in.) is unfortunately too large for the domestic aquarium; *Cichla ocellaris*; *Serrasalmus notatus*, native to the Orinoco, another fish only for the specialist, being the most bloodthirsty of all freshwater specimens; *Chilodus punctatus*, by contrast small and peaceful, which spends most of its time in a vertical position, head downwards and is popularly called the Head-standing Fish. The set was completed with the interesting little swordtail characin, *Corynopoma riisei*, and the dwarf butterfly cichlid *Apistogramma ramirezi*.

On the European stamp front, Albania, Roumania and San Marino are among those recently presenting through the post many diverse forms of marine life. The countries of Eastern Europe are prolific in their stamp issues as much for philatelic as for propaganda purposes. East Germany's multicoloured half dozen devoted to aquarium fish last November included *Cichlasoma cyanoguttatum*; the Blue Gularis *Aphyosemion coeruleum* and *Colisa chuna*, one of the gouramis.

The latest offering from Poland is a set of nine artistic and colourful miniatures of exotic fish from the South Seas. This beautiful philatelic aquarium contains several members of the family *Chaetodontidae*, the butterfly fishes *C. ephippium*, *C. fasciatus*, *C. melanotus* and *C. melapterus*; the showy yellow and purple *Pomacanthus imperator* and the spotted *P. semicirculatus*; the orange striped trigger fish *Balistapus undulatus*; another trigger fish, *Rhinecanthus aculeatus*, with pride of place for *Balistoides conspicillum*, perhaps the world's most beautiful fish.

# Snakes for the snake pit—Part 2

by M. Peaker, B.Sc.

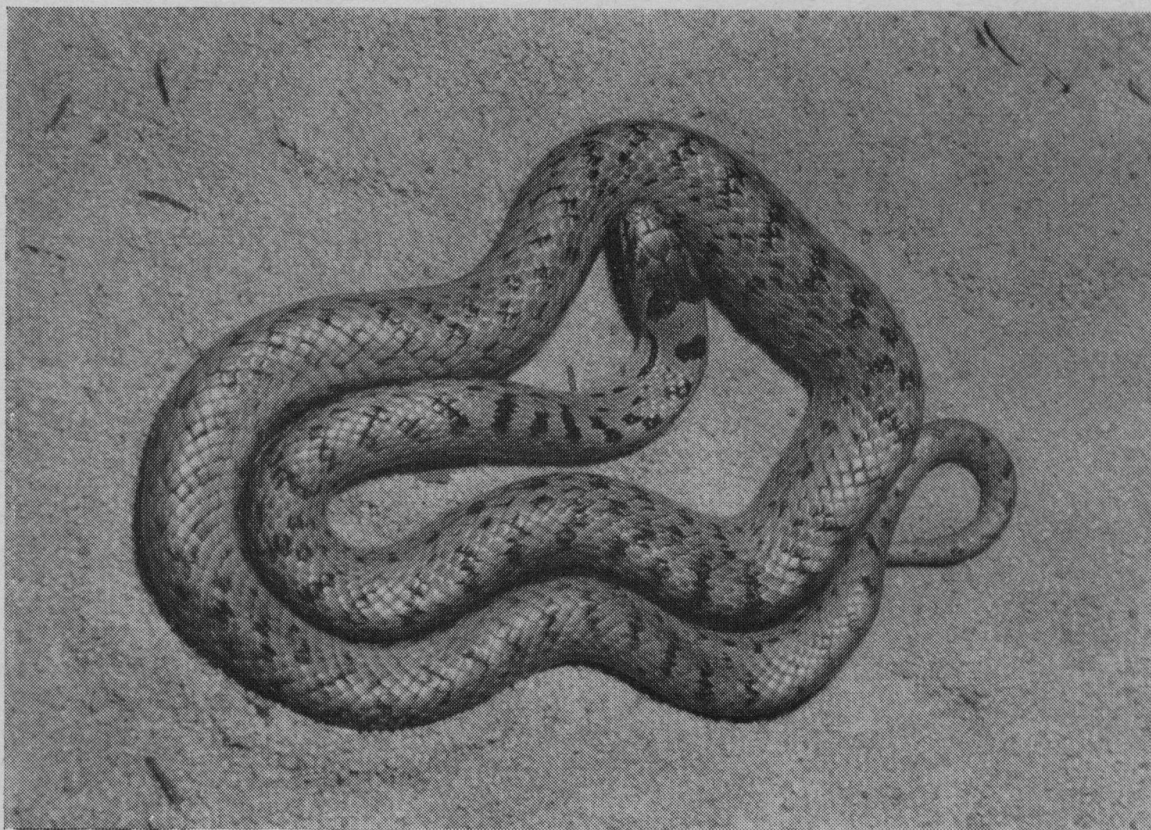
**I**N the first article of this series I described the design of a snake-pit. In this article I shall describe some suitable inhabitants for this type of reptiliary.

The majority of types suitable for outdoor life in Britain are either European or North American. Apart from climatic considerations, length is an important criterion

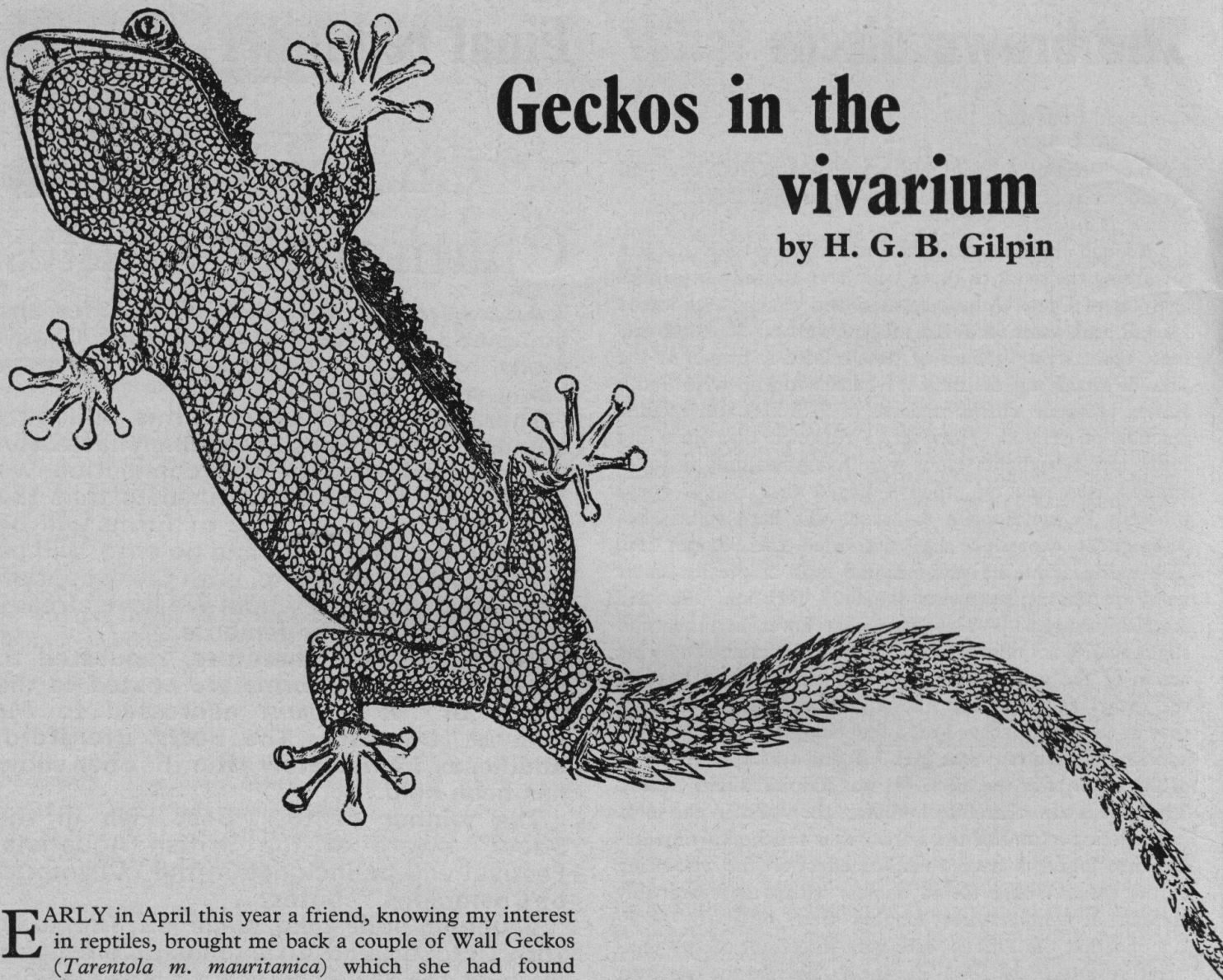
as the walls around the enclosure may perhaps only be three feet high. I do not advocate the keeping of venomous



Grass snake  
(*Natrix natrix*)



Smooth snake  
(*Coronella austriaca*)



# Geckos in the vivarium

by H. G. B. Gilpin

**E**ARLY in April this year a friend, knowing my interest in reptiles, brought me back a couple of Wall Geckos (*Tarentola m. mauritanica*) which she had found running up and down the walls and scampering across the ceiling of her bedroom in Malta. They travelled in a small wooden box, with a perforated lid, and survived the journey in excellent condition.

On arrival the geckos were placed in a 16 inches long by 11 inches wide and 11 inches high, all glass tank, covered at the top with two sheets of glass, so adjusted as to provide a small air vent. The floor of the tank was covered with fine gravel to a depth of one-and-a-half inches upon which was arranged a gently sloping, bark covered, log and a small piece of turf. Some large brown moths, caught in a trap and transported successfully in a cellophane bag, were introduced as food.

These geckos are interesting little animals with the curious habit of flattening themselves against any surface with which they may be in contact, pressing themselves so closely against it that their elbows protrude above their backs. Sometimes they appear to be most content when they can feel pressure all around them and delight in wedging themselves into a fissure in the bark, between two stones or between the log and the glass wall, remaining completely still, so much so, that they ignore insects which

may crawl near or even over them. At other times they will spend hours clinging to the vertical glass walls of the tank or to the underside of the cover, in full view of an observer.

The larger of the two is six inches and the smaller four-and-a-half inches in length. In colour they are sandy brown on the dorsal surface, with a yellowish tinge on the front parts shading to pinkish towards the posterior end, mottled with darker brown, which same colour continues in circular bands along the length of the tail. The ventral surface is a uniform pale grey merging into creamy yellow at the edges.

They have considerable powers of camouflage, their skins changing from light to dark according to their surroundings, so that when wedged against a furrow in the bark they become almost invisible. Their habit of remaining utterly immobile for considerable periods during the daytime adds further protection against detection by possible enemies.

The greater part of the body is covered with tiny, raised nodules and the tail is protected by longitudinal rows of sharp pointed scales. The triangular head, wider than it

is long, is large in proportion to the body and the staring, basilisk eyes with their pale yellow irises and vertical, slit like pupils protrude above the surface. The expansive mouth contains a broad, pink tongue which when extended from the side of the mouth is long enough to reach above the eyes. Indeed they seem to use this organ for keeping the eyes free from foreign particles. A hole leading to the auditory passage is visible on either side of the head behind the eyes.

Each foot, both fore and hind, carries five toes. Their spatulate tips, bluish on the underside and acting as suckers, enable the animals to run at astonishing speed up a vertical sheet of glass and to move effortlessly across the underside of the cage cover.

To begin with the tank containing the geckos was placed on a table in front of the window in a room warmed by a fire but not centrally heated. It soon became apparent that such conditions were far from satisfactory. Daily the geckos became more lethargic and in spite of an abundant supply of insect life they were not seen to eat anything. After five days it was possible to place a hand in the cage and touch one of them without it moving away. Obviously this was a danger warning indicating the necessity for immediate action.

A new cover was prepared, this time of hardboard, edged with one inch square wooden strips so that it fitted snugly over the top of the tank. A three inch by three inch piece was cut out of the hardboard and replaced with perforated zinc to provide ventilation and an electric light bulb socket, connected to the mains, screwed to its underside. A 25 watt bulb was fixed in the socket and the current switched on.

Within a matter of hours a marked change took place in the geckos. Stimulated by the warmth of the bulb, their almost comatose condition was replaced by a welcome return to vitality. No longer was it possible to touch them. Although entirely undisturbed by anything, moving or stationary, outside the glass the insertion of a hand and near proximity of a finger provoked in them an incredible outburst of activity. They flashed across the gravel, over the log and around the sides of the tank almost too quickly for the eye to follow.

This resurgence of energy, whilst extremely gratifying, produced its own problems. The slightest raising of the lid in order to put something into the tank was fraught with danger of the geckos disappearing over its edge. Also, since much of the food supplied was winged and itself active, it became increasingly difficult to introduce more insects without those already present escaping.

Fortunately, the solution to this problem was a simple one. A hole, large enough to admit a hand, was cut in the hardboard lid and one end of a nylon net sleeve attached to its edges. The other end of the sleeve was closed with an elastic drawstring. This device worked admirably and any necessary attention to the tank can now be made without difficulty.

The day after the heating element was installed the larger of the two geckos was seen to eat two insects and since then both have been feeding regularly. As wide a variety of food as possible is supplied, including meal-

worms, moths, spiders, beetles, young stick insects, blowflies and locust hoppers. The last two seem to be the most popular and on this diet the geckos are thriving.

About a fortnight after the geckos were provided with a higher temperature the larger began to slough its skin. The process took several days to complete. Much of it came off in large, pure white patches, impressed with every indentation of the skin. The skin of the tail was the last portion to be lost and this was shed as a complete unit.

When frightened, wall geckos emit a long squeak of protest. So far ours have not uttered a sound, which perhaps suggests they have found nothing to protest about!



A clutch of Gecko's eggs

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## *Potamogeton crispus*

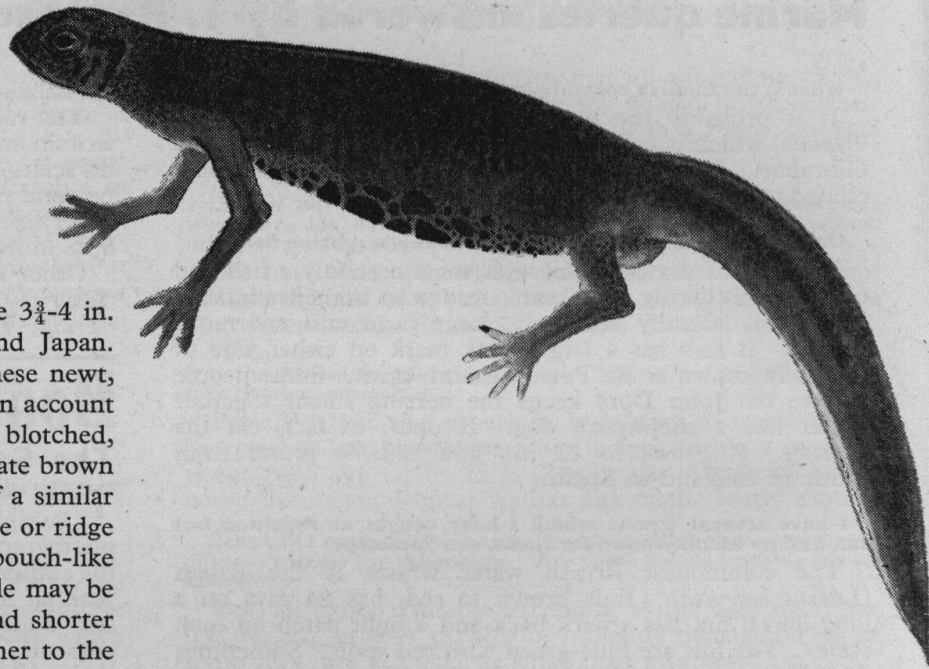
by B. Fry

**T**HERE are no species of submerged plants more easily cultivated in a garden pond than the coldwater potamogetons, and among the finest of the several species to be found in the wild in this country, or listed in the catalogue of a nurseryman specialising in aquatics, is *P. crispus*, commonly called the curly or curled pondweed on account of its wavy-edged leaves, which attain a length of about 3½ to 4 in., and a width of about ½ in. In colour they are a lovely translucent greenish olive that soon becomes suffused with red under a strong light. They grow alternatively along the branching stems. *P. crispus* is brittle, but any pieces snapped off the stems will soon grow into new plants if they are anchored to the bottom. Like lots of aquatic plants, *P. crispus* flourishes most luxuriantly in a bed of clay or non-fibrous yellow loam.

Apart from its decorative charm, curled pondweed is of immense value to the pondkeeper. First and foremost it is an oxygenator. It is also a heavy feeder and provider of shade. These two qualities help to keep free-swimming algae at bay. It will even do well in the indoor aquarium, provided the light is long and bright and the temperature does not rocket much above 65°F. (18°C.) in warm, sunny weather. As a spawning plant it attracts the attention of goldfish as well as frogs and toads.

# The Japanese newt

by Jack Hems



ONE of the prettiest newts imaginable is the 3 $\frac{1}{4}$ -4 in. *Triturus pyrrhogaster* from N.E. China and Japan. Although it is commonly called the Japanese newt, it is also known as the red- or fire-bellied newt on account of its fiery coral underparts, which are spotted and blotched, especially around the margins, with a rich chocolate brown inclining to reddish. The rest of the body is of a similar reddish brown hue. Both sexes have a raised line or ridge extending down the middle of the back, and a pouch-like swelling around the vent, but in general the male may be distinguished from the female by his slimmer and shorter body and more noticeable bulge between or rather to the rear of the hind legs.

The great attraction of the Japanese newt, apart from its decorative charm, is the ease with which it may be kept in a small tank. Unlike our native newts, which seek, and need, some moist secluded lurking place on land as soon as the breeding season is over, the Japanese newt does not seem opposed to living in water all the year round.

A tank measuring about 14 in. in length is large enough for a pair. It should be furnished with a flooring of washed sand or fine grit, some coldwater plants to provide oxygen, and a small rock with a part of its surface just clear of the water for the newts to clamber over or rest on at will. Although *T. pyrrhogaster* is a hardy creature, with a wide temperature tolerance, common-sense demands that it—or rather its tank—should be protected from exposure to excessive sunlight or icy draughts. Its tank must also have a cover of fine-meshed gauze (painted, if of metal, to afford some protection against rust) or glass raised slightly off the top, so that the newts can breathe but not escape (newts—most newts—are persevering climbers).

The Japanese newt is carnivorous in the widest sense of the word. It feeds in nature on a variety of small aquatic and terrestrial creatures, but in the aquarium it will flourish well on restricted diet of lean meat and earthworms. Food is taken with a quick snap of the mouth. If the first snap misses the mark it is followed by a few more snaps in rapid succession. If these, too, miss the target, all interest in food is lost for the time being.

It is not necessary to offer food (a small earthworm or a thin sliver of meat makes a meal) more than twice or thrice a week. Also, it is recommended that all meat should be offered from the tips of a blunt-nosed forceps. Strict adherence to this practice will guarantee that each newt receives its proper share of food without any meat being left over to foul the water. Which prompts me to say that fairly frequent use of a dip-tube to remove excreta and vegetable wastes will keep the water clear and wholesome for a very long time.

It is rare for a pair of Japanese newts that have been kept in a warm room throughout the year to breed in captivity, for several weeks or a few months of cold, with temperatures as low as the forties (°F.), are necessary to slow down the body mechanism (interest in food and physical activity diminishes with a diminishing temperature) and prepare it for breeding during the longer and warmer days ahead. Expressed another way, a period of semi-dormancy has a recuperative and tonic effect.

A female newt ready for fecundation shows an increase in girth, a marked bloatedness. She is, moreover, more active than usual, climbing in and over the plants and walking slowly about the bottom, with an air of purpose in her gait. Meanwhile the male, made aware of her condition by scent, sight, or some strange telepathy (or a combination of the lot), responds to the magnet of her sexual attractiveness by curling and uncurling his tail, and, every so often, lashing it from side-to-side. Besides this play he frequently raises himself or moves on the sand on the tips of his fingers and toes. I have also seen a male swim on to the female from above and then, after a momentary embrace (or so it seems), slither forward and downward to the floor. Sometime during these amorous friskings he extrudes sperms enclosed in a jelly-like substance which the female discovers, and straddles over. The jelly-like substance or spermatophore adheres to her genital opening and releases the sperms into her body. A week or so later egg-laying begins. She wraps the sticky coated eggs singly in the foliage of water plants, using her feet like hands. The leaves of such plants as the elodeas and callitriche are especially favoured, presumably because they are easy to fold and secure in position.

The young tadpoles are of a greyish silver hue, darker above than below, with long fins on the dorsal and ventral surfaces of the body and feathery tufts just behind the head. These are gills through which oxygen is taken from

Continued opposite

# Reptiles and amphibia in Portugal

by H. G. B. Gilpin

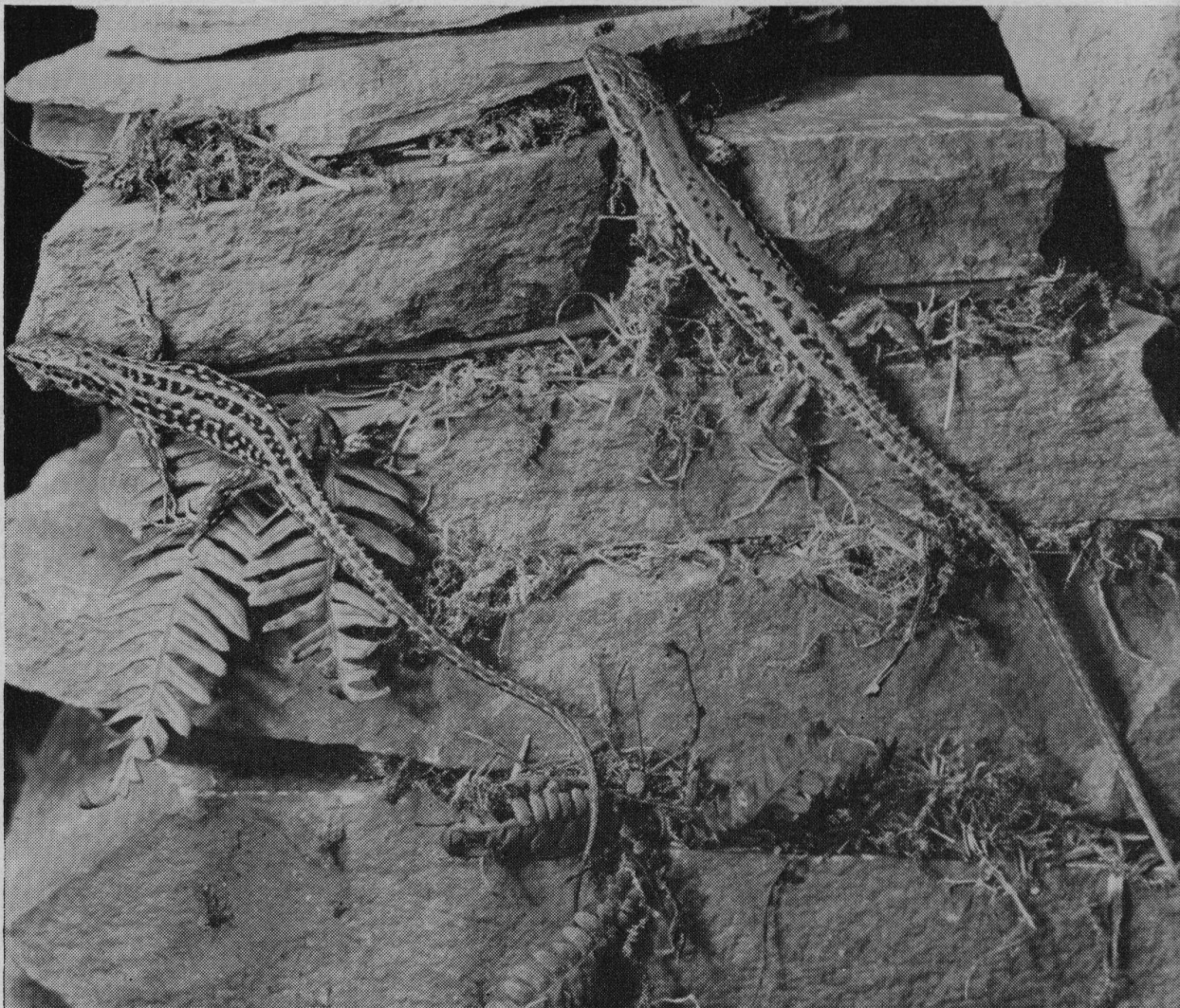
FOR anyone who has fallen under the fascination of these interesting and often beautiful creatures, a holiday in the rural districts of Portugal is a memorable experience. A small party of us spent a fortnight there in March, driving across France and Spain to Rossio which we made our base.

Our first excursion was to a private game reserve at Golega. Leaving the car by the side of some rice fields at the entrance, we walked along a tree-lined path, bordered on one hand by a stream, and on the other by a wide sheet of water which supported a profusion of water crowfoot intermingled with frogbit and water lilies. Willow trees grew along the banks and from the water providing areas of shade from the brilliant sunshine. An immense frog population inhabited the water, the loud, though not unmusical, croaking of the frogs providing a continuous

background of sound. Dragonflies, bumble bees and a host of other insects afforded an enormous reserve of food for the amphibians which in turn attracted numerous waders such as Grey and Purple Herons, Egrets and Godwits and predatory birds such as Common and Black Kites to the area.

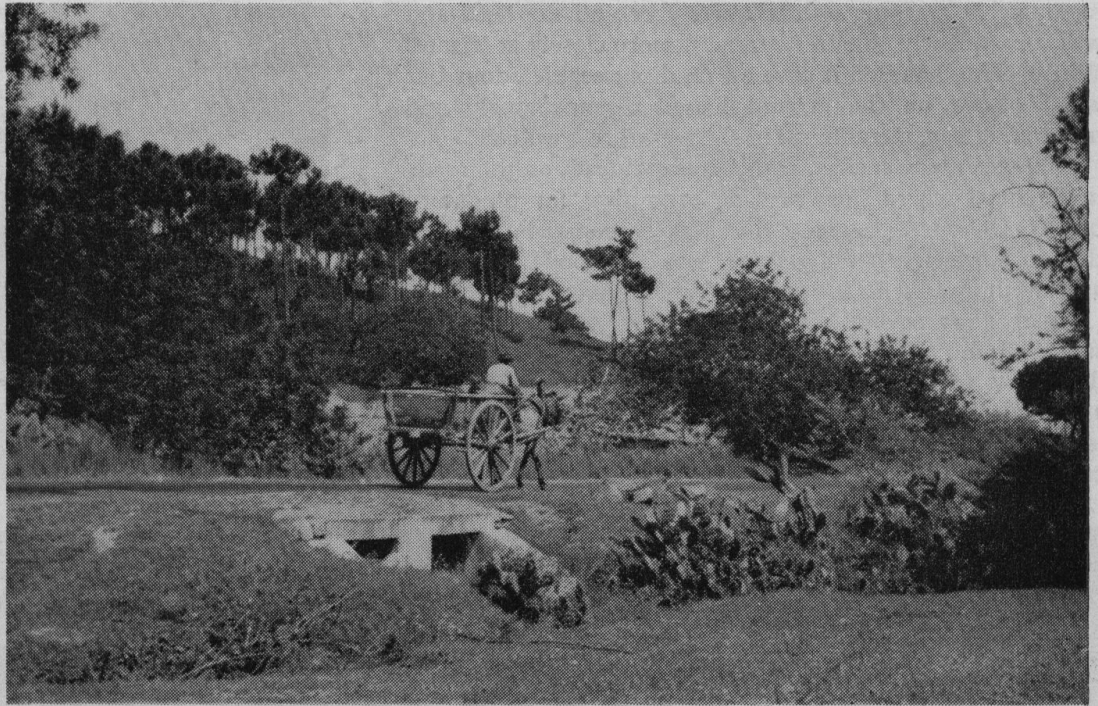
As we walked along the path, frogs, disturbed by our footsteps, "plopped" into the water in front of us. A stealthy approach enabled me to secure a few specimens which proved to be *Rana esculenta*, beautiful little olive green animals with large, irregularly shaped brown markings and a vivid green dorsal stripe.

In the Foros do Arros, a forest of cork oak and eucalyptus trees, two Ocellated Lizards scuttled for the shelter of a loose stone wall as we came nearer. A short distance into the forest we came to an open level patch with rising



A pair of  
wall lizards  
*Lacerta muralis*—  
excellent climbers





Typical lizard country in Portugal, tree frogs are also to be found in this terrain

ground covered with cork oaks, broom, sun roses, gorse and heather on one side, and marshy land through which a small stream trickled on the other. Amongst the trees we saw a very beautiful, eight inches long, olive green lizard with yellow underparts and a deep, blood red face. It was extremely active and, although it posed long enough for us to get a good view of it, it vanished into the undergrowth at the first signs of movement.

Many small Edible Frogs were congregated in the water and amongst the forget-me-nots and water plantains pushing upwards from the shallows. These showed some colour variations from those seen in Golega, being brownish rather than green with a darker lateral line on either side of the central green dorsal stripe and half an inch from it. The principal insect inhabitants of this area appeared to be large grasshoppers and innumerable ants.

Returning along a pathway through the forest we had a good view of a large five-foot long Montpelier Snake. So dark in colour as to be almost black, it moved slowly across the path as we approached and then, accelerating rapidly, took cover in a dry, stony patch of ground thickly overgrown with broom. An immediate search yielded several further glimpses of the snake as it slid between the close growing lower stems of the bushes but their density prevented any hope of capturing it and it finally disappeared completely. These snakes feed largely on small mammals, birds and lizards which they kill with their poison fangs. The bite, however, is not apparently dangerous to humans. A Portuguese friend, to whom I described this snake said he was familiar with the species and believed it was not seriously harmful. Nevertheless, he added, he always avoided contact with them!

We spent one particularly interesting day on a farm near Castello de Vide not far from the Spanish border. This was an ideal place in which to search for reptiles. Great grey boulders dotted the dry stony ground. White broom,

foxgloves, chamomile and the bright yellow flowers of angel's tears grew amongst the coarse grass. The wide, sun-drenched fields were separated from each other by loose stone walls and on both the walls and the boulders many Wall Lizards scuttled and sunned themselves.

At the foot of the walls a number of Ocellated Lizards were seen. The largest members of this species were observed amongst the grass at the base of some farm buildings. One in particular, a good two feet in length and two inches across the top of its head, retreated into a crevice beneath a huge boulder just out of reach but clearly in view. Its treatment of a stick, gently pushed towards it to encourage it out into the open, gave ample indication of the power of its jaws and a firm warning of the painful nature of its bite. Eventually it did bolt with extreme rapidity and was lost to view.

These Ocellated Lizards, *Lacerta l. lapida*, are magnificent animals, their impressive proportions and green coloration, with rows of large blue patches along the sides, forming an eye catching combination. Largely ground dwellers, they feed upon small mammals, other lizards and insects. We saw many of them in Portugal, not infrequently scurrying across the highway.

One of the most interesting spots we visited lay just off the roadside not far from Castello Branco. A stream meandered between enormous grey boulders, widening in several places to form large pools of clear water, before disappearing beneath a stone bridge. We clambered down a steep grassy slope for a closer examination and were very glad we did so. Apart from many small frogs we found, of all the unlikely creatures to meet miles from the nearest village, a solitary goldfish swimming in one of the pools.

In another pool two small heads appeared above the water within easy reach of the bank. I made a quick grab and was rewarded with the capture of a two foot long, olive green Grass Snake with yellow lateral spots. I was

fortunate in grasping it immediately behind the head and was consequently able to examine it more closely at leisure. Whilst being handled it gave off no disagreeable odour but when placed on the ground hissed disapprovingly and made off at considerable speed for the nearest water.

One sees many snakes, both alive and dead, on the roads in Portugal where they provide easy meat for predatory birds. On one occasion a Red Kite swooped in front of the car as we were driving along, seized the body of a snake and swept away with it dangling from its talons.

Apart from several species of vipers, the majority of snakes found in Portugal are harmless, or at least not dangerous to humans, whilst the lizards are all harmless and may be safely handled with the exception of the larger Ocellated Lizards which, although not venomous, can inflict a painful bite.



**Above**  
Farm near  
Castello de Vide,  
home of large  
ocellated lizards



**Left**  
Edible frog  
*Rana esculenta*,  
this species is  
very active but  
seldom strays  
far from water

# The physiology of snakes

by Don Reid

RECENT years have seen a considerable growth in the hobby of Herpetology, or keeping reptiles. One has only to study *The Aquarist's* advertising pages to note that an increasing number of pet-stores are finding a lucrative business in the sale of reptiles and amphibians. Many exotic species are now readily available, and by far the most interesting—and the most misunderstood—branch of the reptile family are the snakes. These unique creatures hold a wealth of fascination all too often overlooked due to man's seemingly instinctive revulsion of them. Therefore I shall attempt to explode some of the unfounded beliefs that are rife, and in so doing to give a simplified picture of the snake's physical make-up and to offer advice on any problems arising from keeping snakes as pets. Although much of what follows can be applied to snakes in general, the emphasis is on the primitive snakes, i.e. the pythons and boas, which figure among the most popular as pets.

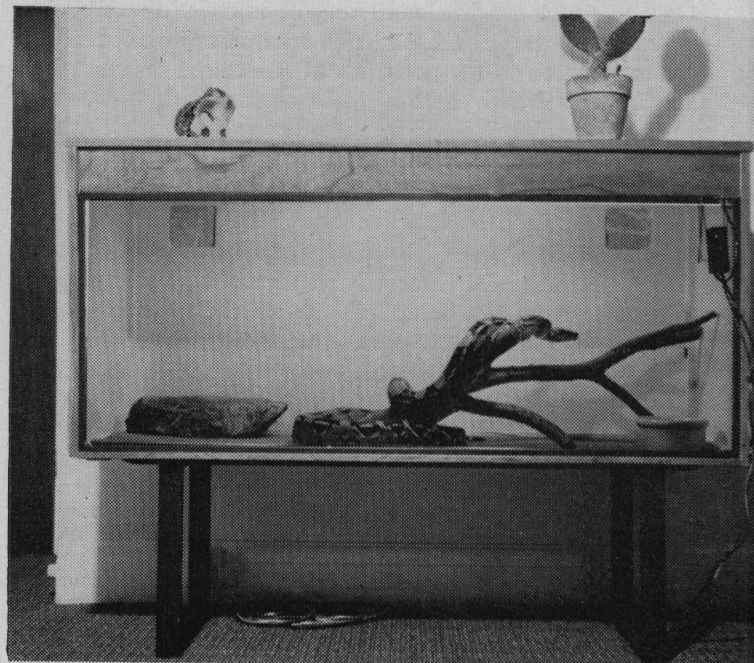
As previously stated the pythons and boas are regarded as the most primitive of the order ophidia, as they have skeletal vestiges of hind limbs; in fact they still carry a pair of movable claws positioned one either side of the anal cleft. Also these snakes have a well-developed pair of lungs, while other higher snakes have the left lung collapsed, with the right lung elongated to fit the body shape.

## Sloughing

The shedding of a snake's skin is carried out at intervals throughout its life. A young, quickly growing snake may shed its skin, or "slough", every four weeks or even more often but the interval increases as the snake gets older. The actual divesting of the old, dead skin is in normal circumstances done quite quickly, but several symptoms are observed during the fortnight preceding this. The first sign to the casual observer is a slight cloudiness of the cusp or eye-cover (this is a permanently closed lower eye-lid; no snakes have movable eye-lids), together with sluggishness and a refusal to eat any but the smallest meals. Also a cloudiness over the entire body is noticed, particularly on the darker areas of the pattern. This clouding lasts for roughly six days then rapidly clears for a further six days after which the skin is rubbed off, usually in a complete or almost complete state. The only attention a captive snake needs at this time is a bowl of water in the cage which is large enough for the snake to completely immerse itself, and a roughish stone or log on which to rub the body to pull the old skin off. It is an interesting point that this dead skin is formed of Keratin, a nitrogenous compound from which our own fingernails are formed. At this point it could be mentioned that the skin of a snake is not slimy; it does not take much thought to realize that were snakes slimy they couldn't lie in the sun for long periods (as they all love to do) without being badly scorched. Also we would have slimy fingernails!

## Locomotion

The snake's method of propelling itself has long been a

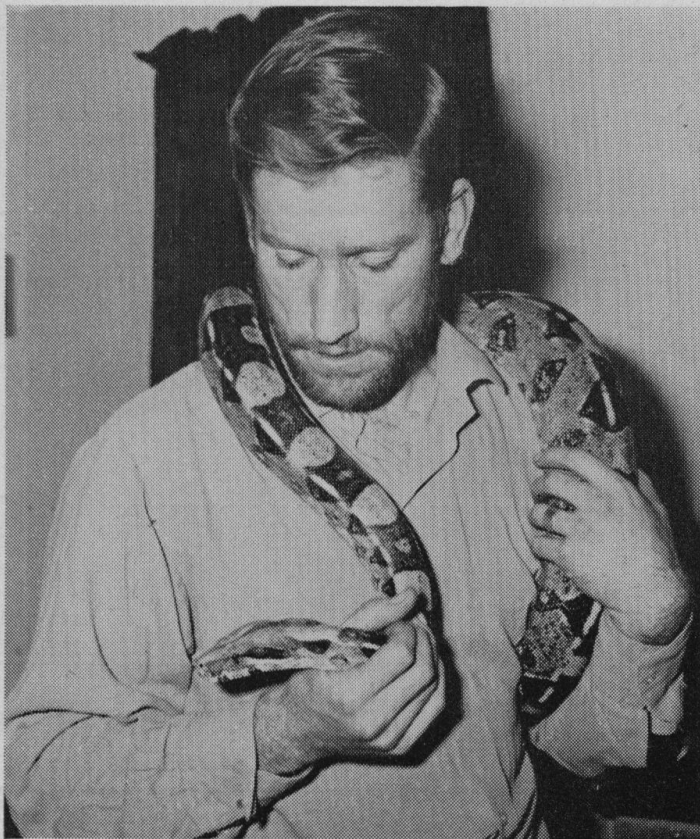


subject of much study and diversity of opinion, but in recent years a great deal of work has been done with x-ray cameras to record the locomotive process. It has been established that different species use varying methods, but as we are mainly concerned with pythons and boas, theirs is the method I shall briefly describe.

Many of the heavy-bodied species, including all the pythons and boas employ the rectilinear or "straight-line" motion. This is brought about by the belly scales—operated by two sets of muscles; one relaxing, the other contracting in turn—working much on the principle of a ratchet. Each scale is moved rapidly in turn, forming a continuous ripple along the body, lifting it very, very slightly off the ground and propelling it forward. This method enables it to move in a straight line, and is the usual method when creeping at normal speed. If, however, a greater speed is required they may revert to the method used by the greater majority of snakes, and referred to as "undulatory". This involves a succession of loops thrusting against any resistant object or material. This produces the familiar wavy, "swimming" action. A third method, only used by a few desert species, is "side-winding". In soft sand the preceding methods are impractical because of the lack of purchase offered by the sand, therefore an interesting method has been adapted which entails literally throwing a loop of the body at a time in the direction of travel, the snake moving in a crabwise fashion.

## Speed

Much has been stated by the sensation-seekers and the



ill-informed concerning the speed at which a snake can travel overland, but in the light of scientific experiments the bulk of these tales can be rejected out of hand. The statement that a snake can outpace a galloping horse is one that can have no substance whatever. Without going into any great detail, and amidst a great deal of anti-climax, suffice it to say that the fastest any snake can travel is about 8 m.p.h., and that only over very short distances. In other words a rapid walk for a few yards would leave any ophidian pursuer (which in itself is extremely unlikely) far behind.

### The Tongue

The snake's tongue, usually the part of this much-maligned creature's anatomy that is most subject to wild beliefs, is devoid of any sense of taste as we know it. Instead it is much-modified to perform a more important task, as it is used for exactly the same purpose as a dog uses its nose. Every flicker of the long black tongue is equivalent to every sniff of a dog's nose. The forked tongue picks up microscopic particles from the air, and when withdrawn the forks are inserted into two cavities in the roof of the mouth. These cavities are known as Jacobson's organ. Simply, the organ "analyses" the air particles and transmits its findings to the brain via the olfactory nerve—the nerve which in all animals transmits the sense of smell. The cavities of the organ are in fact modified nasal cavities. This is the only function performed by the snake's tongue, which plays no part in the swallowing process, as it does in all other animals. The old-wives' tale about the tongue having "stinging" properties is completely unfounded.

### Size of Snakes

On reading only one or two works on snakes it will be found that authors tend to differ widely in their opinions on the size that snakes can attain. Some are content to accept the estimates of any unqualified reports; some refer only to reliable and conclusively proven facts. The "record" claimed for any snake is an anaconda purported to measure 46 feet but the material evidence of this was not produced. Many other claims of around 40 feet are prevalent, but it can be generally stated however, that any measuring much in excess of 30-32 feet, is something of an exception. It should be added that the only reliable way is to measure the body as the skin alone is liable to stretching. This could be how some of the fantastic tales arise.

### Feeding

The general method employed by most harmless snakes to catch their prey is to lie in wait for a suitable victim, or, in the case of nocturnal species especially, to creep up on a sleeping bird or animal etc., strike rapidly to seize the victim in its strong jaws, apply pressure with the jaws until the luckless creature stops struggling and then proceed to swallow it. However, in the case of larger snakes more drastic measures are needed to suppress the struggles of their proportionately larger prey, so directly after the initial strike a couple of coils of the body are thrown around the body of the victim. This is not to crush the beast as is popularly supposed, but to prevent the passage of air to the lungs, so that death from suffocation results.

The swallowing process is both unique and laborious. As the snake cannot tear its food to pieces it must be eaten whole, and to do this a very much modified mouth meets this problem. Instead of the lower jaw being hinged to the upper, as in other animals, it is virtually free. In addition the two bones that form each jaw are separate and can be moved independently. This results in a gape much exceeding the diameter of the head. However the bones cannot be manipulated by their own power; they can only be forced apart by something entering the mouth. The jaws slowly work in turn over the carcass and between these movements the muscles in the neck gradually drag the body farther back so that the jaws can work a little further along, and so on. Once past the head the victim is passed quite rapidly down the snake's body to the stomach, where the extra-powerful digestive juices which break down everything including the bones, come into action. It is believed in some circles that before swallowing the prey the body is coated with saliva for ease of swallowing, but this belief probably stems from an eye-witness having seen a snake with what was in fact something partially eaten and then disgorged.

### Reproduction

As this brief article is designed to bring to light points that may concern snakes kept by amateurs, the subject of reproduction is one that need not be discussed in any great detail as breeding in captivity would probably involve too much expense and space for the average amateur. The majority of snakes—among them the pythons—lay eggs, but a few species, including the boas, bring forth living young. The number of eggs or young varies greatly, both

Continued on page 262

## Marine queries answered

I have heard that there is another fish which, like the scorpion fish, can poison with its dorsal fin. Is this true and if so what fish?

You are probably referring to the weever fishes which are quite common in British waters. "Weever" is in fact developed from the French "wevere" meaning viper. The dorsal fin spines contain poison sacs at their bases. Pressure on these spines ruptures the sac and allows the poison to flow. The great weever (*Trachinus draco*) is most common in Great Britain, but do not worry about stings for they are deep water fish and never attack large animals. The lesser weever (*Trachinus vipera*), however, is a shallow water fish of up to 6 in. in length and can cause great pain if trodden on. It feeds on shrimps and fish fry.

Can the freshwater flounder, now becoming popular, be kept in a marine tank?

The flounder (*Platichthys flesus*) is the one and only flounder, the fresh water type offered being one and the same. The question should in fact be reversed. The salt water flounder *can* be kept in fresh water. It can easily be distinguished from other flat fish by the whiteness of its under or left side. It grows to 18 in. in the wild.

There seem to be many people keeping native gobies and blennies. Can you, please, tell me the difference between the two?

Gobies belong to a large family of shore-living fishes recognisable by the short blunt face and highly placed eyes, almost on the top of the head. The most unusual aspect of the goby is its ability to convert the pelvic fins into a sucking disc. The common goby (*Gobius minutus*) seldom exceeds 3 in. in length. The blennies, although similar to gobies, have only one dorsal fin—elongated to the whole length of the body. They are unable to form a disc from the pelvic fins which are of less than five rays. Some blennies have a rudimentary "angling" device on the forehead which has never developed. The Tompot blenny (*Blennius gattorugine*) is the largest of the British specimens reaching up to 9 in. in length.

Can gurnards fly?

It is doubtful whether this is possible and has never been proved. There are five types of gurnard, the flying one being *Dactylopterus volitans*, a fish not unlike the *Pterois volitans*. The flying gurnard is actually placed in a separate family (*Dactylopteridae*) from the other gurnards (*Triglidae*). The former is easily recognised by its tremendous pectoral fins, the first few rays of which enable the fish to "walk" along the bottom of the sea. It is, all things considered, an extremely interesting fish but none have ever been seen actually airborne.

My dealer has ordered some marine fish for me and has promised to collect them from the airport and deliver them to me. What steps should I take when I receive them re changing them over to the conditions in my tank? Any other advice concerning what to do when my fish arrive would be helpful.

When your dealer gets his fish in stock take a hydrometer reading of the water he keeps them in. Then balance your own tank at home. When you receive the fishes put a few pinpricks in the plastic bag and float it in your tank. This will slowly sink and thus allow an extremely slow change of water. The top of the bag must of course be open. Keep the fishes in darkness for about a week and, if in doubt as to health, add enough methylene blue to make the tank water dark in colour. Give new specimens (and old) plenty of hiding places and do not disturb unnecessarily.

## Marine News

During a recent trip to Germany I saw a new Ultra Violet marine-filter soon to be available in England. It comprises a six-inch tube fitted into the filter system which radiates a bright u.v. light. These neat little units were being used on all the marine tanks in Tropicarium of Frankfurt. They cost around £7 in Germany and the u.v. globe has an expected life of around four months. The bulbs, however, are not exchangeable, so it is a relatively expensive item. Mr. Schmidt of Tropicarium did tell me, though, that a new unit was expected shortly with replaceable bulbs. The unit is, of course, designed as a disease repellent and is, I understand, quite effective.

\* \* \*

A fire which swept through Brockley Aquaria recently destroyed or damaged the greater part of stock in trade. Fireman did, however, consider the fish in the tanks and used water to quell the fire, which was caused by a refrigerator, and not a chemical which could have poisoned the livestock. Once the fire was under control the C.E.B. were rushed to the scene (5 p.m. on Sunday), to restore the electrical supply necessary to keep the tropical fish alive. It is gratifying to know that the authorities really do care when it comes to the push but, alas, all was in vain for the whole stock of some 3,000 fishes had to be destroyed a few days later due to the thick layer of scum and soot which covered all water surfaces.

One remarkable aspect of the fire was that practically all pregnant livebearers gave birth during the fire and smoke period.

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# The physiology of

continued from page 255

from one species to another, and in the same species according to the size and age of the mother. A very rough average for the snakes with which we are concerned is as follows: 40-50 eggs for a python, and about the same live young for a boa. However, these figures can fluctuate in some cases by as much as 20 or more.

### Longevity

The average length of a snake's life is another point for conjecture, as from time to time there occurs an exception to the rule which upsets the recognised estimates. For example the average age of a particular species may be established as being 15 years, with 20 years being the outside limit, when suddenly a reliable report is received of a solitary specimen attaining the ripe old age of 29 years. As with most aspects of a snake's—or indeed any other "cold-blooded" creature's—life, so much depends on a combination of the circumstances arising from its environment. The above example can be considered as reasonably general.

Following is a brief summary of the most common pythons and boas seen in our pet shops:

## Marine News by T. Ravensdale

Day and night work has restored the property and Brockley Aquaria has now re-opened for business again with all new stock including a complete refit of new nylon-coated aquariums.

\* \* \*

The interest in coral fishes being shown by some of Britain's leading companies is soon to be seen in two public displays. A large window in the Charing Cross Road branch of Foyles, the book people, is to be devoted to a large marine display tank during the last week of November and the first week of December. A further interesting exhibit will be one at the offices of "Union Castle" Line in Bond Street. This showroom has an enormous 22 ft. full-scale model of the "Windsor Castle" in the window and under this is to be fitted five 4 ft. nylon marine aquariums. "Union Castle" is, of course, the company which brings marine specimens to the London Zoo from Madeira, so they should be quite able to cope with the problem of fish in static tanks.

\* \* \*

A new animal and fish supermarket is to be opened shortly at Crystal Palace. It will be spread over four floors with a basement of five rooms for quarantining. The ground floor will be tropical fishes. Marine fish, mammals, birds and reptiles will all be available and special breeding and show fish are to be the speciality. The accent will be on

live bred English stock. Meticulous efforts to start the aquarium on the right foot are evident from the fact that future stock is being purchased now to be quarantined until the store opens at Christmas. The store, to be known as "Crystal Aquaria" will stock such items as civets, apes, owls, monkeys, boas, fancy goldfish and coral fishes.

\* \* \*

Don Corning, the remarkable sealer, being used by many marine enthusiasts as a tank sealant, has recently come under fire. Apparently a chemical fungus repellent was added to the sealer in order to prevent cracking in bathtubs due to soap attacking the product (the sealer is, after all, intended for this sort of work). This repellent has, however, produced several cases of coral fish poisoning and Don Corning have quickly answered the many enquiries by pointing out that only "Don Corning aquarium sealer" should be used for marine tanks and not simply plain Don Corning sealer". The former product, although only available in America, is soon to be available from Chiswick Aquaria who first instigated the enquiry.

\* \* \*

The International Marine Study Society found it well worth the effort to go to Belle Vue this year, for I understand that many new members were signed on. The trend towards marines is speeding faster every day. They are certainly here to stay.

# snakes

## **BOA CONSTRICTOR** (*Constrictor constrictor*)

Possibly the best of all the big snake pets. Grows to a length of approximately 12 feet. Handsomely marked with brown, black and white on a sandy-buff ground colour. Feeds chiefly on animals and birds no bigger than a pigeon.

## **RAINBOW BOA** (*Epicrates cenchris*)

This beautiful snake owes its name not to its actual colour which is brown, but to the breath-taking iridescence of its scales when seen in the sunlight. Grows to about 6 feet.

I have deliberately omitted the ANACONDA (*Eunectes murinus*) as its size is prohibitive and it is reputed to be of uncertain temper.

## **RETICULATE PYTHON** (*Python reticulatus*)

A snake that again grows to a very large size (it is the largest of the pythons) but is very beautiful, and is reputed to be quite amenable when young. May be a finicky feeder. Grows to about 28 feet.

## **INDIAN PYTHON** (*Python molorus molorus*)

More common as a pet in America than Britain. Grows to around 20 feet. Marked in dark brown and yellow on light brown ground colour. A larger, darker, northern species (*python molorus bivittatus*) is said to be irritable.

## **AFRICAN PYTHON** (*Python sebae*)

By far the most oft-seen python in this country. About the size of its Indian cousin. Usually makes a very docile pet. Marked in varying shades of brown with yellow edging.

## **ROYAL or BALL PYTHON** (*Python regius*)

Much smaller than those preceding, reaching about 5 feet. Specimens unused to being handled will coil into a tight ball, with the head inside. Very agreeable as a pet. Similar colours as other pythons but rather more bold patterns.

In the second part of this article I will deal with the requirements for these snakes, and how the main problems are to be overcome.

# Snakes make ideal pets—Part 2

by Don Reid

## A guide to Ophiology

**B**EFORE buying a snake of any kind there are one or two preparations to be made to facilitate your future pet's good health and well-being. Firstly, remember that snakes are unique creatures in the animal kingdom and consequently have some unique requirements. Therefore, one should collect as much reliable information as possible about them to supplement the broad outlines that I set out in the first part of this article.

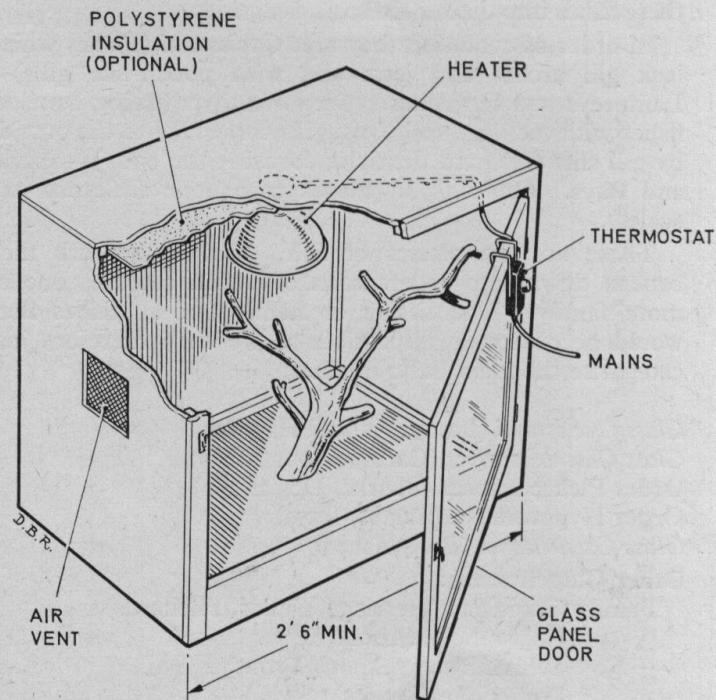
### Food Supply

One must be sure of at least one *reliable* source of food. This is the most difficult part of keeping snakes. In my experience even authors of the most comprehensive works on the subject seem to be reluctant to offer suggestions of where to obtain a supply of food so I shall hereby try to suggest a few possible sources. As snakes in the wild eat only food which they have themselves freshly killed, one has to decide on how best to satisfy this requirement. Fortunately it is not difficult to induce young snakes to take ready-killed food providing it is reasonably fresh and complete with fur or feathers. The accessibility of such food depends largely on individual circumstances. If you are friendly with a farmer, there will no doubt be a certain amount of vermin such as pigeons, rats, mice or rabbits that he would be pleased to dispose of. He may shoot or trap them himself or he may allow you to go to work with an airgun. (Pellets left in the carcase are no trouble to the snake). The larger snakes' (7 feet or more) feeding problems are solved by the fact that wood pigeons are sold complete with feathers. Another reliable method is to breed white rats for food, killing them first by as painless a method as possible. Personally, I would only employ this method in dire emergency. I have never had to resort to this yet, and I would be the last to encourage it. I would rather not keep snakes than adopt this method regularly. Yet another suggestion: even the best pet dealers are bound to have a certain amount of dead stock but this cannot really be considered a reliable source. Such secondary supplies as this can probably be found, and much depends on the would-be herpetologist's circumstances in finding these. It is surprising how many folk in the neighbourhood come to hear of your unusual pet and remember it when they catch a mouse in a trap or when the cat brings home a dead bird. To sum up this all-important paragraph, I would suggest 2 golden rules (a) obtain assurance from your dealer that the snake you intend to buy will readily take dead food; (b) have a reserve source of food supply in the event of failure of the main source.

### Accommodation

The third essential is a heated cage. Heat can be provided by an infra-red chicken-run heater controlled by an outside thermostat of the type used on tropical fish tanks. For

*The illustration below is a drawing of a cage almost identical to the one in which I kept my 6ft Boa Constrictor. It may be thought that this is ridiculously small, but snakes are very lazy creatures.*



longer cages a tubular greenhouse heater would be more suitable. A temperature of max. 85°F., min. 78°F. is desirable although drops for shortish periods to 65—70°F. are not harmful. The point to remember is, as with all 'cold-blooded' creatures, warmth is essential for both activity and the digestion of food. If kept too cold for long periods the digestive juices slow up in their work and any food left in the snake's stomach may decompose and if left may cause the demise of your pet. Also, at colder temperatures the snake will become sluggish so should this occur, the snake-keeper should not expect any show of activity.

No criterion can be set regarding the power of the heater; so much depends on the situation of the cage, its size and shape, and how well insulated it is. I have found that a 150 W. heater to a cage of about 4 cubic feet is quite adequate. It is as well to mention at this point that although ventilation is of course essential, a comparatively small grill will do the job, e.g., a perforated zinc grill about 3 in. × 3 in. for a cage of the above dimensions is fine. There will be plenty of cracks round the door for further ventilation. From an economic point of view the smaller the ventilation grill the less the heat loss. I have known snake-keepers who provide no air-vent at all, but manage to keep their charges healthy.

One would think it would be glad of a 'run' round the room but invariably the snake will crawl under the nearest armchair and curl up. It is believed from observations that wild snakes, during their entire life, rarely travel much more than a mile from the place they were born.

The furnishings inside the cage need only be very modest, the only permanent feature being a stoutish branch of some kind as most of the giant snakes like to climb occasionally. The size of our pets precludes the use of plants in this type of vivarium; besides, they are unnecessary vehicles for introducing unwanted parasites. The floor of the cage should have some covering medium. Gravel or sand, not soil, is the most natural and most attractive, but this makes the cage difficult to clean out (which only has to be done about once a month). Also I have found that gravel taken into the mouth when feeding can lead to cuts or abrasions to the gums. I use a few layers of newspaper, covered by a sheet of plain paper. This can then be thrown away when fouled and replaced afresh. The walls can be painted with a light paint to brighten up the interior, and in addition to this the herpetologist with a creative bent can incorporate a variety of ideas to make the interior more pleasing. For example, a couple of twigs pressed, and then pinned to the rear wall of the cage gives a more natural effect. Finish the interior off by installing a 30 watt strip light, as this will really set off the iridescent rainbow hues of the inmate (or inmates). Lastly, remember that a cage in the house should not be an eye-sore, but a piece of furniture in its own right, so give some time and thought to its design and construction.

Having now made everything ready to receive the snake, the next thing is a visit to a reputable pet dealer who stocks snakes. He will then be able to tell you if the snake you have your eye on is in good health and will readily take dead food. As with every other pet one wishes to obtain as good a specimen as possible, so look for scars and sores, especially round the mouth. Make sure that the mouth closes properly; if it does not it could be

a sign of infection. The mouth is the most susceptible part of the snake's body to infection. See that the tongue is clean, that it flicks out vigorously, that it comes well out of the mouth, and that the fork is well spread. Although the snake's body is naturally much cleaner than creatures with fur or feathers, the overlapping scales could provide a hiding place for mites or ticks, so watch for these. Make sure that the snake you choose has feeding habits that you can adequately serve. For example, some species exist on an exclusive diet of toads, which could be very difficult to supply.

With the chosen snake ensconced in its future home, the temptation to handle it and show it off every 5 minutes will be difficult to suppress. However, the new pet should be left alone for 24 hours or so to settle down and get used to its new home. Another irresistible urge will be to watch the unique and fascinating way in which the snake takes its first meal, but it is likely that for the first few meals the victim will only be taken at the dead of night when the house is quite still. When it settles in there will be ample opportunity to watch this extraordinary feat.

It is very difficult to lay down hard and fast rules as to quantity of food to offer, as an active snake will eat more than one that lies in the same position for days on end, as on occasion they are wont to do. However, the best judge of this is the snake itself, so as long as a steady supply is maintained it will come to no harm. Don't forget, if the reptile should leave an offered carcass, make sure this is not because the body is too big to pass through the mouth.

Regarding water: snakes are known to occasionally partake of a drink, but some schools of thought maintain that a snake receives sufficient water from the bodies of its victims. A bowl of water should be kept in the cage at all times, not only for drinking, but to keep a humid atmosphere in the cage. Water will evaporate rapidly in warm conditions, but at any rate should be changed twice a week. A snake should not be handled for at least 24 hours after a meal, and directly after a meal should not be disturbed at all for an hour or two. During this time the snake will resent any intrusion into its privacy and may decide to resort to the offensive, although these are usually only in the form of threats. It takes sudden fear more than anything to make a snake strike.

Now a few words on handling snakes. Although, contrary to popular opinion, most snakes are generally inoffensive creatures, a few points must be borne in mind. A snake's senses are believed to be mainly poor. The eyesight is poor as far as detail is concerned; external ears are totally absent. Any quick or sudden movement may be interpreted as designed to do harm, so the handler must move smoothly and deliberately. This also applies when moving around near the snake. It probably wouldn't show any reaction, but one never wishes to unduly upset one's pets. Never hold a large snake by the neck alone; always make sure that the heavy body is supported. If a newly acquired snake shows uncertainty of its strange owner's approach, a towel laid carefully over the snake before picking it up will temporarily 'unsight' it until the handler has it safely in his grasp. This should not be necessary after the first couple of times of handling it. Extra care should be taken with young snakes or those not used to being handled, as these are always more



prone to bite. Also, when the snake is about to slough, it becomes temporarily blinded by a certain amount of exudate secreted between the old and new skins, so special care should be taken not to alarm it during this period. Ideally the snake is best left alone at this time.

Although it is not considered essential, many snakes appreciate an occasional bath. If the cage is of sufficient dimensions to house a large water container the matter is solved. But the average snake owner will probably not be able to provide this so a bath-night must be organised. This can be carried out in the bath-tub in water of a temperature approximate to that of the cage or atmosphere from which the snake has just been taken. As all aquarium-keepers know, shocks from sudden temperature changes on cold-blooded animals can result in death. Don't worry if the snake goes under-water and stays there for a while: these adaptable creatures can remain under-water for comparatively long periods of time.

A snake kept in a clean cage should be clear of any sickness or disease. Should any such infection find its way into the cage, here are a few pointers to the more common ailments.

**Ticks** should be dabbed with paraffin or meths. and removed with tweezers.

**Mites** should be washed off with warm water. This bathing should be continued daily for a week or so. To combat mites, cleanliness is essential.

**Colds** may announce themselves by dribbling, and the tongue leaving moist patches on anything it touches. Euromycin on the gums and raising the cage temperature slightly should be sufficient cure.

**Cuts and Abrasions** of a simple nature (which shouldn't occur with careful handling) can be treated with a mild disinfectant, more serious wounds should be referred to a veterinary surgeon, or your pet-dealer may have a remedy. Regularity in feeding, sloughing, excreting, etc., are indications that the snake's processes are functioning properly.

Having thus discussed the main requirements conducive to successful snake-keeping, let us now consider the advantages and disadvantages of such a pet. For many people the chief obstacle to pursuing ophiology as a hobby, is a wife. I am fortunate in having a very indulgent wife who shares my hobby. Others may take a little more persuading. Also you will find that some friends and relations object to this strange pet, but I have found that 99 per cent. of these have come round to take a considerable and enlightened interest in it. I certainly haven't lost any friends through it. By the way, when introducing your snake to one of the uninitiated, use the gentle approach. Never try to force it on them—they'll usually come round to it.

Apart from feeding and supplying heated accommodation, there are virtually no further strings attached. If for any reason all your food supplies temporarily cease to bear fruit there is no immediate cause for worry. A healthy snake can go for weeks or months without food. In fact the record for a snake's voluntary fast is in excess of 2 years. This means that the ophiologist can go away for some weeks without any worries on that score. Other advantages are that they are quiet, odourless and clean. The cage only requires cleaning out after each excretion, which is about once a month. No other pet can make

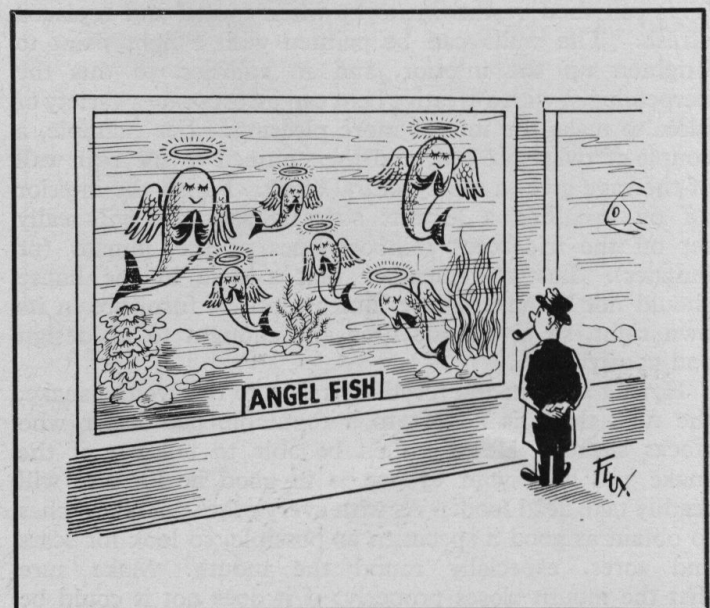
all these undemanding claims. Although we refer to our snake as a 'pet' we must not expect any form of affection. Apart from anything else the snake will never answer to its name, and it has no ears. Snakes are considered utterly incapable of forming any emotional attachments, so be prepared for a one-sided relationship.

It is always a good thing to give your pet snake a run round the room, providing it is reasonably free from draughts. One word of warning. A snake will find nooks and crannies to hide in that you never knew existed. Imagine a snake finding a hole in the bottom of an armchair. The only way to extract the snake would be to dismantle the armchair, not a very satisfactory situation whichever way you regard it. I shall never forget the time that my Boa Constrictor, Rebecca, found her way into the speaker cabinet of my radiogram. I extricated her 2 hours later after much of the wiring and cabinet has been dismantled. The moral of this is: check and double-check. Then treble-check.

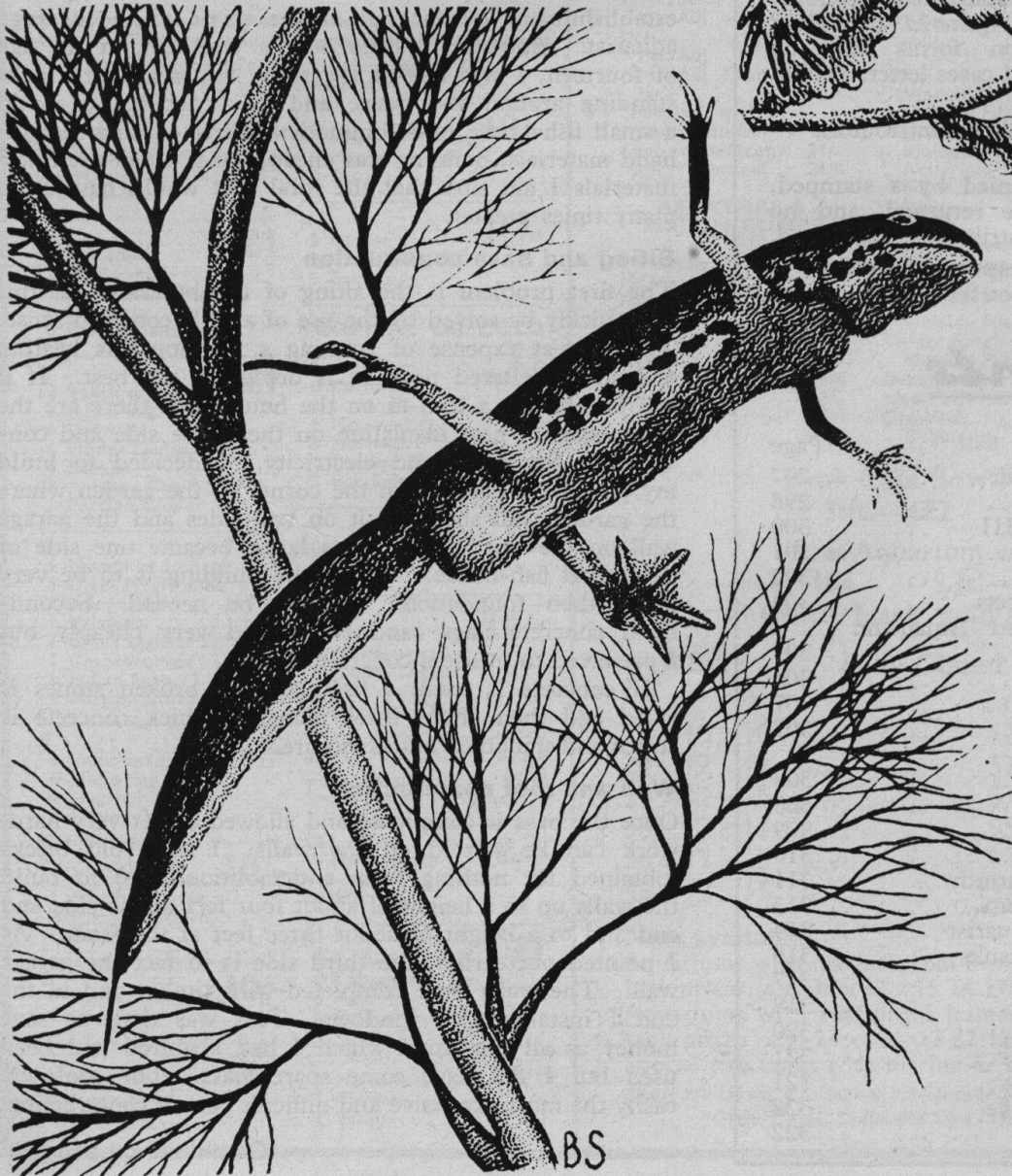
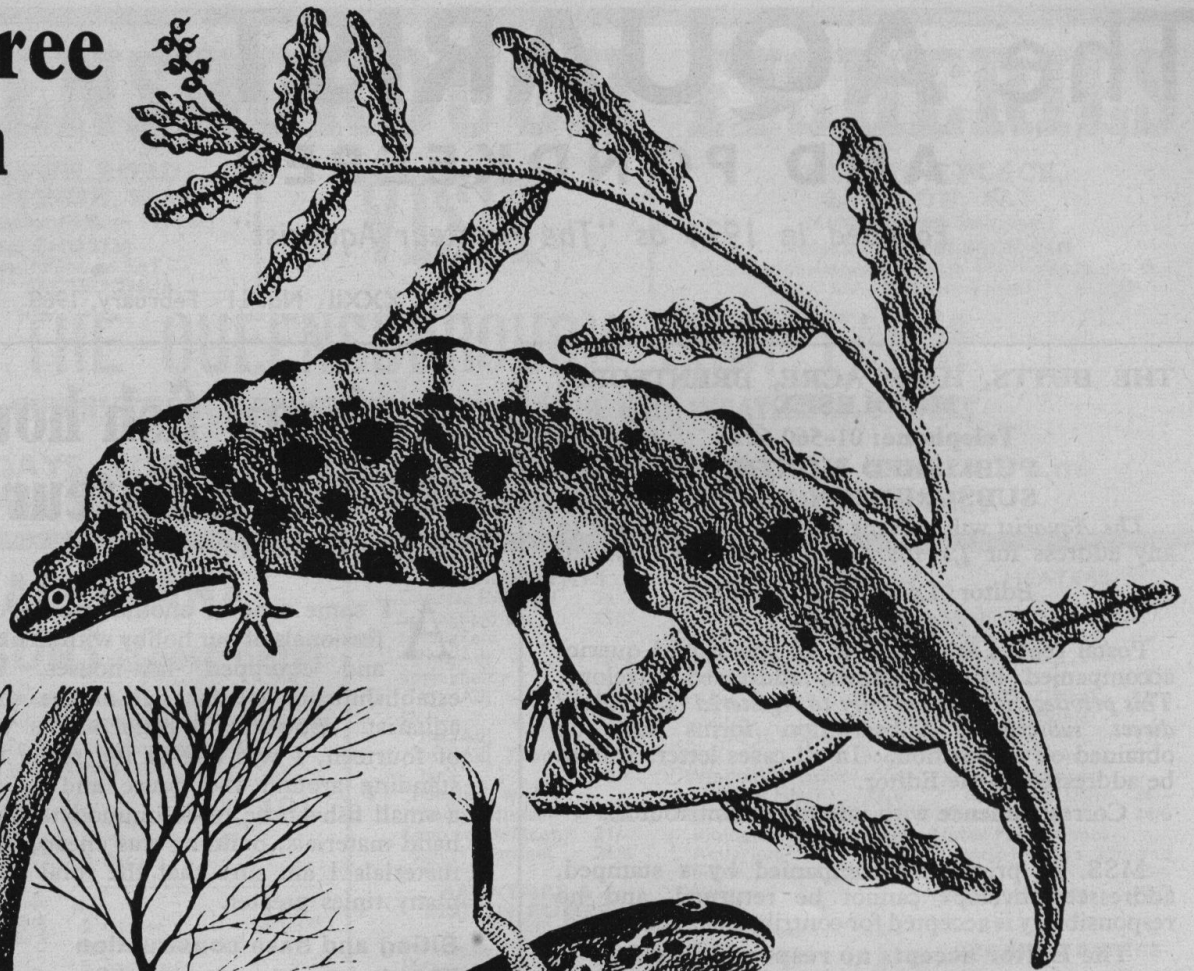
One last suggestion which adds interest to the hobby is keeping a diary of events in your pet's life. Not only is it of interest to calculate the amount of food consumed in a year, etc., but many observations can be made which will make the job of looking after subsequent snakes much easier. To set down on record such items as growth rate/food ratio is of absorbing interest.

The theme of this article has been designed to popularise the growing hobby of herpetology in general and ophiology in particular. There are, however, some snakes which should never be kept by the amateur: the venomous species. I cannot stress strongly enough that these are only for experts and enough accidents happen among this learned fraternity. Poisonous snakes can never be pets, and no matter how securely locked up they may be, the untoward can happen.

Many people may read this article through but still remain sceptical about having anything to do with snakes. I hope, however, that a few have been enlightened on the subject. As previously stated, fear of these creatures is inborn in man. This may be from Biblical times when Eve was tempted by the serpent. But then, Adam was tempted by Eve . . . ?



# Our three British newts



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by  
Bill Simms

**Top**  
The smooth newt near some  
*Potamogeton crispus*

**Left**  
A male palmate newt swimming  
near some *Ranunculus aquatilis*

**A** FRIEND who lives deeper in the country than I do, has kept his garden pond exclusively for native British creatures such as newts (in their season), sticklebacks, and the many kinds of water insects and their larvae. It is fairly large and is planted with really good specimens of British freshwater plants so that I am always able to obtain a good sample for a drawing—most convenient. But it also makes an ideal spot for studying water life in a natural state away from interruptions by passers-by.

Some few years ago he started his newts off by installing a number of Palmates which he transported from another district early in spring. I helped him with this, and it was easy to pick out the species he wanted by the webbing on the hind feet.

This webbing is more pronounced on the males and is shown clearly in the drawing of a male palmate newt swimming near some *Ranunculus aquatilis*. In late summer and autumn, when the adults climb out to spend the autumn and winter ashore, this webbing practically disappears, and at that time it is difficult to distinguish them from Smooth newts.

There is one other characteristic feature, however, and that is the thread-like ending to the tail. Many aquarists use this thread-like ending alone to identify the palmate, but it can be misleading for the young of smooth newts also have this same spike.

Altogether, the identification of our native newts is not easy at any time when they are out of the breeding dress, and in the case of the females at all times it can be more than just difficult—except that size can help a little.

There are three kinds of newts in Britain. The Crested Newt, (*Triturus cristatus*), reaches six inches; the Smooth Newt, (*T. vulgaris*), is about four inches; and the Palmate Newt, (*T. helveticus*), averages three inches.

During autumn and winter, when they are ashore hiding in damp spots, both males and females of all three kinds are alike in appearance, being slightly mottled on a muddy drab colour. It is at this time that size is about the only practical means of distinguishing them; but because there are size differences between individuals in each of the species, this method should not be relied on too completely.

In spring, identifying the males of all three species is simple. The crested newt has a large jagged crest which stands up proudly in the water though being soft and flimsy, it droops somewhat when the newt is taken out of water.

The crest of the male smooth newt is not jagged, but smoothly wavy. The drawing of the smooth newt near *Potamogeton crispus*, shows this clearly. In addition, the smooth newt, which is orange below, marbled with darker spots like the crested newt, has a pale blue band along the tail base.

The male palmate newt has a crest similar to that of the smooth newt, and here the most certain way to differentiate between palmate and smooth newts is the webbed hind foot and spiky tail of the palmate, mentioned earlier.

Telling the difference between females is not so easy, even in the breeding season. They all are brighter in colour, like the males, but to a lesser degree. After much comparison and experience the expert can frequently tell the difference, but he, also, will sometimes be baffled.

The usual way is to scoop a few more out of the pond, and if a male is caught the females can be presumed to be of the same kind, for, normally, different species do not live together. Again, this is not certain because there are excep-

tions to this rule. In one large pond I visit I have found males of both smooth and palmate newts at times.

All the newts have similar breeding habits except in small details that will be described in their turn. In spring, early April usually, the adult newts enter the ponds, slow-moving streams, or canals, and there they acquire their very much brighter colours, and the males develop their crests.

The courting display of the male is very demonstrative. He alternates between graceful manoeuvres around the female, and gentle caresses with his head and tail. Apart from this there is no actual coupling between the sexes. At the height of their mutual excitement the male emits his sperm in a little package shaped roughly like a cone. This lies on the gravel or mud at the bottom of the pond.

The female swims down, and grasps this package of sperm with her vent, and there absorbs it. By this means the eggs inside her are fertilised.

When it later comes to the actual egg-laying there is a slight difference of behaviour. The female crested and palmate newts lay their eggs singly, inside the rolled-up leaf of a water plant, or stuck singly on to a stone, but the female smooth newt is more careless. She may lay two or three eggs together and just allow them to lie loosely in the stem junction on a plant, without any protection.

The eggs take about a fortnight to hatch out, and the young larvae, though something like frog tadpoles, have a more graceful shape, with a longer tail, two rudimentary front legs, and some gills around a smaller head.

These larvae are somewhat transparent and for some weeks this lack of colouring is retained while the small creatures develop. The front legs become longer and in five to seven weeks the hind legs appear. After ten to twelve weeks the general colour becomes olive green dotted with black spots, while the small crests they have developed, and the tail edges, are golden. At this stage, having red, plumelike gills, the young newts are most colourful.

But this is not for long. About a week later the gills and crests disappear and this is a sign that the lungs have now developed, so that the youngsters are air-breathing. They must rise to the surface at intervals for air. This they do with a resounding plop—quite startling if heard in a quiet room containing an aquarium with some of these youngsters.

Normally, at this stage, the young newts leaves the water and find some damp spot ashore to spend the winter. But a few that are not so well developed—possibly through a shortage of suitable foods—remain in the water in the larval state throughout the winter.

Newts of any of these three species are ideal inmates for indoor vivariums—provided these are large enough, and have provision for a deep aquarium section in spring. The food of newts is always animal matter, usually small water creatures, including tadpoles, when in water. On land they eat worms, small snails and slugs, and insects of many kinds.

If you manage to get them to take small pieces of raw meat, make sure that you always clear away any debris for it can cause troubles in many ways if left to rot. Also be sure to supplement this with plenty of insects for they provide vitamins not obtainable in meat.

I am not aware of the newt's true life span, but like many amphibians they can live for many years. One crested newt male I know of has led a solitary life in a large vivarium for eight years, and he was fully developed when caught. It would be interesting to know if any readers possess older ones than this.

# Herpetological notes

by M. Peaker B.Sc.

## SALMONELLA

A recent paper<sup>1</sup> has drawn attention to an ever increasing number of cases of terrestrial and freshwater chelonians carrying bacteria of the *Salmonella* group—the organisms responsible for food-poisoning. In this paper, Drs. Mann and Bjotvedt report the presence of a number of different *Salmonella* types in water collected from containers in which terrapins were kept for sale in New York. These workers reached the conclusion that, “. . . pet turtles are an important reservoir of salmonellae and as such constitute a definite public health problem.”

It is therefore the responsibility of keepers of tortoises and terrapins not to allow themselves or others to become infected by ingestion of these bacteria. Not only is the disease extremely unpleasant but it can apparently be dangerous in some individuals. Besides this obvious motive it is not desirable to create a public-health “scare” since if it were to be established that terrapins are a causative factor in large-scale food-poisoning epidemics then it is possible that the public-health authorities would press for legislation to limit their importation to herpetologists in Britain.

The usual precautions should be taken to ensure reasonable safety and in fact, many animal keepers already employ such measures which are really a matter of simple hygiene, for example, not allowing anything which has been in contact with the animals to touch human or other animals' foodstuff or handling equipment; washing hands after handling or servicing the animals, etc. In the same vein, it will be realised that children should be instructed to take similar precautions. In other words, reptile-keepers in Britain have to ensure that they do not lay themselves open to charges by the public-health authorities as being hazards to public health.

This, the herpetologist may well say, is all very well but what about members of the public who buy baby elegant terrapins (*Pseudemys*) from the local pet-shop—how are they to know? This really leads me to say that baby terrapins, all of which require specialised care should not be sold by the average pet-shop but only by specialist reptile-dealers. They are not suitably cared for, usually I will admit through ignorance, and the death-rate in the first few months after sale must be almost one hundred per cent.

If the pet-trade is to guard itself against severe and destructive criticism it must in the first instance attempt to put its own house in order—a sentiment expressed by a well-known birds fanciers' weekly on a similar subject. An indiscriminate loss-of-life on this scale cannot be permitted to continue. In a main article I shall describe methods by which baby terrapins may be correctly cared for—and this does not mean housing in the plastic “turtle-bowls” which have found their way onto the market.

## REEVESI

It is often stated that the hardy and popular Reeve's terrapin (*Chinemys reevesi*) rarely exceeds six inches in length.

However at least in the southern part of its range it is not unusual to see much larger specimens. Several weeks ago I saw a very large individual in Hong Kong's Central Market—the carapace was over nine inches in length and the whole animal was relatively more bulky for its size than smaller specimens. This large individual was of the light phase and I get the impression that those of the black form do not reach the size of the more-normally coloured types. Perhaps the black ones do not live long enough since they would presumably be more easily seen by predators. This species is only one of those which reach the markets of Hong Kong from the provinces of South China. The others include the gold-coin box-terrapin *Cuora trifasciata*; two attractive species of *Clemmys* (*bealii* and *mutica*) and the big-headed terrapins, *Platysternon megacephalum*.

## AGGREGATES

It is well-known that many terrestrial salamanders tend to group together in the wild or in the vivarium, in fact it is a disadvantage in the latter case, allowing infection to pass rapidly through the stock. The reason for this clumping behaviour has never been clear but in a recent study<sup>2</sup> Dr. R. H. Alvarado of the Oregon State University has concluded that aggregation in ambystomid salamanders is of adaptive significance in preventing dehydration of the individual animals by reducing the surface area exposed to the air. Moreover, it is likely that the air in the immediate vicinity of an aggregated group is more humid than that surrounding an individual so that the humidity gradient and therefore evaporation is decreased.

1 *Canadian Journal of Comparative Medicine and Veterinary Science*. 31, 43-45. (1957).

2 *Copeia*. 1967, No. 3, 667-668.

## What is your opinion?

continued from page 300

readers with general questions suitable for discussion would like to submit them for inclusion in future articles. Have you sent your opinion on any topics yet? Some readers seem to think that this series is only for the expert. This is not the case at all. Even though you may think that your views are of little importance, they could still contribute something of importance to others, so please let us have your opinion. One other point: if you have written before, please do not think that we do not want to hear from you again. We would like your views as often as you care to write. Several of the above letters come from regular letter writers.

# Herpetological notes

by M. Peaker B.Sc.

## American Specimens

Many herpetologists have difficulty in identifying specimens they receive from different parts of the world. Sometimes, it is necessary to check the identity of a species purchased from a dealer or to investigate the habits of a reptile or amphibian in the wild to correlate them with their care in confinement. It will therefore, be of some interest to collectors to know that to deal with almost all of North America in two volumes, a companion volume by R. C. Stebbins to Conant's field guide to reptiles and amphibians of eastern north America to cover the western regions, was published in 1966. Like the other volume, it is in the Peterson Field Guide Series.

Whilst there is perhaps a good deal more information available on north American species than on those from other parts of the world, I find Conant's volume particularly useful (although expensive at 40s.) for simple identification and concise resumés of the habits of the herpetofauna of this region.

## South American Testudines

If, like I was until a few weeks ago, you were under the impression that *Testudo denticulata* and *Testudo carbonaria* were one and the same animal—the Jaboty tortoise of South America, it may come of a surprise to know that these are once more regarded as two separate but closely related species and that they are now called *Geochelone denticulata* (Linn.) and *Geochelone carbonaria* (Spix). The original morphological differences were described in 1960 and some biochemical differences between the two forms have recently been elucidated by Drs. Newcomer and Crenshaw of the University of Maryland.

## Basilisks

Small basilisks (*Basiliscus*) are sometimes imported from northern South America. I once kept a ten-inch female which refused all food and had to be force-fed for months until it eventually accepted food voluntarily. Basilisks are noteworthy in that they are often adorned with dorsal crests and bizarre extensions in the skull region. They have always fascinated the herpetologist by their ability to run on the surface of water. Normally aboreal, when alarmed they run rapidly only on the hind-limbs and continue from land onto the water. The speed of this surface running has recently been measured by two workers in Panama and found to be approximately five and a half miles per hour\*. It is likely that they run on, rather than swim in, that water to avoid aquatic predators which lurk beneath the surface.

## And Iguanas

Although I personally have never had any trouble in persuading young common or Linnean iguanas (*Iguana iguana*) to feed, I know that sometimes newly-arrived specimens give difficulty. A tip I once received was that to present yellow-coloured food almost invariably tempted the specimens to feed for the first time. After that they are said to take all the items of diet usually given to these species. Iguanas seem to appreciate a large vivarium—

ours were housed in an enclosure 3 ft. × 4 ft. × 7 ft. high, well-supplied with large branches and a pool. Although I have heard of them living (perhaps surviving would be a better word) at English room temperature, this is not really sufficient and the air temperature is best maintained at a temperature of at least 80°F.

## Ptyas

Several weeks ago we received a four-foot snake which was quickly identified as the common Indian rat snake (*Ptyas mucosus*). Another species, *Ptyas korros*, the Indo-chinese rat snake also occurs in Hong Kong but is not so common. Our specimen has accepted mice to eat although on reading the relevant pages of the third volume of the late Dr. Malcolm Smith's *Fauna of British India* I find that he considered frogs to be the main item of its diet in India. I shall try this one with the Chinese Bull frog *Rana rugulosa*.

\*Rand and Mark, *Copeia*, 1967 No. 1, 230-233.

# Aquarist with an aptitude

continued from page 331

a busy tour when getting on a plane seemed just like waiting at a bus stop! He called in at British Guiana (as it then was), visited fish farms, and a world-famous plant man in the Everglades in Miami, Florida, and finally to New York to see how American aquarists applied their ideas.

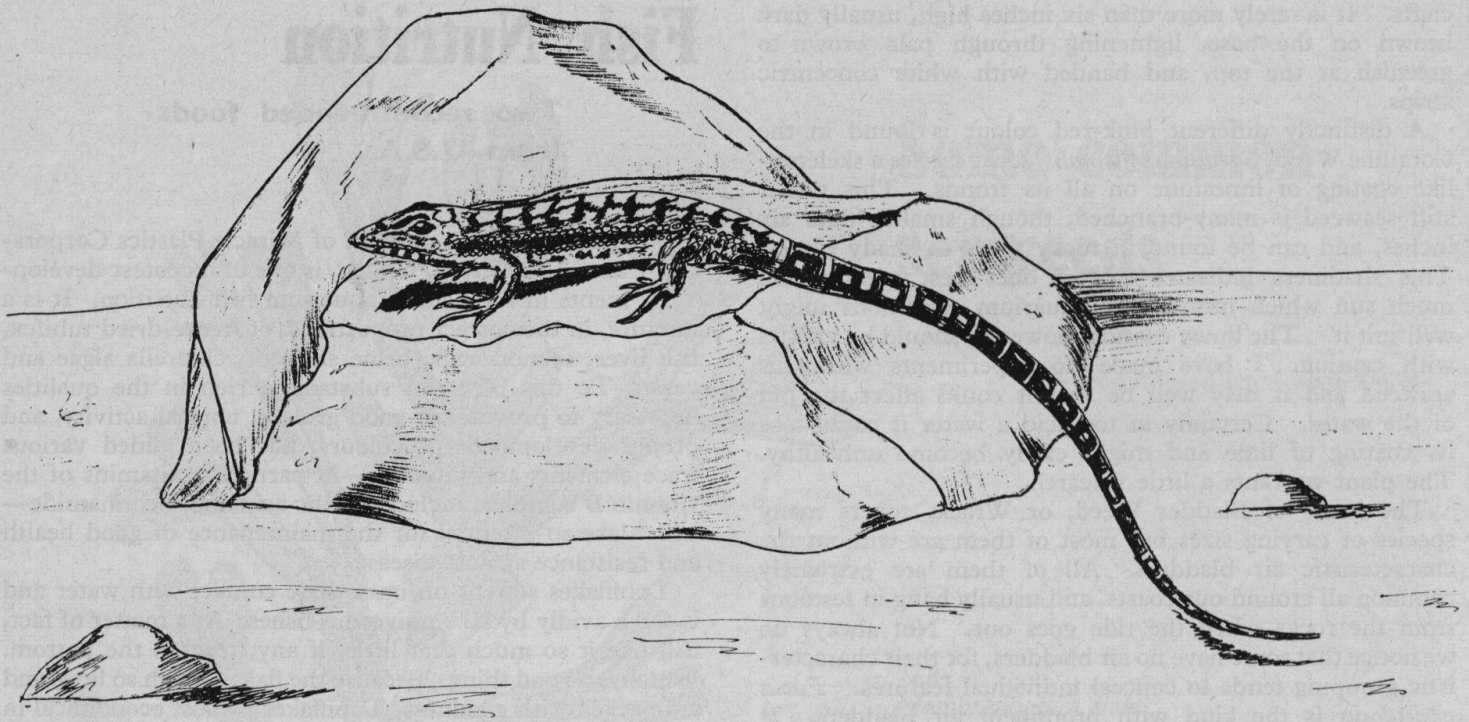
Recently he has returned from a seven-weeks expedition through Brazil and Paraguay in his quest to discover new plants. Brazil is the home of a vast number of aquatic plants, including the famous "Amazon Sword." The journey of some 33,000 miles took him through the Matto Grosso area, notorious for its dense jungles and with dangerous hazards at every turn. He and his companions, Dr. Joachim Schultze of West Berlin and Michael Bleher, a plant collector of Brazil, worked under severely trying conditions, but the discomforts and dangers were forgotten in the excitement of discovering new plants. All the specimens collected have been pressed for a herbarium collection.

From this journey and others, Tom has assembled a wonderful collection of colour slides and cine film, and at times he felt that he was on location for shooting a film "epic," with so much photographic equipment to carry. Between the rigours of travel, the lack of food and the weight of this equipment, he lost a stone in weight on this expedition.

Tom Horeman is a man of many capacities—aquarist, biologist, inventor, researcher, businessman—but he has never lost touch with the basic qualities that underlie his career; a natural sympathy and kindness for those in need, a desire to find out what makes a person "tick", and an inexhaustible patience and curiosity in seeking for knowledge. He is at his best in adversity, which brings out a rare strength of character.

He is still learning—still following that bent that came into being in a hospital lecture room many years ago and which continues to give him the real values in his life.

W.J.Y.



# The wall lizard

*(Lacerta muralis)*



by H. G. B. Gilpin

**T**HESE lizards are widely distributed amongst the warmer European countries, islands in the Mediterranean and Asia Minor and occur in a great number of geographical varieties. They are commonly imported into this country and their small size, slender shapes and lively habits make them ideal inhabitants of a vivarium. They have the further recommendation of being inexpensive to buy.

The overall length of the males is about seven and a half inches and that of the females six and a half inches. The somewhat elongated head surmounts a slightly flattened body which continues into a gracefully tapering, finely pointed tail, approximately twice the length of the body.

The upper parts of the body vary in colour from grey to brown, handsomely reticulated with black in the males. The female is striped with lines of black patches along the back and has a brown band bordered with paler stripes along the sides. The under parts are white, yellow or sometimes brick red, occasionally brightened with blue spots along the outer row of abdominal scales.

These animals, being diurnal, are particularly suited to vivarium life as, although they retire occasionally to some hidden retreat, most of the day they are constantly in view. An added advantage is the rapidity with which they settle down. Most of those I have kept have disliked being actually handled and have been reluctant to take food from the fingers but otherwise they have become extremely tame and shown no signs of alarm when they, or their quarters, have received attention.

It is perfectly safe to confine Wall Lizards with other lizards of the same size. They ignore those of other species and although a social hierarchy develops when

Wall Lizards are kept together in a group, I have never known any actual damage to result from their occasional sparring matches which rarely amount to anything more than expressions of mutual defiance.

I have frequently seen it stated that these European lizards will live comfortably in this country at room temperature but, as with Geckos, I have never cared to expose them to the rigours of the English winter, even when they are kept indoors. They will survive quite satisfactorily when given the comparative freedom of an unheated greenhouse providing it contains a bank of soil of such depth as to allow them to bury themselves safely below danger level and so hibernate throughout the colder months. In the house where no such facilities are available they are all the better for a little extra heat. That afforded by the installation of a 25 watt electric light bulb in their quarters is entirely adequate and the obvious enjoyment of the lizards as they bask in its warmth more than justifies its presence.

They are not troublesome to feed and will take winged insects up to and including the blowfly in size. It is true these insects are not always available but during most months of the year maggots can be obtained from shops supplying anglers' requisites or from firms catering for aviculturists requiring regular deliveries of bird foods. Some of the maggots will be eaten directly by the Wall Lizards but most will pupate and very soon develop into the adult flies. With a little care it is possible to stagger the hatchings so that a fairly constant sequence of the insects can be maintained. A single hatching will content the lizards for several days.

Wall Lizards, like most animals, do best on a varied diet and this can be achieved by ringing the changes with newly hatched locusts—Wall Lizards cannot cope with locusts much more than a week old—woodlice, young stick insects, crane flies when in season, and spiders. The latter are great favourites with my Wall Lizards and appear to be particularly beneficial. I have been told that Wall Lizards will eat small earthworms. These creatures cannot long tolerate the warm, dry conditions of the vivarium and if not eaten immediately would soon shrivel and become a nuisance. Consequently I have no personal experience of their value as an article of diet for this species of lizard. Mealworms, especially the small ones, are an unfailing standby and can always be used to fill a gap in the feeding programme.

Unless hungry, Wall Lizards show the utmost indifference to the presence of insects and it is not uncommon to see one of the lizards draped across a rock with a trio of young locusts perched on its back, utterly oblivious of the insecurity of their prospects. When a Wall Lizard is hungry, however, its behaviour undergoes an abrupt change. On sighting an insect it remains poised, immovable as a stone statue, for some seconds and then, suddenly galvanised into action, leaps towards its prey and seizes it in its jaws.

Wall Lizards require water and will drink from a pot. This should be small and so placed as to prevent the lizards from sliding through it, which they will do if permitted, during one of their not infrequent hurried excursions around their quarters. The water in itself would do them little, if any harm, but sand sticks all too readily to their

wet skins. This, apart from any possible ill effects it might cause, is unsightly and best avoided.

Although active, the small size of these lizards enables one to keep them satisfactorily in a comparatively small vivarium. One two feet by eight inches by eight inches is quite adequate and if suitably furnished will supply them with all the exercise they need.

In the wild these lizards inhabit dry, rocky country and are also frequently found in sparse woodland where very little water is available. They occur on walls, old buildings and ruins and I have seen them scampering over the thatch hovels of the Spanish peasants where no doubt an abundance of insects was to be found. This type of terrain can be simulated in a vivarium by covering the bottom with an inch or so of dry sand and building a background of large stones. At least one of these should have a flat surface facing the electric light bulb as the lizards will enjoy sprawling across its surface and basking in the heat. Sunken pots containing small cacti improve the appearance of the vivarium and I have never known them, in spite of their armour of spines, to affect the lizards adversely.

Wall Lizards are fond of climbing and a small gnarled branch with several short outgrowths, laid slantwise across the vivarium will enable them to indulge their proclivities in this direction thereby benefiting themselves and adding to the interest of anyone watching them.

Beginning in May or June the females start to lay their eggs, from two to eight to a clutch. A second or even third clutch may be produced before the end of the summer, each clutch being buried in the ground in holes dug by the female.



## Precious as gold

The Siamese Fighter is a joy to behold.  
He is fancy, fearless and fantastically bold.  
He comes from Siam and places like that;  
And is ready to fight at the drop of a hat.

In attracting attention he never fails;  
He just opens his fins like billowing sails.  
His colours include the yellows and blues;  
And reds and greens of various hues.

He's not very big and not very little;  
He builds his home from bubbles and spittle.  
When courting a female he's very aggressive;  
And when he's got fry, very possessive.

In a book index to find the fish I prefer,  
To the name "Betta Splendens" you'll have to refer.  
He'll bring to his owner pleasures untold;  
And to the person who owns him he's precious as gold!

A. BEASLEY