

Mabuya multifasciata



Easy to feed and handle, these Skinks provide an attractive and fascinating addition to the vivarium



ALTHOUGH less gaily coloured than many lizards, these skinks make attractive inhabitants of a vivarium. As in all skinks the legs appear weak in relation to the rather heavily built body but in this species the tail is longer and slenderer than in most of their near relatives, being as long or slightly longer than the body and tapering sharply from a thick base to a fine point.

Their overall length is about nine to ten inches which together with their bulk makes them somewhat impressive in appearance. They are less active however than many smaller species and keep in good condition and seem to be perfectly content in comparatively limited quarters.

The dark grey of the upper surface merges into a lighter grey along the sides and contrasts pleasantly with the pale yellow of the throat and under parts. They are particularly handsome immediately after sloughing their skins, when the grey is over cast with dark, bright green which gleams like burnished metal in the sunlight.

I obtained my present pair of these skinks early in the year from a newly imported consignment. They are ovoviviparous and I was told by the dealer who sold them to me that one of the females had produced five young ones shortly after it came into his possession. He showed me one of the

by **H. G. B. Gilpin**

babies which was dark, chocolate brown, almost black in colour and about two inches in length. He was feeding them on greenfly. This, apart from the trouble involved in collecting adequate supplies, seemed, judging from the condition of the one I saw, a satisfactory preliminary diet.

The adult skinks from the beginning were easy to feed. When I first brought them home they were even willing to eat blow-fly pupae. This was distinctly unusual as past experience had indicated that apart from fruit-eating lizards, these animals generally show little interest in food unless it manifests considerably more animation than that exhibited by a chrysalis. Possibly they had had little opportunity to feed whilst in transit and were sufficiently hungry to try anything their sensitive tongues suggested might be edible.

Since then they have been offered, and accepted, a variety of insects including locust hoppers, blow-flies, gentles mealworms and earwigs. They will also take woodlice. On the whole they show a preference for winged insects. Adult locusts are too large for them to cope with but they will each consume up to a dozen week-old hoppers at a "sitting." The introduction of an unfamiliar insect (to them) appears to stimulate them into orgies of over-eating. Towards the end of the summer a plague of crane flies appeared in this area. Quantities could be collected in the space of a few minutes from the outside walls of wooden buildings. These were avidly consumed by the skinks which, between them, disposed of between sixty and seventy of the insects in twenty-four hours.

After such heavy gorging sessions neither skink showed much interest in food for several days but both put on weight and were in fine condition by the beginning of winter.

One imagines that this type of feeding approximates to that they would experience in the wild state, where the advent of sudden swarms of insects would enable the lizards to build up sufficient stores of food in their bodies to enable them to survive periods of scarcity.

Apart from drinking, which they do by lapping up water with their long tongues, the skinks show little interest in water. Mine are kept in a very dry vivarium, eighteen inches by fourteen inches by fourteens inches, covered with a lid, in which holes covered with perforated zinc afford ventilation, and furnished with a bark covered log. Aquarium gravel to a depth of two inches is spread over the floor and at times, although they are usually to be found in the open part of the vivarium, they bury themselves in this medium or hide behind the log.

One of them once disappeared for several days in this way and when resurrected showed no inclination to eat. The animal deteriorated so rapidly that it became necessary to forcibly feed it with mealworms. Once having swallowed the larvae its appetite returned. The introduction of a dozen or so spiders completed the "cure" and within days it was eating its normal quota of food. It was some weeks however before it replaced its lost weight. Since this incident, if either skink has remained hidden for more than a few hours, I have uncovered it and there has been no repetition of the trouble.

These skinks are particularly satisfactory animals to keep as they rapidly become very tame. A week or so after they came into my possession both would take mealworms from the fingers. Individuals do vary to some extent. One of this pair, the female, gives the impression of enjoying being stroked, especially when it is in the process of sloughing its skin, whilst the other, although perfectly steady even when a hand is introduced into its quarters, dislikes being touched and slides out of range at the too close approach of a finger. The female shows no resentment and does not attempt to escape when picked up. I am told that these skinks will sometimes bite but none of the species has ever done so in my experience. This again may well be an individual idiosyncrasy.

They do dislike sudden movements and when the lid of the vivarium is raised, care should be taken to do so gently and unhurriedly as, though normally rather slow-moving creatures, when startled they can jump a considerable distance and move with surprising celerity.

Whilst these skinks live together with other members of their own species of approximately the same size, it is undesirable to mix them with different kinds of lizards, particularly if the latter are smaller than themselves. On the one occasion I did so, their projected companion being a good sized Wall Lizard, the skinks left no doubt as to their intentions, which were far from honourable, and it became necessary to remove the Wall Lizard with the utmost dispatch.

Coming as it does from a far warmer climate than ours, *M. multifasciata* requires a heated vivarium. I have obtained entirely satisfactory results by fitting a 25 watt, pearl electric light bulb into a socket screwed to the underside of the lid. The bulb is connected to a thermostat and maintains a constant temperature of 80°F.

The genus *Mabuya* is widely distributed throughout Africa, particularly in the South and West, where they are mainly found on exposed steppe land and savannah. They also occur in mountainous regions to a height of 5000 feet.

Breeding African Clawed Toads

by Terry Jennings

FOR many years the Clawed Toad (*Xenopus laevis*) has been used in human pregnancy tests; now it is becoming increasingly popular as a laboratory animal in school and college biology courses, and the aquarist who is able to breed these animals may well find these establishments a profitable outlet for his surplus stock.

In nature, *Xenopus* is confined to the African continent where it is usually to be found in swamps, rivers, ditches and waterholes over the whole Cape Peninsular and further north as far as the Sahara and Abyssinia. It occupies a fairly low position in evolutionary history inasmuch as the species has never learnt to leave the water.

Several characteristics of the adult toads distinguish them as extremely aquatic, including the position of the eyes on the top of the head which enables the toad to see above the surface of the water without the rest of the body being visible. The webs between the toes, which are capped with sharp claws, have become so exaggerated that each foot resembles a half-opened umbrella. The front legs are very small and used almost entirely for conveying food to the mouth once it is grasped. The toad's pointed head assists it in burrowing beneath stones for food which largely consists, in the wild state, of freshwater worms, small crustaceans and aquatic insects. Its very flattened body probably enables it to live almost completely concealed by mud at the bottom of the pond. Further, as a result of thousands of years of total immersion, the toads have developed highly sensory tubular patches on the skin which are believed to detect vibrations of the surrounding water.

Adult Clawed Toads are not very demanding in their requirements for life in captivity. A large tank, an old sink or even a baby's plastic bath are suitable containers in which to keep the toads. In winter they should remain indoors because they prefer a temperature of about 23°C. (73°F.), although they will live quite happily in water which ranges in temperature from 10°C. to 28°C. (50°F. to 82°F.). The toads can leap out of a tank quite easily, so it must be fitted with a secure cover. Two-inch mesh Claritex, obtainable from most ironmongers, is excellent for this purpose but the tank must always be kept in a shady place.

The toads should be fed twice a week, and since they are carnivorous they can be offered scraps of raw meat, liver, heart and even live earthworms. Any uneaten food should be removed from the tank, otherwise it may foul the water. It is best to change the water the day after feeding. Tap water can be used if it is first allowed to stand for a day or so to allow all traces of chlorine to disappear.

I have made no mention of other furnishings for the tank such as shingle, rocks and water plants. This is simply because none of these is essential although they do add to the aesthetic appeal of the tank and its occupants. This, however, has to be weighed against the hindrance

these items present to speedy and frequent change of the water.

An adult female Clawed Toad is normally four times the size of an adult male from which it is also distinguished by the presence of labia in the cloacal region, absent in the male. The whole body is covered with mottled markings which become darker against a background of stones or weeds and paler when the toad is placed in a bright light or against a white background. They prefer, however, to be kept fairly dark.

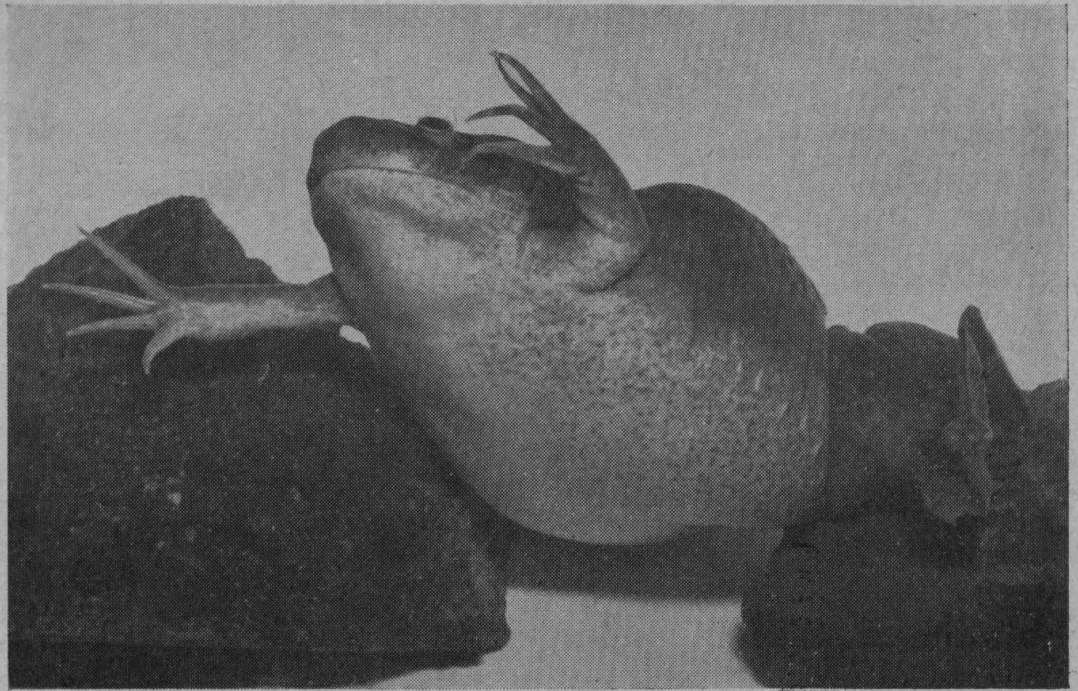
Under their native conditions the toads reach maturity in two years. The breeding season is usually July, but in captivity it can be something of a problem to induce them to breed. A successful attempt was made at Cambridge some years ago by keeping the aquarium very cool for a month, and then warming it up to stimulate the approach of spring, with the added influence of a few seasonable showers produced by means of a bath spray. In due course eggs were deposited singly on stones and water plants, and from these eggs tadpoles were quickly produced.

A more satisfactory method of encouraging Clawed Toads to breed is by injecting both male and female with a hormone preparation which starts off the mating process. This technique is not as complicated as it may seem, but as with many other familiar actions, the use of the hypodermic syringe improves with practice.

A sexually mature pair of toads should be kept at 23°C. in a small tank, about 12 in. × 8 in. × 8 in., fitted with a lid of perforated zinc, for at least a month to acclimatise them to their new conditions. A similar tank will be needed later for the eggs, so that it may be easier to stand both of these small tanks in a larger one containing water which is maintained at 23°C. In this way only one heater and thermostat is needed instead of two.

The injection consists of Pregnyl or chorionic gonadotrophin, which can be obtained from most suppliers of biological equipment. T. Gerrard and Co. Ltd., of Worthing Road, East Preston, Littlehampton, Sussex, keep stocks of both toads and hormone and I have always found these people very helpful. Pregnyl is sold in packs consisting of separate ampoules of the hormone powder and distilled water. A supply of ampoules of two sizes, 100 i.u. and 500 i.u. is needed. Disposable plastic syringes can be obtained from most chemists. A 2ml. syringe is preferable and it is as well to have several size 18 hypodermic needles available. Doctors and hospitals use disposable syringes of this type and can sometimes be persuaded to save the ones they have finished with.

One of the ampoules of distilled water should be broken open and drawn up into the syringe through the needle. An ampoule of Pregnyl of the appropriate strength is then opened and the distilled water emptied into it. The Pregnyl dissolves immediately and can then be drawn up



African
Clawed Toad

in solution into the syringe, taking care to get rid of all air bubbles by pointing the needle upwards and slowly raising the plunger until all the air is expelled.

When the injection has been prepared, the first toad should be taken from the tank with a net. Some authorities recommend that the toad be grasped firmly in a dry towel, but I have found these animals so slippery to hold that this method was just not successful. My own answer to the problem was to use a polythene bag, one of the perforated type used for fruit or vegetables is ideal, and the animal can then be trapped in one corner of the bag and injected through the polythene.

One of the animal's back legs should be extended during the injection and the skin of the back of the thigh pierced, with the needle directed towards the line of 'stitch marks' on the surface of the skin. The needle should be kept just beneath the skin and directed slightly upwards so as not to pierce the internal organs. Care is needed when holding the syringe to ensure that the contents are not discharged before the toad's rather tough skin has been pierced.

Two injections are necessary for each toad—a 'primer' injection which prepares the female and induces the production of the black nuptial pads in the male and a second injection is given four days later to induce mating and spawning. For the primer injection 50 units of hormone are needed for the male and 100 units for the female. The whole of one of the 100 unit ampoules dissolved in distilled water will be needed for each female. One such ampoule will serve to inject two males, each being injected with 0.5 ccs. of the solution.

For the second injection, four days later, a 500 unit ampoule of Pregnyl is used. Prepare a syringeful (1 cc.) but inject only 0.6 ccs. into the female and using the same syringe, inject 0.2 ccs. into the male. If more than one pair of toads is injected at the same time (and this is advisable since failures are not infrequent) the remaining 0.2 ccs. of Pregnyl can be used for another male. After

use the syringes should be washed out with distilled water and the needles sterilized in alcohol (methylated spirits will do). They can then be used again.

To make it easier to transfer the spawn, a piece of muslin, to which most of the eggs will adhere, can be placed in the tank before the toads are injected. The toads generally go into amplexus about twelve hours after the second injection and spawning continues for several hours. After spawning the toads should be returned to the main tank, bearing in mind that there should be no sudden change of temperature, and rested and well fed for at least a month before another attempt is made to breed them.

The eggs require a good supply of oxygen in the water in order to develop. If they are laid in large masses it will be necessary to transfer some of them into the second small tank using a wide-mouthed pipette for the purpose. A proportion of the eggs are nearly always infertile and these are usually those which have not adhered to the muslin or the sides of the tank.

When the larvae hatch, about three days after the eggs were laid, they at first cling to the sides of the tank or hang from the surface of the water. For the first two or three days the tadpoles cannot feed because they have no mouths but there is still quite a lot of egg yolk in their stomachs which they use as food. When they are four or five days old the tadpoles develop mouths and begin to eat. At this stage they are herbivorous, and under natural conditions eat microscopic algae in the water. In captive conditions it is easier to feed them on dry, powdered nettle leaves which can be obtained from some health food stores and also from many dealers in biological supplies. The amount of food to give each day can only be judged by experience. No more should be given than the tadpoles can clear in twenty-four hours as a surplus will soon start to decay and pollute the water. In any case, the

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A brine shrimp hatchery

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be checked and the thermostat adjusted if necessary. When the temperature is correct, place a quantity of brine shrimp eggs in one container; the next day place some eggs in the second container; on the third day switch off the air pump and allow 2 or 3 minutes for unhatched eggs to settle. Open the door and using, preferably, a fine circular net, catch the shrimps in the first hatcher taking care not to drop brine on to the bulbs. Dip the net and shrimps in warm fresh water to reduce the salt and feed to the aquarium. Add eggs to the third hatcher, close the door and switch on the air. Repeat daily and a constant supply of live food is assured. Some aquarists prefer to syphon off the shrimps.

It is worth while to experiment with different brands of eggs and observe the proportion which hatch. The effects of different brine strengths and borax addition can be investigated. In these cases it would be best to set up all three units at the same time for direct comparison. If it is wished to grow shrimps to maturity a few, say 5 or 10, could be kept in a jar of brine floating in an aquarium or in a warm spot such as by a central heating stove. Old aquarium water should be used with the usual amount of salt. A small quantity of old aquarium water or green water should be added every few days and perhaps a trace of "Liquifry," yeast or powdered food. I have seen shrimps which have been raised to maturity and have bred freely which were only "fed" with aquarium water, so any foods should be used very sparingly.

The unit described provides a constant source of live food which is appreciated by most fish and essential for some. It also provides the basis for controlled experimentation of hatching conditions. The design may also be useful for hatching some types of fish-eggs. The results of experiments carried out in this apparatus would be of interest and it is hoped they will be published.

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tanks should be cleaned at least once a week and, later on, more often than this.

The rate of growth of the tadpoles is affected by the temperature of the water, quantity of food given and amount of space available. At 23°C. the tadpoles take from seven to eight weeks to develop from hatching to metamorphosis, although a proportion are always smaller and grow more slowly.

At the onset of metamorphosis, when the tadpoles have grown strongly webbed back legs and their tentacles have begun to shrivel, the amount of water in the tank should be reduced so that they can reach the surface more easily. When the tails start to degenerate, small organisms such as enchytraeids, *Daphnia*, *Tubifex* or *Chaoborus* larvae should be offered. Later the young toads can be weaned onto small pieces of shredded sheep's heart.

The toads always provide plenty of interest for the aquarist and, although it would be foolish to pretend that breeding them is anything less than nerve-racking, there is something rather fascinating about being able to control the breeding behaviour of an animal at will.

Tropical fishkeeping: has it a future?

By T. G. Wall

TROPICAL Fishkeeping is growing in popularity to such an extent that an aquarium in the home is almost as much a part of the scene as a television set. This theme has been the subject of comment on several occasions. Recently, however, I have been analysing the possible cause or causes for this increase in interest.

Is it I wonder, due to the fact that the hobby has been made easier to follow successfully? There are several reasons why this may be so. In these days of rising prices, for example, I find that fish, far from "Going Up," have maintained a level and, in many cases, have actually dropped significantly due, probably, to increased efficiency in transport from abroad. If you find this fact hard to believe, glance through old copies of the *Aquarist*! Equipment, too, has become more varied and sophisticated with very little increase in cost.

The most important improvements, however, seem to have been made in Aquatic Food-Stuffs—the variety and quality of dried foods available having risen tremendously; live foods and their substitutes, too, are much more easily obtained. Few Aquarists nowadays arm themselves with buckets and nets and plod over muddy fields in search of the much prized *Daphnia*! Even *Tubifex*, once a difficult-to-get risky commodity, now comes in freeze-dried form.

So, all in all, the shop-borne aquarist has only to drive to the local Aquatic dealer to satisfy his fishy requirements. Here, too, dealers have increased in number to accommodate the market; almost every village and town has its quota. Visits to aquatic nurseries are now commonplace—even the new motorways help!

Have all these advantages no debit side? Do we miss the safari to a distant breeders' establishment? Do we know anything about the pests and diseases once so common? We do not find leeches, *Dytiscus larvae* and *Hydra* in our little bags of disinfected *Daphnia*! Has some of the fun gone out of searching for a rare variety of fish or plant? Will an "easy-come, easy go" attitude grow within our hobby, resulting in a slump similar to that which occurred just after the last war?

There is no doubt that difficulties overcome give greater satisfaction than mere routine in the long run.

Who knows? Only time will tell.

Solution to "Find the fish"

see page 395

Answer, PIRANHA



Iguana iguana (juvenile).

The Green Iguana

by H. G. B. Gilpin, B.Sc.

THE Green Iguana, sometimes called the Limnean Iguana, by reason of its colour and bizarre shape is a most fascinating saurian. It is a native of tropical South and Central America. Arboreal in habit, it is commonly found in trees, particularly those overhanging water, into which it plunges when disturbed or alarmed. A good climber and swimmer—it can remain under water for a surprisingly long time—this Iguana moves somewhat slowly and heavily on the ground. The adult is greenish grey in colour, marked with darker brown transverse bands. Its thick tongue is non-protrusible and its teeth are fused to the inner slope of the jawbone. This latter characteristic serves to distinguish the species from true Agamids.

Other outstanding features are the relatively large, almost circular, scale on each side of the lower jaw just below the posterior end of the mouth, the low crest of soft, wavy, individual spines extending along the neck, back and first third of the tail and the smaller fringe and heavy dewlap beneath the throat. Green Iguanas are oviparous, the female depositing her clutch of 12-14 soft shelled eggs in February. The eggs are buried in sandy soil and left to hatch.

Unfortunately, because of its need for really spacious accommodation, the adult Green Iguana, which may reach a length of six feet including a tail approximately twice as long as the body, places too great a strain on the resources

of the average amateur. From time to time, however, young specimens of much more manageable dimensions are offered for sale at moderate prices and these make delightful inhabitants of a vivarium. I came across some such in a pet shop early last year and lost little time in securing one for myself.

On reaching home I installed it in a vivarium two feet long and heated by a 15 watt electric light bulb, hitherto the exclusive domain of a Ruin Lizard (*Lacerta sicula*) and a Moorish Gecko (*Tarentola m. mauritanica*). This was a mistake as the conditions designed to suit the needs of the Gecko proved to be too dry for the Iguana. The temperature appeared to be quite satisfactory but the lack of humidity produced symptoms of incipient dehydration in the latter animal. Provision of a vivarium floored over half its length with moss and containing a larger water vessel, corrected the trouble.

When first purchased the Iguana was twelve inches long, pale green in colour with darkish brown bars on the tail. The green on the back tended to change to a light brown at times. The throat frill also varied in colour. Sometimes bluish green, on occasion it became a decided pink, probably due to an increase in temperature. This colour change may also have some connection with courtship display in the breeding season.

The long thin tail was flattened from side to side and the

legs longer in proportion to the body than is the case with most species of lizards. This feature was particularly noticeable when the Iguana was moving amongst the branches with which the vivarium was furnished. Although when at rest it flattened itself against a twig, it raised itself well clear of the support when in motion.

These young Iguanas make excellent vivarium animals. Although considerably larger than its companions, mine made no attempt to harass them or regard them as contributions to the menu.

Also in its favour was the fact that it did not spend its time lurking in some hidden retreat but was always on view, either creeping with stately deliberation amongst the branches or stalking determinedly across the floor in pursuit of food. When inclined to rest it spread itself across a flat stone, laid below the electric light bulb, with closed eyes, luxuriating in the heat.

Feeding presented no difficulties although I am not sure that the nutritional needs of these lizards are always fully understood by proprietors of pet shops. On occasion I have seen young Iguanas offered for sale in cages where the only observable food supplies consisted of fruit and lettuce leaves. This may, I feel, give novice purchasers the wrong idea about the animals' dietary requirements.

It is true that adult Iguanas feed largely on tender leaves and fruit, occasionally supplementing them with such small birds and mammals as they can capture, but young specimens are far more addicted to live insects than to vegetable matter. Indeed, mine showed no interest whatever in fruit or vegetation but fed avidly on maggots, flies and mealworms, the latter being by far the most favoured item on the menu.

From the first it showed few signs of nervousness and in a very short time it became tame enough to take mealworms from the fingers and allow itself to be picked up without struggling. Never, neither in the early stages nor later, did it make any attempt to bite.

Young Iguanas require a constant supply of water. Fortunately, from the point of view of the vivarium keeper, unlike some arboreal lizards, they are quite willing to drink from a vessel which they do by lapping up the water with their short tongues.

When visiting the Reptile House at the London Zoo last October I was interested to see a two-foot-long member of the species. Its enclosure contained a small pool set in the gravel covered floor and was furnished with branches, ivy and artificial plants. The arrangement looked attractive and judging from the condition of its inhabitants, suited their needs admirably. Food supplied included lettuce, fruit and that ever useful standby of the reptile enthusiast, locust hoppers. These insects, incidentally, are quite easy to breed and with a little organisation one has small difficulty in maintaining a succession of hoppers which, ranging in size as they do from the tiny, newly hatched insects to the fully developed two inch imago, form valuable food for a wide variety of lizards.

The season is now with us when we may expect to see new importations of lizards in the pet shops. Should these include young specimens of *Iguana iguana*, they are well worth securing for inclusion in the vivarium not only for their individual attraction, but also for their ease of maintenance and lack of aggressiveness in mixed company.

Council for Nature acts on seals slaughter

UNCONTROLLED slaughter of seals in Britain could be prevented if a Conservation of Seals Bill which came before Parliament yesterday (Wednesday, 3 April) were to become law, says the Council for Nature. The Bill provides for the conservation of both grey and common seals in England, Wales and Scotland and in territorial waters. It would make it illegal to kill or take a seal without a licence issued by a Minister of State on the advice of the Natural Environment Research Council. The only exceptions would be where a seal was in the act of causing damage to fishing tackle, or for the rescue (or dispatch) of an injured animal.

A licence would specify the number of seals to be taken, the means to be used and the areas in which the licence was valid. It would be issued, for a twelve month period, only for the maintenance of a healthy breeding stock or the reduction of surplus seals; the prevention of serious damage to fisheries; and for educational or scientific purposes.

The Conservation of Seals Bill had its First Reading in the House of Lords yesterday (Wednesday, 3 April) where it was introduced by Lord Cranbrook. It has been prepared by the Council for Nature after careful consideration of the many interests involved, including sealhunters, salmon fishers, animal lovers and conservationists. The Council for Nature feels that a measure to regularise and ameliorate the existing confused and unsatisfactory situation is overdue. It hopes that this considered attempt at a rational policy for the conservation of seals will receive the goodwill and support of all moderate opinion.

Find the fish

by D. Thiel

The first is in CRY but not in HOWL,
The second is in FROWN and also in SCOWL,
The third is in MERRY but not in GAY,
The fourth is in YESTERDAY and also TODAY,
The fifth is in DYE and also in DIP,
The sixth is in HOP but not in SKIP,
The seventh is in PORCH but not in HALL,
The eighth is in BAT and also in BALL,
The ninth is in SIGNET and also in SWAN,
The tenth is in JANET and also in JOHN,
The eleventh is in TRUNK but is not in CASE,
The twelfth is in FRILL and also in LACE,
The next is in LID but not in STOPPER,
The last is in POLICE but is not found in COPPER.

Solution on page 442

Herpetological notes

by M. Peaker, B.Sc.

RATTLES

IN England, I had two vivaria, one 4 ft. long, 2 ft. wide and 18 in. high, the other 3 ft. by 15 in. by 15 in., specially designed for small and medium-sized constricting snakes from temperate regions. Both had large pebbles for floor covering and housed a succession of specimens from Aesculapian snakes (*Elaphe longissima*) to Coachwhips (*Masticophis flagellum*). Since mice or other small rodents were usually provided for food, the feeding methods of a number of species could be compared.

One particular action of interest I first saw in a Western Coachwhip (*Masticophis flagellum testaceus*). As a specimen stalked its prey, it vibrated its tail and rattled the gravel loudly. The mouse immediately stopped its activity, listened and sniffed attentively. At this moment while the mouse was still investigating the noise, the head of the snake struck and the mouse was devoured. Since this first occasion I have seen even more pronounced tail vibration a number of times in the European Four-lined Snake (*Elaphe quatuorlineata*) with exactly the same effect. Such a behavioural mechanism seems to be advantageous in that the attention of the rodent is held while the snake's head strikes from a different direction.

It may be that the rattle of the rattlesnakes (*Crotalus* and *Sistrurus*) might have been developed primarily for its use in attracting and holding the attention of the intended prey rather than as a warning device against interference by large mammals. The acquisition of rattling segments on the tail might then confer an advantage in holding the attention of the rodent while the snake injects venom. This thesis gains support when the feeding habits of rattlesnakes are considered. Usually, they hunt at night detecting their warm-blooded prey by the sensory pits situated between the nostrils and the eyes. These pits detect the warmth of a small rodent. At night, of course, the prey cannot be seen clearly, if at all, so that if the strike was made "blind," relying only on the pit detectors, the mouse may have hopped away. However, if the rattling segments were to be vibrated, the mouse, on perpetual guard might cease its activities to listen and sniff in order to try to determine the cause of the sound. This would give the snake time to pin-point the position of the prey and to strike accordingly. The use of the rattle as a warning device might then have followed as a secondary development.

This hypothesis is, of course, purely speculative but I would be pleased to hear from any herpetologists who have made observations on this tail-vibrating behaviour in snakes.

FROGS . . . IN VIVARIA

One of the most difficult problems facing the keeper of the true frogs (Ranidae) is the damage they may cause to themselves by leaping in a confined space. Usually, unless a large outdoor or indoor enclosure is available, the frogs

severely damage the tip of the snout. This injury allows bacterial and fungal parasites to enter and unless treatment is swift, the animal usually dies. Even if a cure is effected, the snout is usually disfigured. The most difficult situation to cope with is the transporting of specimens. If unaccompanied, a box, padded with high-grade cotton-wool is ideal and damp newspaper, paper handkerchiefs or soft toilet paper should be added. The frog should be washed clean of any adhering earth before it is packed in order to prevent abrasions of the skin.

If frogs are being moved personally, large polythene bags are ideal. The polythene is so soft that the frog remains uninjured until it can be released into a large enclosure. Again, damp paper makes good packing material and the bag should be distended with air before a rubber band is fastened around the neck. The bag can be distended by blowing into it following several deep inhalations. Only a small part of the air from each breath should be used—the "dead-space air" so that the oxygen or carbon dioxide content is not changed. The air in the bags should be changed every few hours. This method is very satisfactory and I have transported frogs for several days in large polythene bags packed into a "grip" travelling bag without loss.

Apart from these methods, a can or wide-necked polythene bottle which is perfectly smooth on the inside may be employed and this is particularly useful for aquatic specimens such as *Xenopus*. The lid should have holes punched in it from the inside.

. . . AND ON TAPE

Recent papers in the *British Journal of Herpetology* have called attention to the existence of a number of records containing tracks of amphibians calling. With the advent of easily-transportable tape recorders, there is the possibility that many amateurs will be able to make recordings of many of the European anurans. Moreover, many exotic amphibians regularly call in vivaria and these sounds would not be difficult to collect. In the wild a dish reflector for the microphone would probably be necessary to exclude extraneous sound but in the vivarium, the normal home equipment would be fully adequate. High-fidelity in the upper frequencies would be unnecessary since any sounds produced above 10,000 cycles per second are unlikely to be of any biological significance since the ear of anurans cannot detect sound of a greater frequency than this, in comparison with 15,000 in man.

Solution to "Find the fish" (page 441)

Answer: *CORYDORAS JULII*.

THE MARBLED NEWT (*Triturus m. marmoratus*) is a large, handsome species growing to a length of about 6½ in. in the case of females (a little shorter in males) and is found throughout Spain, Portugal and Southern France. The coloration is really quite striking, consisting of bright green marbling on a black background. Add to this the male's high, straight-edged crest (interrupted at the base of the tail) with black and cream vertical stripes and you have a reasonable picture of the Marbled Newt in the breeding season—surely the most resplendent of the European newts. The underside—not usually seen—is a dark grey-brown colour with a sparse peppering of white spots.

A pair soon settles down well in an 18-in. tank provided with a means to leave the water and planted out with such varieties as Starwort (*Callitriche spp.*), Canadian Pond-weed (*Elodea canadensis*) and Water Forget-me-not (*Myosotis palustris*). The last mentioned is particularly favoured for egg-laying because of the greater width of the leaf which makes the female's task considerably easier and quicker. Indeed, so popular is this plant that the leaf takes on an appearance reminiscent of a concertina with as many as six eggs being individually folded into their own "envelopes" down the leaf. This process is accomplished by using the hind feet to fold over the leaf and into this the egg is laid.

Egg-laying is preceded by the courtship which will only occur if the pair has hibernated during the previous winter and has then been content in their summertime aquatic residence. This may be assured by giving the newts an adequate and varied diet including such items as earthworms, anglers' maggots, frog tadpoles, raw meat (liver seems to be especially popular) and even the occasional unwanted Guppy seems to be welcomed. The lively display of the male is a most fascinating spectacle and is one which may be seen quite frequently during the spring and early summer for he continues to display to the female intermittently (though with no result) after she has mated. This display consists of the male standing at right angles to the female and directly in front of her. The tail is then curved at the mid-point towards the female and is gently waved in a "beckoning" motion

THE JUNIOR AQUARIST

The Marbled Newt

by Peter Burns

showing off the pale stripe on the side of the tail to full advantage. Occasionally the male turns on his side—supported only by his snout and the tip of his tail—thus forming an arc in an attempt to "impress" the female by revealing, in full, the bright dorsal markings and, of course, the crest. When in this position the male suddenly lashes his tail (rather like a whip being cracked) to jerk him back onto his feet and into his original position. He then repeats the process again and again, sometimes more vigorously than others, for as long as twenty or thirty minutes. At this time, either the female moves away (which sometimes results in the male's nudging her sides) or the male drops a small "packet" of sperms (herpetologists call it a spermatophore) which the female then picks up in her cloaca. Egg-laying commences one or two weeks afterwards.

The eggs of the Marbled Newt are roughly oval (being approximately 5 mm in length and 3 mm in width) and each contains a white, spherical embryo. As many as 450 eggs may be laid over a period of two or three months on the basis of a few and often. To prevent the adults eating the resulting tadpoles it seems best to remove the "egg-infested" plants two or three times per week to a separate aquarium to allow them to hatch safely, replacing those plants taken with fresh ones. Hatching generally takes place approximately three weeks after laying. At first the youngsters lie helplessly on the bottom or cling to the plants or aquarium glass using special organs (the balancers) in the form of two drooping filaments behind the eyes. They seem to eat nothing until the intestinal tract is clearly seen to be developed. At this stage large quantities of *Daphnia* should be added to their aquarium and these will be eagerly snapped up resulting in rapid growth. Because the eggs are laid over a considerable period, some tadpoles are a good deal bigger than others so it is advisable to split the youngsters into two or more aquaria according to size; it can be most disconcerting to see one of them disappearing down the gullet of one of its bigger brothers! These tanks should be thickly planted with Water Milfoil (*Myriophyllum spicatum*) and Water Crowfoot (*Ranunculus aquatilis*) since the newt tadpoles have a habit of nosing anything and everything and



The marbled newt

Photo by Lionel E. Day

if it moves, they snap at it—including toes, legs and tails of other tadpoles with obvious damage; so, by planting densely, this danger is lessened.

After about four months of this larval and dangerous existence, the large feathery gills behind the head are absorbed as so are the fins along the top, the back and along the tail; the body coloration becomes darker and then assumes the adult patterning; it breathes air and its metamorphosis is completed and it leaves the water.

As this happens the youngsters should be placed in a container holding smooth, moist earth with half a dozen pieces of bark, flower pot, etc., as hiding places—a small dish of water is unnecessary so long as the cage is kept humid. A shallow, wooden box, lined with a plastic bag (cut to measure) and covered with a piece of glass makes an ideal home for the “newtlets”. They present no difficulty in feeding since they readily seize small pieces of earthworm or clots of

Tubifex placed in front of them. Their appetite and growth are amazing so that if they are kept active and feeding through their first winter, within a year some of them will reach a length of 4 in. and males will exhibit the beginnings of a crest in the form of a low dorsal ridge (as opposed to the orange stripe in the females). Normally, however, maturity is attained by the third year.

Hibernation is essential to breeding and may be accomplished by not feeding the animals for two weeks and then placing them in a container such as a cubical biscuit tin into which has been placed first a layer of earth and then dead leaves—all topped by a layer of moss for insulation. Replace the lid and put the whole in a garage or cellar where the temperature is low but not below freezing-point. Under these conditions the newts should pass the winter successfully and re-appear five months later none the worse.

The Secretive Slow-Worm

By Eric Gillingham

Anguis fragilis is an aberrant lizard which has elongated his body-length somewhat and shed his limbs in order to facilitate burrowing into thick vegetation rather than into the soil, and has retained the viviparous method of reproduction.

Undamaged specimens occasionally reach eighteen inches in length, but this is very rare in Britain. Many large specimens have truncated tails, due to the ease with which these appendages may be broken-off. It is well known that this facility serves to promote survival in several quite unrelated groups of lizards—all of the Geckos, many of the lacertids and some of the skinks. As the food of this little lizard is almost entirely composed of slugs, small snails and earth-worms there has been no necessity for any extensive modification of the jaws; similarly the eye-shields (sclerotic) are still protected by the conventional lizard-type eyelids, which move up from the bottom in order to close, contrasting thus with the mammalian scheme. The external opening to the outer-ear has also been covered-up.

I have referred to this harmless reptile as the secretive slow-worm on account of its retiring disposition. It relies entirely upon concealment in order to survive; it is scarcely even truly nocturnal, as it feeds chiefly in the early morning and early evening and at least when gravid the females are often to be encountered basking in the July sunlight particularly on top of those low loose-stone walls which are so typical a feature of the south-western counties wherein the slow-worm abounds. While we are surveying its distribution, it must be observed that *Anguis fragilis* enjoys a very wide range indeed: not only is it one of Europe's commonest reptiles, but as far as Great Britain is concerned, I suggest that it has secured a position of numerical supremacy over all the other five native reptiles together. It ranges from Southern



Group of Slow-Worms of different ages showing colour variation

Sweden to Western Russia, England, Scotland and Wales (but it is absent from Ireland. Through France, Switzerland, Germany to Hungary and parts of Yugoslavia, it reaches into North Africa and South East Asia. Despite this enormous range, many people who live where it abounds, seldom, if ever, see it.

Now let us review this creature from the stand-point of the vivarium-keeper. For the young enthusiast, it is the beginner's selection, *par excellence*. For a start it is never aggressive: if we agree to exclude the nuptial love-bites with which the male addresses his bride, we may safely say that no slow-worm has ever bitten anyone larger than a slug so that it is safe with other reptiles—except adders and smooth-snakes which feed upon slow-worms! It does not move very fast and its climbing abilities do not compare with those of the snakes or of the quadrupedal lizards so that it does not often escape. Its personal requirements are readily supplied—a dry retreat, under a piece of bark, or a

flat stone, a source of drinking-water (incidentally, they prefer to absorb droplets of water from leaf-surfaces, and these they usually obtain from dew). The food is almost universally obtainable. Small worms and slugs are to be taken for the asking in most localities, even in urban surroundings. Many slow-worms adapt themselves after a time to less familiar provender and will take the larvae of the meal-beetle (*Tenebrio molitor*), gentles, and even in some cases, strips of raw meat dipped in beaten raw egg: this last occurrence, is however unusual. By the way, do not offer wood-lice to reptiles or batrachians, as they are useless from the point of view of nutrition, and in my experience only toads will accept them, and even these do not thrive on them, and often reject them.

Another reason for recommending this little anguid is its sheer longevity: specimens which have survived more than fifteen years in captivity are relatively common, and there are well-authenticated instances of over thirty years!

Anguis fragilis reproduces itself freely in captivity, if the natural conditions are carefully simulated. These requirements are relatively simple. It will be necessary to provide opportunity for concealment—sphagnum-moss peat, or even just plain turf are all equally good in this respect. Provision should also be made for a permanent and dry retreat and a tin-lid or a shallow-tray containing dry saw-dust, sand, or even pine-needles is an obvious way of supplying this need. Cover the tray with something flat and reasonably heavy—a piece of stone, slab of slate or slice of bark, leaving only a small aperture available to give ingress. Place any newly-acquired specimens inside this hide-out and allow them to find their own way out of it and in so doing to orientate themselves with the lay-out of the vivarium. It will also be necessary to cover the tank with glass or perforated zinc, not on account of the climbing propensities of the permanent inmates, but simply because it will be desirable to limit the wanderings of any unconsumed slugs, snails etc. which may be introduced into the tank from time to time as food for the residents.

Sexing of slow-worms is a fairly simple matter once you have accustomed your eye to the colour differences which occur over a range of individuals.

Newly-born slow-worms are all exactly alike—that is to say they all resemble one another, and differ most remarkably from their parents. They are around two-and-a-half inches in length, anything between six and sixteen in number, and they are all a light creamy-golden colour on the back, with a dark chocolate line (sometimes two) running from a spot above the occiput down the back-bone to the tail; the sides are also dark chocolate, and the ventral surface is a metallic blue-black, unrelieved at this stage by any spots. There is usually present also a small dark spot on the front of the head between the eyes.

Both sexes are identical for the first year or so and as they become sexually mature about the third year of life the sexual differentiation begins to show in the colour pattern and males assume a regular dark shiny-bronze hue and silvery spots begin to appear on the belly. The females, however, always retain the linear markings; the central dorsal stripe

splits up and migrates to the sides; in some cases this occurs more than once and the final effect is, in her case, that she has at least three and often five longitudinal stripes running down the sides.

Some very old males develop a fascinating peppering of dark-blue spots which are *never* seen in the females.

So outstanding is the appearance of some of these old males that more than one of the earlier zoologists fell into the trap and described them as a separate species. The first victim of this rather natural misconception, nominated the proposed new species 'Colchica'.

The favourite food of our native anguid is a common grey slug called *Limax agrestis*. In its turn it provides a tasty delicacy for many insectivores, and at least two other reptiles, and as far as this country is concerned its numbers are controlled by predation from moles, shrews, hedgehogs, and vipers, and at least in Dorset and some adjacent counties, by the Smooth snake (*Coronella austriaca*)—but always, and everywhere, alas, the most persistent destroyer is *Homo ignominus Horribilis!*

Spatterdocks

by B. Fry

THE SPATTERDOCKS, or nuphars, are water plants (closely allied to the true water lilies, or nymphaeas) that range across the northern hemisphere from North America, through Europe and Asia, to Japan. The majority of species are indigenous to the U.S.A. Essentially they are plants of slow-moving or still waters. The large, heart-shaped leaves, often mistaken for lily pads, that add attraction to our canals, even in industrial areas, are those of *N.luteum*, which is widespread in the British Isles and throughout Europe. This nuphar has yellow flowers, popularly known as brandy bottles on account of their alcoholic smell. Sometimes it is called the yellow pond-lily. *N.luteum* is too overwhelming a plant to cultivate in the home aquarium,

though occasionally a seedling will stay small, with submerged leaves, for quite a long time. Seedling plants are quite accommodating as regards temperature.

N.pumilum is much smaller in all its parts than *N.luteum* and is therefore well-suited to aquarium culture. Although some of the more recently published reference books written for aquarists tell us, or suggest, that this species is widespread in Europe but is absent from the British Isles, the erudite Robert Gathorne-Hardy, in his *Wild Flowers of Britain* (Batsford, 1938), records that it may be found in high-lying tarns in the north. *N.pumilum* has the most charming submerged foliage: translucent, wavy-edged, and of a delicate grass green. Its basic needs are a good light and a compost richer than washed sand alone. It is the plant commonly sold by the dealers under the all-embracing name of spatterdock.

N.japonicum, as its specific epithet indicates, is native to Japan. It has the same tissue-thin foliage as *N.pumilum*, but the leaves are broadly

arrow-shaped. There is said to be a variety of this nuphar with red-brown leaves. A hybrid *N.japonicum* × *N.pumilum* has just appeared on the market. This plant adds greatly to the charm of a decorative tank and is quite happy if it is given comfortable room temperature (or a tropical temperature) and a reasonable light.

N.sagittifolium from the eastern half of the U.S.A. is popularly known as the Cape Fear spatterdock. Unlike the nuphars mentioned above, it will not flourish in the coldwater aquarium. It calls for tropical conditions. It also demands a strong light. The wavy-edged leaves are lanceolate and are held upright on strong stems. The leaves of a well-developed plant measure about 7 in. long by some 2 in. across.

Propagation of nuphars is by seed or division of the rhizomatous root. A root cutting is best weighted with a lead band and merely laid direct onto the compost. If the cut end shows signs of rapidly spreading decay, the rotting portion should be sliced off with a razor blade.

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Reptile Communities in the Outdoor Vivarium

by Andrew Allen

AFTER MAINTAINING SEVERAL indoor and tropical vivaria the aspiring herpetologist will naturally progress to some sort of large outdoor vivarium. All the available alternatives allow much satisfaction in the layout of the interior, it being possible to set up an accurate reproduction of practically any European habitat. Having decided to build some sort of outdoor vivarium it will be necessary to decide which; although in all the inmates will live happily for many years and benefit from the almost innumerable advantages in scope, layout, breeding and feeding over the inhabitant of the indoor vivarium.

There are three major alternatives—a greenhouse, a reptiliary, or a cold-frame. Each has advantages in respect of particular communities of reptiles.

For those living in the far North the applications of the reptiliary are limited, and only a few species can be kept that will survive the hazards of snow-drifts and freezing rain. In these regions the extra warmth of the greenhouse may be critical. In the Midlands there is a wider range of inhabitants, though still limited. In the South the reptiliary has the weighty advantage that it is the cheapest of the three, and can be built from waste materials, though the overhang, the vital part, must be well constructed. But in every region the reptiliary is limited to the hardier species, prohibiting green toads, spadefoot toads, eyed lizards and others that will thrive in the greenhouse. Furthermore, tree frogs cannot be kept in the reptiliary for obvious reasons, and it



Slow worms

has to be a very well-designed reptiliary that will baulk the escapist urge of green and wall lizards. Several of the more active frogs such as the agile and edible frog would treat a three foot wall with disdain. But the latter will settle down readily in an unwall'd garden pond, thus making it equally eligible for the reptiliary. It is worth considering that food will always enter the reptiliary from outside, though a cat may also do the same. There is also the feeling when one leaves home that some prize specimen may have absconded by your return. A hibernating chamber situated in a dry position is an advantage in the reptiliary, but is not essential in the other two.

The adapted cold-frame is primarily suited to amphibians, and also to slow-worms. Using one's own materials one could also build an outdoor vivarium with individual advantages. Both must be situated in a fairly shady position. The humidity can be maintained at the right level for amphibia, but is hard to regulate in the case of reptiles, which also resent the lack of

vertical space, even when the vivarium stands on several courses of brick.

The greenhouse is the most expensive of the three, but in many ways the most satisfactory. A wide range of less hardy reptiles and amphibians is possible and every refinement of design can be included. It is safe from the ravages of the weather, and is entirely escape proof if the base is sturdily built. All conditions can be minutely controlled.

This, then, should give some guide to the best alternative for your purse, for your garden, and for the type of community you wish to establish. If you have a small garden it is best not to keep male marsh frogs which may croak you out of your own home!

When arranging a community it is wisest not to include the hunter with the hunted. No one would mix grass snakes and smooth newts if the latter were intended to thrive and breed. This is a very obvious example, but there are many reptiles which would gladly eat their nearest cousin on the evolutionary tree, let alone their own offspring, though this last oversight is

usually due to bad eyesight. It is unwise to coop terrapins with small newts or eyed lizards with any of their smaller relations. Marsh or edible frogs will greatly appreciate a small toad or a baby snake or lizard.

Although the adults of many species may live together in peace, if not in amity, many will eat the young of their companions. Also many species living in water, though they will not molest an adult frog, will thrive on their tadpoles. In this way the larger newts, axolotl, marsh frogs and clawed toads, as well as terrapins, are all a risk. In confined spaces adult green, Schrieberi's, eyed lizards and glass snakes are all cannibalistic. A clawed toad will grab at anything large enough to eat or considerably larger. So the community should be arranged both with regard to aesthetical beauty, and breeding aspersions.

Some possible communities; numbers depend on size of vivarium.

REPTILIARY

1 small, simple reptiliary of about 8 ft. x 4 ft.

(a) 6 viviparous lizards (*L. vivipara*)
4 slow-worms (*A. fragilis*)
4 common toads (*B. bufo*) and/or
5 midwife toads (*A. obstetricans*)
8 yellow or fire-bellied toads (*B. variegata* or *bombina*)
10 of smooth, palmate, alpine newts (*T. vulgaris*, *helvetica*, *alpestris*)

(b) 4 slow-worms (*A. fragilis*)
4 edible frogs (*R. esculenta*)
4 common frogs (*R. temporaria*)
4 moor frogs (*R. arvalis*)
4 common toads (*B. bufo*)

6 crested or marbled newts (*T. cristatus* or *marmoratus*)

2. If the boundary wall is about three feet high, and the area is double or more than that of 1 (a) with a moat.

(a) 6 green lizards (*L. viridis*)
11 wall lizards (*L. muralis*)
4 slow-worms (*A. fragilis*)
5 dalmation toads (*B. b. spinosus*)
6 S. A. clawed toads (*X. laevis*) or
6 marsh frogs (*R. ridibunda*) or
8 crested newts (*T. cristatus*)

(b) 2 glass snakes (*O. apodus*) and/or
2 grass snakes (*N. natrix*)
2 tortoises (*T. hermanni* or *graeca*)
4 dalmation toads (*B. b. spinosus*)
6 European or Spanish terrapins (*E. orbicularis*, *C. c. leprosa*)

3 COLD FRAME

The amphibian species mentioned under "greenhouse" may also be housed in a cold frame.

GREENHOUSE

4. In a greenhouse of about 12 ft. x 6 ft.

(a) 5 viviparous lizards (*L. vivipara*)
7 wall or ruin lizards (*L. muralis*, *L. sicula*)
4 slow-worms (*A. fragilis*)
15 tree frogs (*H. arborea*)
4 natterjack or green and/or common toads (*B. calamita*, *viridis*, *bufo*)
5 spade-foot toads (*P. fuscus*)
4 midwife toads (*A. obstetricans*)
8 yellow bellied toads (*B. variegata*)
6 mud frogs (*P. punctatus*)

(b) 8 green lizards (*L. viridis*)
4 slow-worms (*A. fragilis*)
4 moorish geckos (*T. mauritanica*)

4 medium sized European, Spanish, painted terrapins (*E. orbicularis*, *C. C. leprosa*, *C. picta*) or

5 axolotl (*A. mexicanum*) or
5 clawed toads (*X. laevis*) and
3 agile frogs (*R. dalmatina*)
3 edible or common frogs (*R. esculenta*, *R. temporaria*)
5 fire salamanders (*S. salamandra*)

(c) in a larger greenhouse
3 eyed lizards (*L. lepida*) or
4 dalmation lizards (*L. v. trilineata*)
4 Schrieberi's lizards (*L. schrieberi*)
4 glass snakes (*O. apodus*) or
3 grass snakes (*N. natrix*)
3 dice snakes (*N. tessellata*)
2 garter snakes (*T. sirtalis*) and
3 hermann's tortoise (*T. hermanni*) or
Carolina box tortoise (*T. carolina*)

The following species not mentioned may also be kept in:—

1 (a). sand lizard (*L. agilis*).
2 (b) if sufficiently well designed reptiliary with a re-arranged community—adder (*V. berus*) or aspic viper (*V. aspis*).

4 (a) Australian tree frog (*H. ewengii*); Alpine salamander (*S. atra*).

4 (b) painted frog (*D. pictus*); ribbed salamander (*P. waltl*).

4 (c) Blanding's terrapin (*E. blandingii*); Reeve's terrapin (*G. reevesi*); Aesculpien snake (*E. l. longissima*); ladder snake (*E. scalaris*); smooth snake (*C. austreaca*); viperine snake (*N. maura*); angry snake (*C. viridi-flavus*).

In addition many hardy American species are available in this country, settling down well in the greenhouse, the snakes, frogs and toads being too numerous to mention individually.

Success with angels

by Anthony Fox

I thought I would write to you about the funny thing that happened one Saturday. For some weeks now I have constantly been losing fish; so the bright idea struck me that I should breed some to keep down the cost. (As it gets very expensive for a 13 year old boy.)

On Saturday morning I got up, fed the fish inspected them for any signs of illness. On noticing my two angels up in one corner I decided to investigate. They were eating something on

the filter tube and, on further inspection, they turned out to be eggs. I was very excited to see these dozens of eggs, but I wasn't sure what the parents were up to, so, I put my hand in the tank and kept all the fish away from the eggs while we roughly separated the tank. Both my fish books said the parents would look after the eggs until they were fry. With mixed feelings I let the parents go back to the eggs. They commenced eating them but this time I noticed they picked out only the bad ones. My confidence was restored in the angels and I saw them chase other fish away from the eggs. I was still deter-

mined to guard the eggs and my parents went to Southend and bought me an aquarium divider, and so we started to separate the tank into two; however, on commencing the operation I noticed the angels had begun eating all the eggs, (they must have been frightened by our trying to divide the tank) but, in the end we succeeded in giving the eggs a quarter of the tank on their own. (The tank is 48 in. long so I thought the fish wouldn't be cramped, as due to our losses there aren't many anyway.)

This morning I got up early and saw the eggs were alright, so now I look forward to when they hatch.

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Lacerta viridis

by H. G. B. Gilpin B.Sc.

COMMONLY CALLED THE Green or Jersey Lizard, this handsome saurian ranges from S. Europe to the Channel Islands. It is neither native nor, in spite of a number of specimens being released on occasions, feral in Britain as far as I know at present. I have seen them basking in the heat on sunny stone walls in Portugal where they look magnificent. They are naturally alert and are not easy to approach closely in their own native environment.

Viridis is a singularly beautiful lizard which reaches some fifteen inches to sixteen inches in length. The tail is graceful and slender and accounts for two thirds of the total length. The upper body colour varies from yellowish green to vivid grass green and the underside from yellowish white to deep, clear yellow. It is related to the much larger Ocellated Lizard.

Provided it is given a reasonable amount of room, *viridis* is an excellent vivarium animal, not the least of its virtues being the ease with which it can be sexed. Adult males in breeding condition have rich, cobalt blue throats but this alone is not an entirely decisive characteristic as young males are sometimes entirely innocent of any blue coloration and on occasion one encounters females in which it is quite pronounced. A more reliable differentiating factor is the colour of the upper parts of the body. In males the basic green is profusely speckled with tiny black spots, whilst in females the black is confined to large black patches. Sometimes the female is plain self green, completely free from markings and sometimes she carries from two to four whitish stripes. The males also have stronger, coarser heads than the females and have a

thicker root to the tail. Completely dark, practically black specimens, are not unknown. The young are brownish and sometimes, but not always, spotted with white.

Green Lizards are extremely active and capable of moving with considerable rapidity but are not unduly nervous or highly strung in captivity. In fact, they are particularly easy to tame and under confined conditions soon become familiar with their owners. A pair I have at present, imported through the trade from Italy, fed freely on inch long locust-hoppers within half an hour of their coming into my possession and in less than twenty-four hours the male accepted mealworms from my fingers. Inside a week both of them could be picked up and handled without difficulty.

A not inconsiderable recommendation for these lizards as vivarium inmates is their habit of remaining almost constantly on view. The floor of the converted aquarium in which I keep mine is covered with a couple of inches of fairly coarse gravel and one corner is occupied by a bark covered log. Very rarely one or other of them will retire for a short spell behind the log and even more rarely do they bury themselves in the gravel. The majority of the time however they

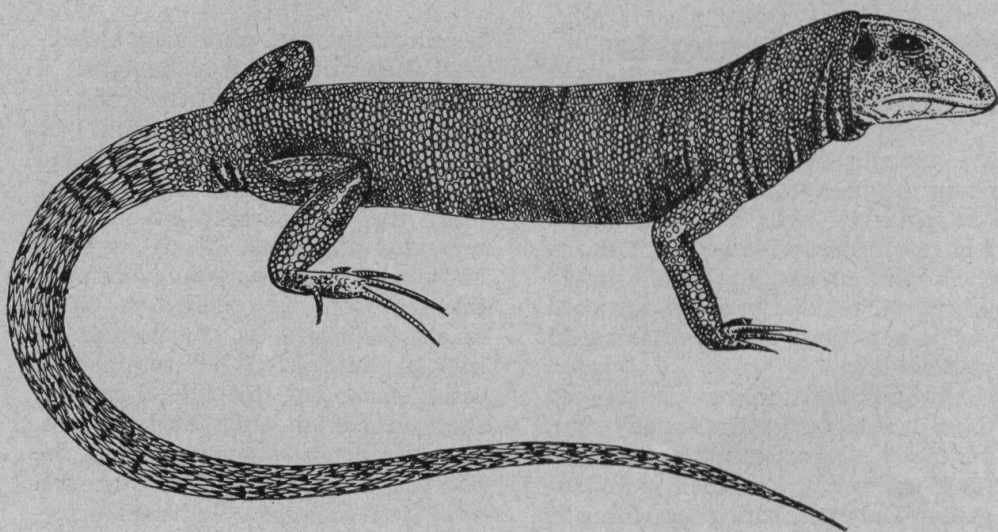
spend revelling in the heat beneath the electric light bulb or stalking through their domain hunting for food.

Green Lizards are oviparous, the clutch consisting of some five to twenty eggs. Under natural conditions the female buries her eggs in damp sand. According to different authorities the incubation period varies between one and three months and the parents are reported to remain in the vicinity until they hatch.

I am hoping my current pair will help to establish the facts more accurately. They were seen to mate on May 16th. The behaviour of the male was somewhat violent but no damage to either participant resulted. He clamped his jaws on the back of the female's neck, coiled himself along her length and for a brief moment their vents came into contact.

I have seen it stated that six to eight weeks elapse between copulation and egg production. In view of the fact that she started to deposit her eggs the following day there is no doubt that this female had been previously mated before she came into my possession.

Depositing her eggs satisfactorily involved the female in a protracted outburst of energy, lasting throughout the day. She scraped out a large hole



under the log by vigorously hurling the gravel in all directions, violently scratching it out with both fore and hind feet. She was still working away when I left her for the night but by the next morning calm had returned to the vivarium. The female appeared to be considerably thinner than she had been and not only was the hole filled in but the gravel had been scraped up from all directions until it sloped gently, almost to the top of the log. Both lizards were sprawled peacefully across the summit of the pile but the sight of food galvanised them into immediate action and between them they consumed four fully adult locusts and a dozen mealworms in a matter of minutes. Evidently their attempts at propagation had involved a considerable expenditure of energy.

Green Lizards are said to eat earthworms and sometimes soft fruits.

Personally I have not succeeded in persuading them to take fruit but, when short of more acceptable fare, they have eaten earthworms of up to four inches in length. Given the choice they much prefer locusts, particularly half grown hoppers, blow flies, spiders, maggots and mealworms. They need water, drinking it fairly freely, and will take it from a pot.

In the wild these lizards hibernate in winter but under vivarium conditions I like to keep them active throughout the year by the use of a thermostatically controlled heater maintaining a fairly constant temperature of 80°F. I know of one reptile enthusiast who keeps Green Lizards in an unheated greenhouse. They appear to do well and spend the winter hibernating in artificially constructed underground burrows.

Although male Green Lizards tend to fight among themselves when in

breeding condition they will live amicably with other species of comparable size. I kept one pair for some time together with a pair of Skinks of approximately equal length but rather greater bulk, and both species seemed perfectly content and indifferent to the presence of the others. I should not, however, be inclined to trust them with lizards much smaller than themselves.

Green Lizards are not difficult to obtain and are frequently offered for sale in pet shops. They are inexpensive to buy and their beauty of shape and colour together with their active habits, tameness and adaptability make them well worth a place in the vivarium. Personally I would recommend them highly as the first choice of a beginner in reptile keeping wishing to gain experience of lizard culture before venturing upon more exotic and more difficult species.

Fish Food Review

continued from page 667

on to the surface of the water and is greedily eaten by young fry.

'Gordon's Formula' is a fish food which was devised by Dr. Gordon a number of years ago. The recipe is given in some of the smaller books for guppies. The food was rather difficult to prepare from fresh liver, etc., and required heating. The resulting paste-like gel was not too easy to keep fresh for long periods but the food was thought very highly of by American guppy breeders. The freeze-dried version has removed all the bother of preparation and the food comes in about $\frac{1}{2}$ in. square cubes. I have found this food most useful if small pieces are crushed between finger and thumb and scattered on the tank water. Fish of varying sizes and ages can then feed on appropriately sized pieces. All of my fish seem to be very fond of this food as they do of the mosquito larvae. These are in the form of small, almost black granules and powder, and they have a fairly strong smell which apparently attracts the fish quickly. The final freeze-dried food which I have had the chance to

test so far is the red worms. These are ordinary freeze-dried tubifex worms which have not been compressed into blocks and which have retained a more natural colour than those in cube form. My fish seemed to prefer these loose worms to those in cubes as they were more easily taken and eaten.

The analysis of each food is given on the side of the pack, and most of them are high in protein content, this being the constituent which builds strong, large and healthy fish. One can see that the prices vary considerably, and by careful selection one can obtain best value for money; e.g. cubes of tubifex are 3s. 3d. for 5 grams and 'free' red worm tubifex costs 5s. 6d. for 12 grams.

Although these freeze-dried foods, as with other brands, are quite expensive, the trouble that they save one in not introducing diseases or pests, nor having to buy, rear or catch live foods, is worth the cost. One can, of course, include both live foods and freeze-dried foods in the fishes' diet, as well as the normal stable diet of various ordinary dried foods and fresh foods from the kitchen or garden at home. The other foods, especially the daphnia, interest me and I hope to review these in the future. B. W.

Goldfish Fanciers Criticised

Fishing and goldfish breeding have come under attack in the Shanghai newspaper, "Liberation Daily," which describes the hobby as "an evil wind" spread by chairman Mao Tse-Tung's opponents.

Quite a number of young people had become influenced by this "evil wind" and were spending most of their time "frantically fighting" to buy materials to make fish tanks, according to an article in the newspaper.

The newspaper said some people used state materials and utilised their working hours to manufacture their goldfish bowls in the factory workshops and thus help spread anarchism.

What is it?

From page 648

ANSWER

Swim Bladder of Veiltail Goldfish

Pseudocordylus subviridis

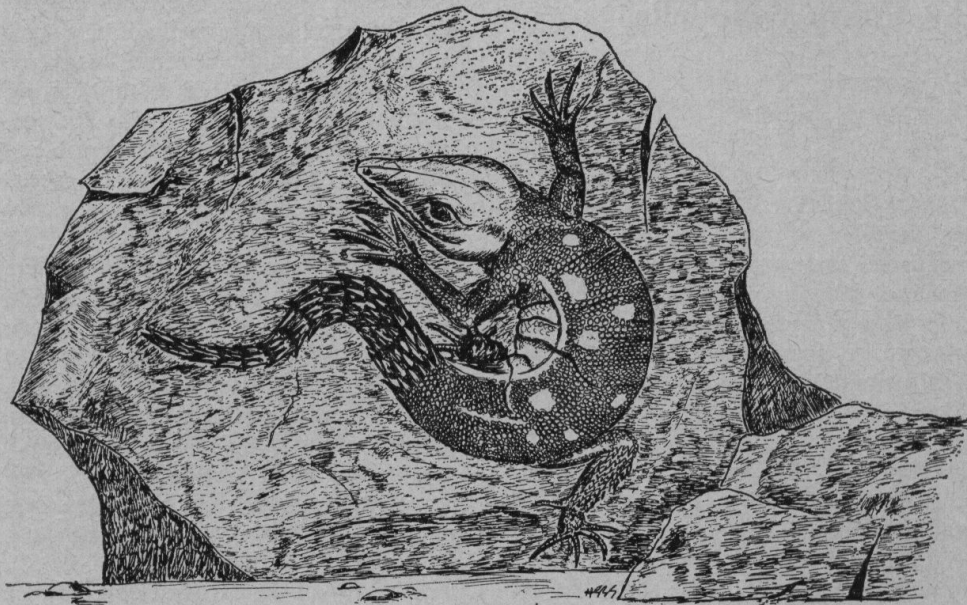
by H. G. B. Gilpin, B.Sc.

COMMONLY KNOWN AS the Craig Lizard, this saurian is typical of the rock-dwelling species. The body is extremely flattened, so much so, that at first sight it gives the impression of having recently completed an extended hunger-strike. It is, however, ideally constructed to suit the needs of a rock-dwelling animal accustomed to retreating into narrow crevices in boulders, to escape the attentions of the numerous predators who prey upon members of its order. Its shallow body enables it to penetrate incredibly narrow cracks into which few enemies can follow it.

Pseudocordylus is further protected by its colour which merges imperceptibly into its background. Its broad, triangular head and, for its size, powerful jaws, are horn coloured. The ochre patched back and tail are a dark, unobtrusive brown and a wide, ochreous-yellow band extends along the sides. The abdomen is greyish-yellow. The tail, which as a further protection, can be shed in moments of stress, is covered with rough, sharply pointed, protruding scales.

Although not brightly coloured, like some rock dwelling lizards, *Pseudocordylus* has an intriguing appearance and is well worth a place in the terrarium. When newly caught it is, as perhaps one might expect from an animal accustomed in its natural habitat to disappearing with the utmost celerity into some rocky refuge at the first intimation of danger, somewhat timid. It soon becomes reconciled to captivity, however, and ceases to dash madly for the cover of some convenient rock cranny whenever one approaches.

At first sight its somewhat menacing appearance makes one a little doubtful as to the wisdom of handling it with unprotected hands. Any risk in doing so is, I imagine, illusory as on the numerous occasions when I have found it necessary to handle mine, it has, apart from a few preliminary struggles, proved entirely innocuous



and soon settled down. At no time has it attempted to bite. Care should be taken, however, to treat it gently and cautiously, otherwise one might be left holding a portion of tail whilst the lizard disappears into the most inaccessible crack available. The loss of the tail will not inconvenience it but, although regeneration of the lost part will take place, it will never regain completely its former beauty. Also one might experience considerable difficulty in reclaiming the truant.

In view of its relatively huge head and wide mouth (my present specimen, although no more than seven inches in total length, has a head one-and-a-half inches across its widest part) I should hesitate to keep it in the same quarters as smaller lizards. I have found it completely inoffensive and non-aggressive towards lizards of comparable size. For some months my specimen shared its accommodation with a pair of Jersey Green Lizards (*Lacerta viridis*) and an Agama and all four lizards lived together peacefully without the slightest signs of bickering.

Pseudocordylus, although normally a somewhat lethargic lizard, is given at times to bursts of activity when it will hurl itself across the whole length of its quarters. In doing so it might well damage its nose against the

glass or some intervening obstruction. Because of this its terrarium should be reasonably extensive. I have found a converted aquarium three feet by fifteen inches by fifteen inches to be quite satisfactory.

I have divided the floor of mine into two parts, one covered with thick, low growing moss and the other with a couple of inches of dry, coarse sand. The variation in texture of these two materials seems to keep the animal's feet in good order. The *Pseudocordylus* uses the two surfaces indiscriminately, if anything rather favouring the moss.

For furnishing, the terrarium is decorated with a few large rocks chosen for their colour, shape or interesting appearance and so arranged to provide little "caves" into which the lizards can retire when so disposed. The *Pseudocordylus* does make use of these retreats if faced with the sudden advent of a stranger but normally spends most of its time in the open. A four-inch diameter earthenware pot of water is sunk in the sand for drinking purposes, its rim reaching some half-inch above the surroundings.

The Crag Lizard is a native of S. Africa and requires a temperature maintained at not less than 70°F. This can be provided quite simply by

Continued page 684

THE WATER THYMES

by Philip Swindells

THE ELODEAS OR Water Thymes must be familiar to the vast majority of aquarists and pond owners, for these prolific growing oxygenating plants are widely commercialised and can always be found in dealers' shops. Unfortunately the genus has recently been subjected to an upheaval in nomenclature and species formerly known as *Elodea* are now reclassified under *Egeria*, *Lagarosiphon* and *Anacharis*.

There are about ten species currently known as *Elodea*, all of which are of North or South American origin; the commonest being *E. canadensis*, the Canadian Pondweed. This is the plant introduced into Europe at the end of the last century, which spread rapidly along canals and waterways making them virtually unnavigable. Fortunately it died out after several years leaving a much less vigorous form in its place. It is believed that the plant originally introduced was the male form, separated botanically at that time as a species, *E. planchonii*, a plant which is now comparatively rare in cultivation. The *E. canadensis* now common in these regions, and the

one of commerce, is usually the female form. This has dark green, serrulate leaves borne in whorls around long branching stems, and tiny floating lilac flowers with long thread-like peduncles. These are only occasionally produced, usually after a spell of warm humid weather, and are water pollinated. Regrettably, owing to the invasive nature of this species, it can only be recommended for the aquarium or pools in which an excess of underwater growth can be easily controlled.

Elodea occidentalis has a similar habit of growth, becoming a nuisance in shallow acid water, but more restrained under neutral or alkaline conditions. Its stems are long and slender with whorls of sparsely placed narrowly lanceolate leaves and masses of small nut-like fruits; the latter enclosing extremely viable seeds which contribute in no small measure to the spread of the species.

A native of South America, *Elodea callitrichoides*, is almost identical, except that its stems are much stouter and fruits are rarely produced. This most attractive little plant is currently naturalised in parts of the Home Counties, but is not reliably hardy and therefore more suited to the aquarium than the garden pool.

Although completely hardy, *E. nuttallii* (*Hydrilla verticillata*) always looks its best in an aquarium where it can be viewed from the side. Its delicate lanceolate leaves being almost translucent and borne in dense whorls around the slender much-branched

*Elodea—
there are ten
species currently
known*

stems. This extraordinary plant abhors the presence of organic matter in its growing medium, and is much happier in a stiff clay or gault compost.

Lagarosiphon major (*Elodea crispata*), however, does not appear to be too particular as to soil conditions, thriving in the most unlikely of places, and thrusting up long stems densely clothed in broad, dark green, crispy foliage. I would think this is probably the finest oxygenating plant for a pool as it rarely gets out of hand and retains its character throughout the winter.

Almost as popular, but not quite as robust is *Egeria densa* (*Elodea densa*), a frequent inhabitant of both tropical and coldwater aquaria. It looks at first glance like a very well grown *E. canadensis*, but closer inspection will reveal that its tiny floating three-petalled flowers are white and obviously insect pollinated. In common with all Elodeas and their allies, propagation is affected by stem cuttings some three to six inches long, held together in bunches by a strip of lead around the base and dropped or planted in the pool or aquarium.

Pseudocordylus subviridis continued from page 683

fixing a 60 watt electric light bulb, connected with a thermostat, to the inside cover of the terrarium. An opaque glass bulb is preferable to a clear one as, although it gives adequate light, it reduces the glare considerably. The animal revels in the heat and spends much of its time pressed flat against a convenient rock, basking in the warm rays.

Although, as is the case with the vast majority of lizards, only live food is acceptable, feeding presents no great problem. Blow-fly maggots are taken readily. If some are left uneaten they pupate and quite soon, at the prevailing temperature, flies

emerge and are soon snapped up by the lizards. Locusts, both third instar hoppers and the fully adult insects, form a popular item of diet and in times of shortage of winged insects the ever useful standby of the lizard keeper, mealworms, form a satisfactory substitute on the menu. Woodlice, although less popular than insects or their larvae, will be eaten when more favoured foods are unobtainable. These are usually easy to find and if placed in the terrarium will form a colony underneath the moss, providing a reserve supply of food against times of possible shortage.

When live food is given quite often the insects will not all be eaten immediately as lizards, unless hungry, normally show no interest in them. Frequently the surviving insects crawl into the water vessel and being unable to crawl out drown themselves. This is a complete loss as the lizards will not feed upon the dead bodies. Prevention is simple. If a stone is placed in the water vessel, level with and touching the rim, any insects, inadvertently submerging themselves, readily avail themselves of the escape route so provided and are available whenever the lizards are again ready to take them.

AMPHIBIANS AND DECOR

by Peter Burns

THE LACK OF popularity of keeping amphibians in captivity, when compared with tropical fish for example, may be due in part to the rather unattractive and unimaginative surroundings in which they are almost invariably kept. Such sights as cracked, rusty aquariums containing a few rather decrepit frogs and perhaps a somewhat lugubrious toad sitting in one of the corners can hardly be conducive to recruiting many amphibian enthusiasts. Such a state of affairs, however, is not always analogous with keeping these animals since their quarters can be made to look quite pleasing provided that a little care is expended on the matter.

Perhaps the commonest type of furnishing for an amphibian cage is a flooring of soil with pieces of flower-pots as retreats—neither of which is particularly appealing aesthetically. And neither can such an environment be termed a reproduction of the natural habitat, since most terrestrial species live in habitats providing a high humidity—taking the Common Frog (*Rana t. temporaria*) as an example. After spawning, the frogs generally frequent long grass for the rest of the summer. And again, the Fire Salamander (*Salamandra salamandra*) is said to inhabit damp woods—the floors of which would probably be characterised by leaf litter, moss and perhaps pieces of bark and it is these last-mentioned items which can be utilised to great effect in vivaria. Where the cage is fairly large, say 3 ft. × 2 ft., the interior can be made more attractive by placing a strip of bark (e.g. 18 in. × 4 in.) near the back and putting more earth between the bark and the back wall and this area can then be carefully planted with moss. Wall Screw Moss (*Tortula muralis*) is an admirable type for the purpose since it is hardy and can be found almost anywhere on walls, stones and by the

side of paths. If it is removed carefully from its substrate it will live quite satisfactorily on the soil of the vivarium. Where a small converted aquarium is being used, if sufficient moss can be found the entire floor can be planted and an interesting background may be provided by a large, single piece of bark up against the glass. There are, however, problems. First, of obtaining the piece of bark of the right size and second, of flattening it to make it usable. The first may be solved by finding a large, dead tree—this is none too easy and almost impossible in towns and cities. But if you live in the country, you should have little difficulty. Once found, the bark is generally fairly easy to remove. Next comes the flattening which is usually rather tricky. If the bark is loosely wrapped in wet rags and put under a stone or half-brick—this is generally quite effective.

For most of the year a pool of water is not generally a necessity for the more terrestrial amphibians such as most toads and salamanders. However, a small pool is often used by many of the commonly kept species such as the Edible Frog (*Rana esculenta*) and also helps to maintain a humid atmosphere inside the vivarium. If a pool is to be provided, it is best to make it as attractive as possible. An example of an improvement over the tin-lid or small sunken dish is to copy the methods used in making garden ponds using pool liners—though on a considerably reduced scale, of course! If the flooring is perhaps two inches in depth, remove all the soil leaving only the thinnest layer of soil to just cover the bottom. Then lay a plastic bag (cut open) in this depression and place small pieces of rock around the edge and simply fill with water.

By nature, amphibians are principally nocturnal and are consequently difficult to see in their cages without disturbing them to a considerable extent. Fortunately, this can be overcome quite satisfactorily in the case of wooden cages. In essence, this consists of arranging (i) a retreat in the form of a totally enclosed area—i.e. a cavern in miniature, (ii) a viewing window in the side of the cage as one of the side-walls of the retreat and (iii) a wiring arrangement

such that, on opening the sliding door on the outer side of the glass, a small light is switched on inside the retreats.

It is best, first, to cut away the relevant part of the cage wall and glue in place the four wooden slats ($\frac{7}{8}$ in. × $\frac{1}{8}$ in. is suitable). The glass to be used is ordinary window glass and hardboard is quite adequate for the sliding door. The width of the narrow piece of wood separating these two will depend on the width of the cage wall (if this is $\frac{1}{2}$ in., for example, the separating piece of wood will need to be between $\frac{1}{16}$ in. and $\frac{1}{8}$ in. in width).

An easy mistake to make is to forget that the two outer slats and the sliding door come higher up the side of the cage than the glass or the inner slats, since it is above the latter that a further piece of wood must be fitted on which is to be the wiring (this is B in Fig. 2 but is not shown in Fig. 1 for the sake of clarity). Two pieces of wire are required for this part of the circuit (ordinary single-strand copper wire is ideal)—one piece is glued on the underside of B up to halfway along it so that this end is left bare and the other end is connected to the small bulb holder screwed to the inside of the “cave-to-be”. The other piece of wire is glued along the other half of B so that there is a small gap between the two exposed ends of wire. The rest of this piece is glued along the back of the same piece of wood (for neatness principally) and thence can be connected to the battery which can be positioned at the most convenient place in the cage. The two remaining connections (one on the bulb holder and one on the battery) can then be joined by using more wire. Because of the space between the sliding door and the glass, it is possible to position (by glueing) a small piece of wire on the former so that, on lifting the door, it completes the circuit and the light is switched on. It will be noticed that only glue has been mentioned where perhaps tacks or nails could be used—Evo-stick is one of the best adhesives for the purpose and is neater than the above and just as efficient on this rather small scale since the system is quite successful even with the glass measuring only 3 in. square and the retreat

measuring only 8 in. × 5 in.

As for arranging the "cave" itself, it is best to have only a thin layer of soil as flooring (as compared with the general depth in the rest of the vivarium) and pieces of bark are suitable for the walls. An entrance passage (as shown in Fig. 1) is advisable, not only to make it more attractive but also to keep the light out, making it more favourable for the amphibians. The rather low roof can be formed by using a piece of slate and on top of this, perhaps, a thin layer of soil and then a carpet of moss over the top of the entire cave. Thus the general effect, from above, should be a gradual upward slope (if the set-up is at the end of the vivarium) and the narrow entrance (to keep out the larger and therefore more clumsy toads) some distance from the viewing panel so that it does not look

more false than it has to.

With reference to lighting in the cage as a whole, this is not to be recommended generally since amphibians as a rule detest excessive light, notable exceptions are the Edible Frog (*Rana esculenta*), and the Marsh Frog (*Rana ridibunda*). However, if the light bulb can be suitably concealed, an interesting (almost eerie) effect can be obtained by use of green light though this should not be used for more than a couple of hours; during the evening is the best time.

Up to now only the land vivarium has been considered since this gives greater scope than water and it is also probable that more amphibians are kept on land than in the water. Newts, however, show their greatest colour and are liveliest in the water during early summer. Perhaps the best maxim is to follow the ideals of

the tropical fish keeper. Thus overhead lighting shows up the colours of such an attractive species as the Alpine Newt (*Triturus alpestris*). Aquariums housing newts all too frequently lack growing plants in sufficient quantities. A reasonable variety of hardy aquatics can be found in many ponds or, if this is not practical, plants such as *Myriophyllum*, *Elodea canadensis* and *Callitriche* (Starwort) can be obtained from most aquarist shops. Most newts will thrive in such an aquarium though the water should not be heated. There are two amphibians which soon make a mockery of tasteful planting and crystal clear water; these are the Axolotl, (*Siredon mexicanum*) and the South African Clawed Toad (*Xenopus laevis*)—especially the latter whose large size and lively nature at feeding times make regular water-changes essential.

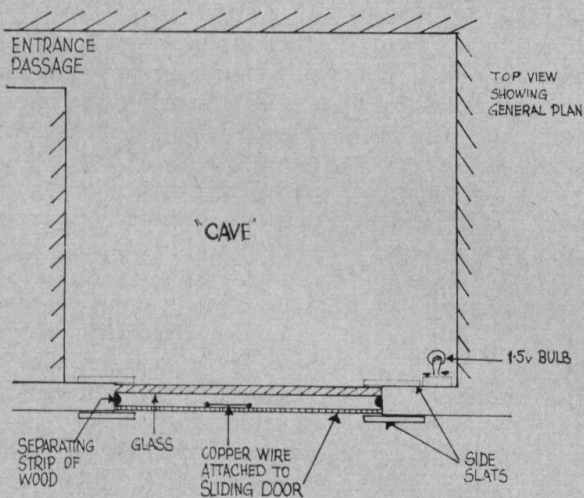
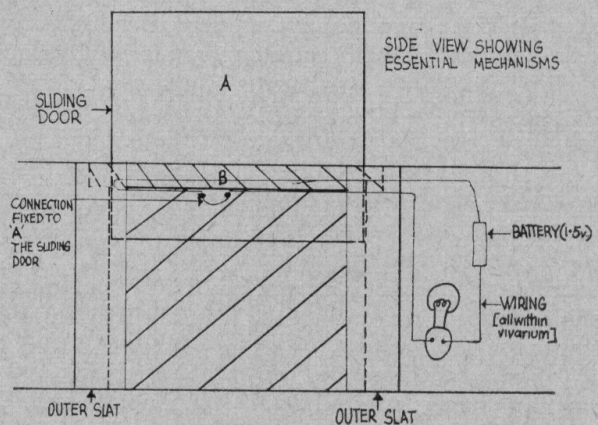


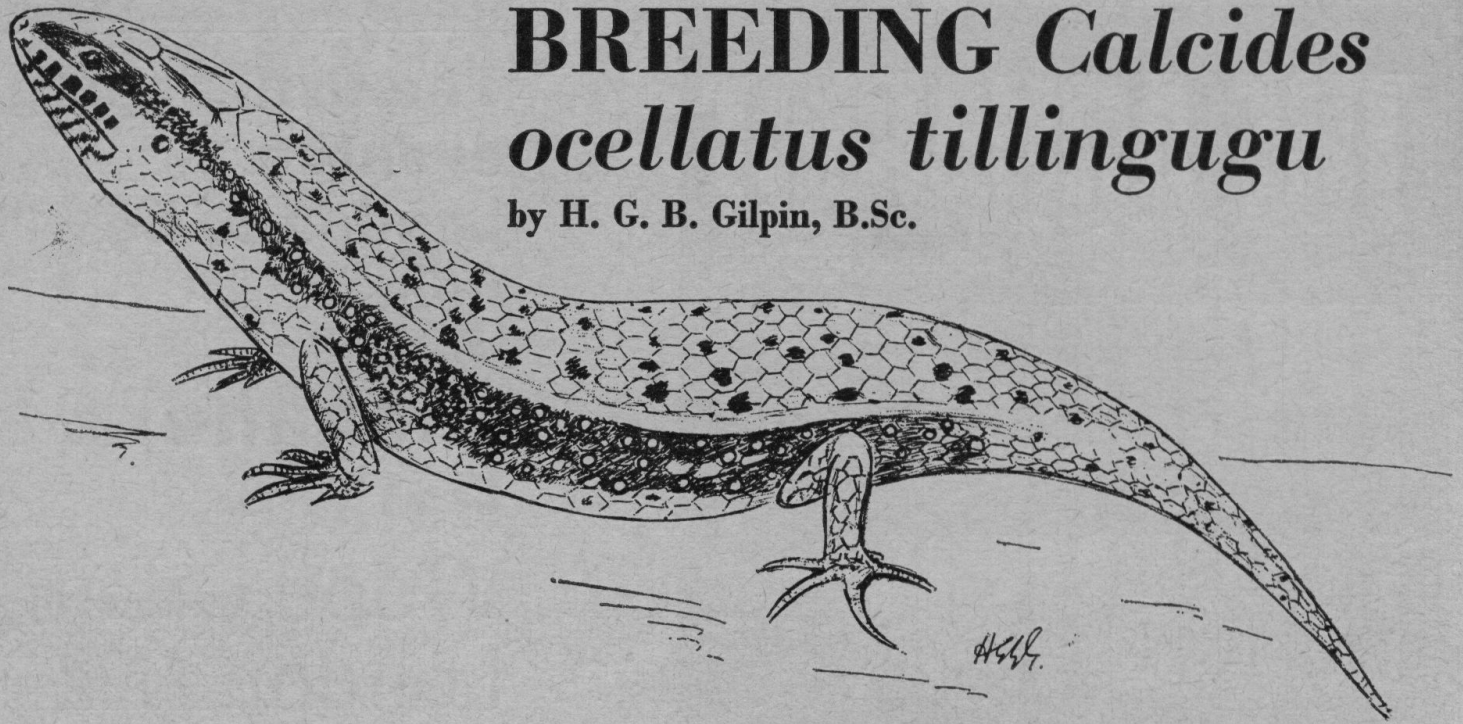
Fig 1.

Fig 2.



BREEDING *Calcides ocellatus tillingugu*

by H. G. B. Gilpin, B.Sc.



THE EYED SKINK, a sub-species of the Ocellated Skink, *Calcides o. ocellatus*, occurs in Tunisia, Algeria, Sicily, Sardinia, Pantellaria and Malta. It is found in vineyards and orange groves. My pair were caught in a nursery comprising twenty acres of cultivated and waste land where water was available. Not many were seen in Malta generally but they were fairly numerous, both adults and young, in this particular spot. It was noticed that the adults usually occurred in pairs.

My pair arrived in England in April, 1968, in good condition, and were placed in a vivarium 17 in. x 11 in. heated to 80°F. The floor was covered with two to three inches of smooth pebbles, each roughly the size of a marble, in which both skinks immediately buried themselves. After a while they pushed their heads above the pebbles, leaving the rest of their bodies submerged. In this position they were almost invisible, the fawn-brown heads, wide between the eyes and narrowing sharply to pointed mouths, merged marvellously with the rounded stones.

After a day or so, they emerged and spent some hours each day basking in the heat from the overhead electric light bulb, giving me an opportunity to observe them more closely. They were identical in colour. Their stout, powerful bodies, sepia brown in colour, were marked with trans-

verse lines of dark brown, oval spots. A fawn line on each side separated the back from the flanks and below the line the spots merged into a black band dotted with circular fawn spots. The underparts were white. The male, stouter built and rather coarser than the female, measured 11 in. from nose to tip of tail, the female being one inch shorter. In both sexes the legs were disproportionately tiny and although they seem inadequate for carrying such heavily bodied animals on solid ground (indeed they scarcely raise the abdomens above the horizontal) they cause little obstruction below the surface where the skinks can move with considerable speed. I discovered this when attempting to catch them, finding they moved underneath the pebbles faster than my hand could follow them.

The bodies were covered with hard, smooth scales, so highly polished as to appear metallic in finish. This forms a slippery surface, which together with the very muscular nature of the bodies, makes them difficult to hold in the hand.

My pair commenced to feed within a day or so after they were first installed. All feeding, with these two at least, appears to take place at night or in the early morning. This may be due to their somewhat nervous natures since, although they will lie out in the open as long as one

remains perfectly still, at the slightest sign of movement they disappear below ground. This tendency to withdraw from observation is not readily overcome. Mine have been with me almost a year now and still "sound the retreat" at a surprise approach.

To begin with they would only eat adult locusts consuming two to three apiece every 24 hours and showing little interest in hoppers. Nowadays they will take locust hoppers as small as the third instar and also consume blowflies and some mealworms. These skinks are said to take raw meat but mine have refused steadfastly to show any interest in this article of diet. I have not offered them beetles but, judging from the powerful appearance of the jaws, can well believe they would have little difficulty in crunching up these insects as described by some authorities.

Although I have not actually seen the adults drink, the level of the water pot falls regularly and there is no doubt that they need water and are prepared to take it from a vessel. A day or so ago one of the young ones was observed lapping water with its tongue. After cleaning out their quarters, just before Christmas, I replaced the pebbles with three to four inches of rounded gravel and introduced a bark covered log. They showed little interest in the log,

except to burrow underneath it, but the gravel caused a slight change in their habits. Instead of protruding their heads, as they had done when supplied with pebbles, they submerged the whole of their bodies, leaving no part exposed. At this time the temperature was allowed to rise to a constant 90°F.

On February 20th, my attention was drawn to the skink's vivarium and to my surprise and delight, although the female had shown no previous signs of being in young and in spite of fairly constant observation during which I had not seen the male taking any particular interest in her, a baby skink was basking on the surface of the gravel. On running my fingers gently through the gravel, I dislodged five more young skinks. Being all too well aware of the enthusiasm with which mature lizards regard their offspring as a welcome addition to the menu, I hastily transferred two of the babies to a fresh vivarium, leaving four with the parents. One, born with a malformed jaw, died within 24 hours but the rest flourished. After a week, although I had seen no attempts by the adult skinks to devour the young ones—(probably because their burrowing habits, firmly established in the babies from the day of their birth—enabled them to avoid any direct contact with their parents) I decided to eliminate all possible risk and transfer the adults to other accommodation, so leaving the young ones to grow on in familiar and apparently satisfactory surroundings.

Catching the adults involved blind groping in the gravel until the fingers encountered a skink, a process which was not made any easier by the speed with which they moved as soon as they were touched. The female showed no particular resentment on being handled but the male responded promptly and bit my finger, hanging on with all the determination of a bulldog. The bite did not draw blood but was nevertheless quite painful.

Owing to temporary shortage of room, the adults were put in with a full-grown pair of Jersey Green Lizards. The floor of the vivarium was covered with a dry mixture of coarse sand and soil, in which the skinks buried themselves with the same enthusiasm they had shown when based on gravel. The two species appear to agree perfectly well

and there have been no signs of conflict.

Meanwhile the young ones are growing steadily, feeding freely on newly hatched locust hoppers, tiny mealworms and small stick insects, the latter being by far the favourite article of diet.

The babies were each about nine centimetres in length at birth and are almost identical with their parents in colour and shape. They are less nervous than their parents, spend far more time in the open and do not disappear with the same readiness when approached. It will be interesting to see if this state of affairs continues or whether they revert, as they grow older, to the inherent nervousness of the species.

WALKING' FISH THAT WALKED OUT

Extract from
Malay Mail, Kuala Lumpur

by Joachim Ng

KUALA LUMPUR, Mon.—A "walking" fish which the Selangor Aquarists' Society wanted to enter for the 3rd Annual Tropical Fish Exhibition beginning on Wednesday, has walked out on them.

The fish left the same way it came when it was caught—walking on its fins.

Unusual

It all began about two weeks ago when a schoolboy, Stewart Labrooy stopped his car at the 15th mile Federal Highway, when he noticed an unusual object waddling across the road.

A close look dumbfounded him. It was a two-foot long walking fish!

So Stewart took it to the home of Mr. Douglas K. K. Lee, president of the Society.

Mr. Lee decided to enter the fish for the exhibition. He also decided that fish fanciers throughout Malaysia should know of this unusual fish. So he called in a T.V. Malaysia camera crew and let lose his walking fish on his lawn. It promptly moved around "rather like a walrus."

And then on Wednesday night the walking fish—an Ikan Haruan—suddenly decided it had had enough of publicity. It broke through the

plastic net covering its tank and has not been seen since.

However there is one consolation for the fish fanciers because T.V. Malaysia will screen the antics of the walking fish tonight after the English news.

Strange as it may sound the Ikan Haruan, or China Walking Fish, is actually very common in this country. It lives in the swamps.

But what most people do not know is that it can live out of water for up to seven hours with just a trace of moisture.

It can also walk miles.

The five-day exhibition at Stadium Negara will be opened by the Sultan of Selangor.

It will feature 45 species of fish. More than 400 entries have been received for the show.

The emphasis this year is on the larger varieties of local fish, such as the Knife Fish, the Ikan Toman and the Ikan Bulan.

FIND THE FISH

Doreen Thiel

The first is in DOSE but not in PILL
The second is in COLD and also in CHILL

The third may be found in RAIN
and also in WATER

The fourth is in MOTHER as well
as in DAUGHTER

The fifth is in OCEAN but not in SEA

The sixth is in POTATO and also
in PEA

The seventh is in HILL but not in DALE

The eighth is in BARGAIN and also
in SALE

The ninth is in COTTAGE but not
in HOUSE

The tenth is in JUMPER and also
in BLOUSE

The eleventh is in START but not
in BEGIN

The twelfth is in BRANDY but not
in GIN

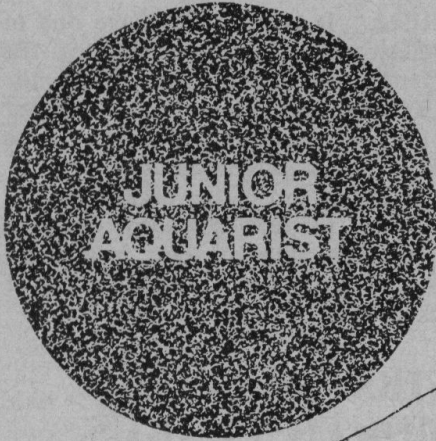
The next is in FRONT and also in REAR

The fourteenth is in GUN but not in SPEAR

The fifteenth is in AQUARIUM
but not in TANK

The last is in SMACK and also in SPANK

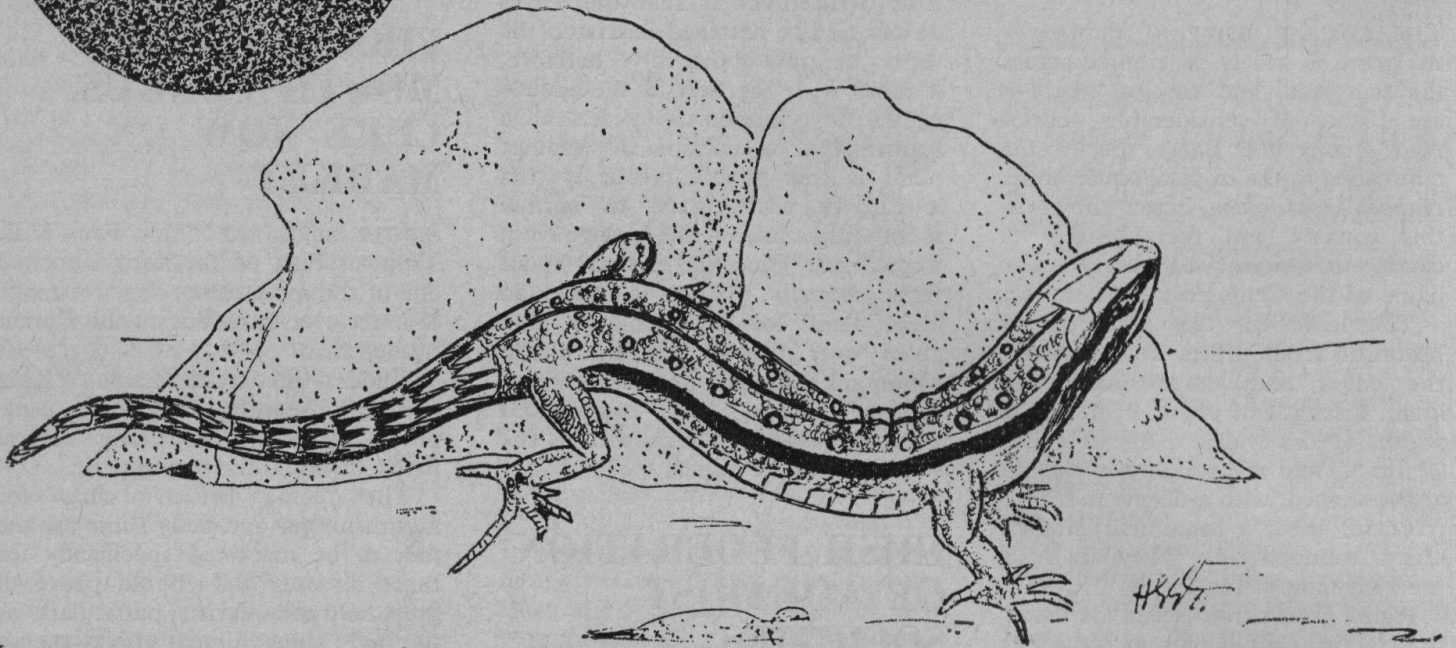
Solution on page 48



KEEPING AND BREEDING

Lacerta vivipara

by H. G. B. Gilpin, B.Sc.



I HAVE KEPT A CONSIDERABLE number of these charming little lizards and bred them successfully on a number of occasions. From six to eight inches long, the Viviparous Lizard, although not vividly coloured, is a shapely and attractive creature. The basic colour, though variable, is greenish brown to medium or dark brown on the upper surface with a broad, dark band through the eyes and along the sides. A similar but narrower line, bordered on each side by a row of lighter spots, passes down the centre of the back.

The males are rather smaller than the females and have orange underparts, sometimes spotted with black. The underparts of the females are usually grey, yellow or yellowish green. This is not an entirely reliable method of distinguishing between the sexes as a number of females I caught in the Swiss Alps all had clear orange abdomens. There was no doubt about their sex as some of them subsequently produced young. The presence of a swelling near the base of the tail in males, which is absent in females, produces a more certain method of differentiation.

The abdomen, as with other members of the *Lacertidae*, is covered with small, rectangular scales. The scales of the tail, which is a little longer than the head and body, are elongated and arranged in transverse rings. Many species of lizards shed their tails when in danger of capture but the Viviparous Lizard seems to do so more readily than most and, if they must be handled, particular care and gentleness are essential.

The only reptile to be found in Ireland, the Viviparous Lizard is frequently encountered in this country and widely distributed in central and northern Europe.

They are at home on sunny banks, in fields, open spaces in woods and marshy ground and are frequently to be found in the neighbourhood of water. Once established in an area they are likely to remain there for many years. In this country they are commonly seen on roadside verges and railway embankments; in Ireland I found them on stony, heath-covered ground, within a stone's throw of the sea and in Switzerland

I saw them in considerable numbers amongst the low growth at the edge of forest tracks or sunning themselves on fallen timbers. In Switzerland, too, many were met with along the banks of fast-running streams and among the huge boulders dotting the sheltered mountain valleys, 4,000 ft. and more above sea level, no great distance below the snow line. Incidentally, apart from a single, very large slowworm, Viviparous Lizards were the only reptiles I saw in Switzerland.

As vivarium inmates Viviparous Lizards have many advantages. They are good-tempered creatures and may be kept safely in mixed groups of males and females. Their non-aggression also extends to other species of comparable size. They soon become tame and spend most of their time in the open parts of their quarters where they can be seen. Although fairly active they do not require a great deal of room and their tolerance of moderately damp conditions means that it is possible to ornament the vivarium with living foliage.

A pleasant appearance can be achieved by covering the greater part of the floor of the vivarium with moss, embedded in an inch or so of leaf mould, and filling in the remainder with a layer of rounded gravel. A few large "rocks" placed on this gravel will provide opportunities for the lizards to sprawl out and bask on their surfaces. A few flowering plants—African Violets are particularly satisfactory — arranged along the back wall is a worthwhile addition. It is advisable to stand the pots in small trays to prevent undue moisture seeping out into the moss and gravel. A strip of rough bark laid across the front of the pots disguises them effectively and provides the lizards with a climbing area of which they are not slow to take advantage.

A water vessel must be supplied as Viviparous Lizards drink freely. Some also like to submerge themselves in the water lying for several hours with just the head above the surface.

They will feed upon most insects small enough for them to swallow, including newly hatched locusts, flies, blowfly maggots, butterflies, grasshoppers and winged ants. Spiders are eaten with enthusiasm and small mealworms form a welcome addition to the menu. Some will eat small earthworms and slugs but many decline to show any interest in either.

Viviparous Lizards are not difficult to breed in captivity. As their name indicates, the young are born alive although occasionally eggs are produced. When this happens they hatch immediately. The newly born lizards are one inch to one and a half inches in length and black in colour. After a month they begin to assume the brown coloration of the adults, the tail being the last part of the body to change.

Growth is rapid provided abundant supplies of food are available. On several occasions I have obtained six baby lizards at a single birth and at times as many as eight. Since these have invariably arrived in July or August, it has usually been possible to provide them with adequate amounts of small animal life. At this time of the year most gardens are infested with more aphides than their owners consider desirable. These, together with ant larvae, tiny spiders and newly born woodlice, are taken

by the baby lizards with avidity. Clumps of newly dug moss contain a wealth of minute living creatures and when introduced to the vivarium provide an excellent reserve of food. If the vagaries of the English summer cause shortage of natural foods from the garden, the babies will feed freely on fruit flies, day-old stick insects and very tiny mealworms. These can all be bred under controlled conditions and are invaluable foods for many species of lizards during the earliest stages of their lives.

Care should be taken to remove the young lizards as soon as possible after they are born to fresh quarters, away from their parents who will show no hesitation in hunting them down and eating them. After producing half a dozen or so young ones the females are very much reduced in condition, with folds of loose skin along their sides, and they need especially careful treatment. They must be given ample amounts of food, in as wide variety as possible, if they are to survive.

Since pairing amongst these lizards normally takes place in May or June, it is not unusual for females caught in July and August to present their owner with a family. I brought back a large female last August from Switzerland in a cellophane bag perforated with pin holes and half filled with dry moss. On reaching home and opening the bag I discovered that she had produced eight fine babies, all of which were in good condition and extremely lively.

Although not essential, I like to provide the babies with a minimum temperature of 60°F as this keeps them active and encourages them to feed. At this stage, too, their water pot should be shallow with gently sloping sides. I have known them to creep into a steep-walled water vessel at night and, being unable to extricate themselves, drown before morning.

In the wild Viviparous Lizards hibernate in this country from October to March but in indoor vivaria I prefer to provide them with sufficient heat to keep them awake and feeding. This does not apply to lizards kept out of doors where adequate provision has been made for them to retreat below ground level beyond all danger from frost.

MUCH ADO ABOUT £5. 12. 6.

by Phillip Brown

AFTER HAVING KEPT ordinary tropical fish for several years I decided to branch out into the hobby of Tropical Marine Fishkeeping as many other aquarists seem to be doing today. The first thing I proceeded to do was to become confused. Deciding to set about this difficult hobby with care and attention, I bought two books on this new hobby, namely, "Coral Fishes" by T. Ravensdale and the "Marine Aquarium" by Wolfgang Wickler. This sounded splendid. Here for a couple of pounds I had acquired the knowledge of two great specialists, but reading through the books I found out a very important thing; they disagreed with each other. T. Ravensdale was in favour of an expensive rust-proof, corrosion-proof aquarium with massive filters on the outside of the aquarium, churning water through them at 100 gallons per hour with ozone being continuously pumped through a protein skimmer which looked like it was worth 12s. 6d. but turned out to cost £3. W. Wickler, however, did not need all this; all he wanted me to get was a watertight container, a solution of salts, a hydrometer, some aeration, a few rocks, adequate illumination, a filter with nylon wool and some heating. Because I was still at school at the time and only earning 30s. a week with about £3 saved up, I decided to compromise and bought a 20-inch bow-fronted plastic aquarium and a Gro-Well bubble-up filter. I put a plastic-bunged heater in the corner, some coral and rocks on the base of silver sand, a thermostat on the outside and an aerator and pump which necessitated me budgeting my earnings for a good week or two. But in the cause of amateur science I carried on and bought two ten-gallon packs of Tropic-Marin, one for the water of the tank and one as a standby.

FIRE WITHOUT SPARKS

by Dr. Gregor Drummond



WINTER HIBERNATION makes most European amphibia rather disappointing to keep in a vivarium. If we leave them alone, then we see them for only a few months of the year—and if we try to keep them awake in winter, they die before they should. This is only one respect in which the Fire Salamander has distinct advantages for the vivarium enthusiast, for he is on the move all through the year.

On the move is putting it rather broadly. If ever there was a fire

without sparks it is *Salamandra salamandra*, as Lineus called him. You could not wish for a more peaceful, friendly, ambling old fellow than this creature. His behaviour is about halfway between that of my lizards and crocodile. On the one hand he does not dart about, making capture the sort of problem it is with my House Gecko. On the other hand he does not lie motionless and disinterested for days on end like my Black Caiman.

Although he spends little time in

the open, you soon find his black and yellow-spotted body lumbering forward through the plants when you tap on his home at feeding time. He has a very short tongue and so takes his earthworms, mealworms, woodlice or pieces of meat directly into his mouth from your fingers. Being a lazy cove by nature, he soon comes to prefer this to searching for food himself.

He is very happy to be picked up gently and stroked a little, making no effort to get away. This absence of

FISH FOOD REVIEW

fear of humans is remarkable among the lower creatures. The only comparable example I know is my Common Chameleon, who likes to climb up my arm and sit on my shoulder like a monkey—matching his colours to my shirt!

The Fire Salamander does not do this. He is quite content just to sit on my hand, peering at me with his large black eyes. I wash carefully after this because, although he is friendly, the Fire Salamander cannot help releasing secretions from the double row of glands along his back and tail.

This invisible secretion, called 'salamandrin', is very toxic to all animals. It must never be allowed to get into an open wound or to reach the eyes or nose. Although it is not at all dangerous, salamandrin can cause much painful discomfort—which is a most useful defence for such a soft, slow creature.

Given reasonable living conditions, Fire Salamanders live in captivity for several years, unlike all other salamanders. I have had mine for two years and it is full of health. No great problems are involved in keeping them—ordinary room temperatures are perfectly suitable—but one or two points need attention.

The adult Fire Salamander stays on dry land and is actually averse to water. For drinking and for keeping the air moist, the vivarium should contain a pan of water not more than an inch deep, for they cannot swim or float and they easily drown in deeper water if no support is available.

They like to burrow, so you should provide a peaty or mossy soil—no sand or gravel to tear his soft skin, though a rock or two for climbing on is appreciated. They do not bury themselves completely so you will see some yellow spots about somewhere. Do not be afraid to dig him up for a chat and a stroke.

Far from resenting this, he comes to enjoy it. You can feed him at the same time.

If you are lucky enough to acquire a pair, there is no reason why they should not breed, for this is quite common in captivity. But you will need patience. From about June to August the male deposits sperm on pieces of moss and then the female picks it up directly into her cloaca. And there it remains for a long, long time. It will certainly not be before the following spring, possibly later, that the young are in evidence.

Not only does the mother keep the sperm from being fertilised for several months, but retains the young inside her until they have developed good pairs of limbs. At that time she sidles into very shallow water and releases from 20 to 70 baies, which swim away immediately.

You can keep the young happy with enchytrae worms, chopped earthworms and minced meat. They are hungry little critters and grow fast, so you will need a plentiful supply of food on hand when the mother finally decides to let you have them. Quite a few will succumb to Nature's weeding out of the weakest, but you should have enough survivors to make a useful deal with the local pet shop.

Finally, one of the most satisfying things about the Fire Salamander is that, possibly because of his secretions, he seems to be almost totally immune to pests and diseases. Like every other animal, of course, he has microscopic parasites, but these appear to do him no more harm than the bacteria in our own mouths.

You may be sure that if you acquire one or more of these delightful animals, you will have an interesting, pretty, friendly, trouble-free pet for many years to come. They can be obtained quite cheaply from those who advertise amphibia in *The Aquarist*.

"AQUA-FREEZE" FREEZE-DRIED tropical fish foods, distributed by B. C. Tops Ltd., Wirral, Cheshire, and manufactured by the Commercial Freeze-Drying Co. Ltd., Clitheroe, Lancs.

This new range of freeze-dried tropical fish foods is the only British manufactured freeze-dried fish food on the market at present. The whole range, which consists of five varieties, is 100 per cent pure food, and no fillers, additives or colouring are included. Varieties available are freeze-dried heart, roe, shrimp, worm and liver. The heart, roe and shrimp, retail at 3s. 6d. per plastic drum, which contains 5 grams of heart, or 5 grams of shrimp, or 10 grams of roe. The 5 grams of worm, or the 10 grams of liver, retail at 4s. 9d. Unfortunately the containers' labels do not carry an analysis of the protein, fat, etc., content of the foods.

Most of these foods have a relatively large particle size, except for the roe, which is reasonably small and is suitable for some of the smaller fish. The others, straight from their containers, would be more suitable for larger fish, but the larger particles may be crushed before being fed to the fish. Smaller fish will nibble at the larger particles. The shrimp appears to be adult shrimp which have been broken up, complete with shell, and are not the small brine shrimp which one hatches from eggs. The worms are not the common tubifex, but appear to be garden worms which have been broken up a little. All of the foods would be suitable for larger fish, including the roe, which would also be suitable for smaller fish, but for very small fish, each of the foods would need to be crushed between the finger and thumb to produce a suitable size for eating. Fortunately, as a result of the freeze-drying process, this is easily done.

B.W.

Herpetological notes

by *Megalobatrachus*

Vitamins

An adequate supply of vitamins is essential in the diet of all higher animals depending upon the species. However, in many mammals, including man, excess of certain vitamins is known to be detrimental so that the quantity of vitamin D, for example, given to an animal must be regulated. Reptiles are also known to be susceptible to the excessive supply of vitamin D. Hypervitaminosis D has been recorded several times in the Common South American Iguana (*Iguana iguana*) and an account of one of these cases is given by Dr. J. D. Wallach in the *Journal of the American Veterinary Medical Association* (volume 149, page 912). I always attempt to give my animals vitamin and mineral supplements but this is usually a rather hit and miss affair since the precise or even approximate nutritional requirements of most animals is not known. The formulae for vitamin additives I prefer are those used in the Basle Zoological Gardens and these are given in their latest form by Dr. H. Wackernagel in *International Zoo Yearbook*, volume 6. If the supplements cannot be given with the food, a water-soluble vitamin preparation can be added to the drinking water unless of course the water container happens to be a large pool.

Dr. Horsfield's Tortoise

One of the more uncommon tortoises which can be kept in the garden enclosure is Dr. Horsfield's tortoise (*Testudo horsfieldii*) which is found from the Caspian, across Turkestan to Afghanistan. This species is said to reach a length of about nine inches while a specimen I had several years ago measured just under five. This species has small thigh tubercles similar to those of the usually imported North African Spur-thighed tortoise (*Testudo graeca*) and

the clawed tail of Hermann's tortoise (*Testudo hermanni*). It also has only four claws on each foot. The specimen I had was a dull olive-brown colour although some reference works state that it may have black blotches on the carapace.

I housed my specimen in a large garden enclosure containing a pool. It shared this enclosure with three specimens of the Spur-thighed tortoise and on very warm days, a Berlandier's Gopher tortoise (*Gopherus berlandieri*). The pool was inhabited by European and Spanish terrapins (*Emys orbicularis* and *Clemmys leprosa*). My specimen was not so boisterous as the three Spur-thighed tortoises but spent a large part of its time clampering over a rocky area I had provided. It slept and sheltered from rain in the shelter under a rockery.

It ate the usual vegetarian tortoise diet and I never saw it consume carrion provided for the terrapins (Hermann's tortoise will often eat carrion). Specially favoured were soft, ripe tomatoes and dandelion flowers.

Since some of the specimens imported may be from the warmer parts of the range, hibernation may not be successful and it may be better to maintain them in an indoor sub-tropical enclosure. My specimen showed a desire to hibernate and this was successful for the first winter but it died at the end of the subsequent hibernation.

Old Aquarists

Some time ago I obtained some issues of *The Aquarist* of 1932 and 1933. The advertisements are particularly interesting and some of the prices I wish still applied. Green lizards were 1s., Dalmation Giant Green Lizards, 2s. and 3s.; Wall Lizards 6d., Blue-tongued Skinks 20s., Australian Long-necked Terrapins

10s. and 20s. Angulated Tortoises were 5s., 12-inch Leopard Tortoises 40s. and Giant Zonures 10s.

In the same issue, an article by the Editor, A. E. Hodge, dealt with keeping Fire-bellied toads, then known as *Bombinator igneus*. Three excellent photographs with accompanying notes are shown of the Axolotl, Spectacled Salamander and Olm and a letter from a reader deals with the dangers of keeping the Glass "Snake" or Scheltopusik with Green lizards, the latter being eagerly devoured by the former.

Diet of a Sea Snake

The sea snakes (*Hydrophiidae*) are an extremely interesting group. Dr. H. K. Voris of the University of Chicago has found that in two species of the genus (*Emydocephalus*) the stomach contents consist entirely of fish eggs (*Ecology*, 1966, volume 47, page 152). These two species have no dentary teeth and Voris considers that fish eggs may be the exclusive diet of these two species since a snake with no dentary teeth would be unlikely to be able to capture and devour a mobile vertebrate.

Other sea snakes are known to eat fish which are captured by use of their extremely potent venom.

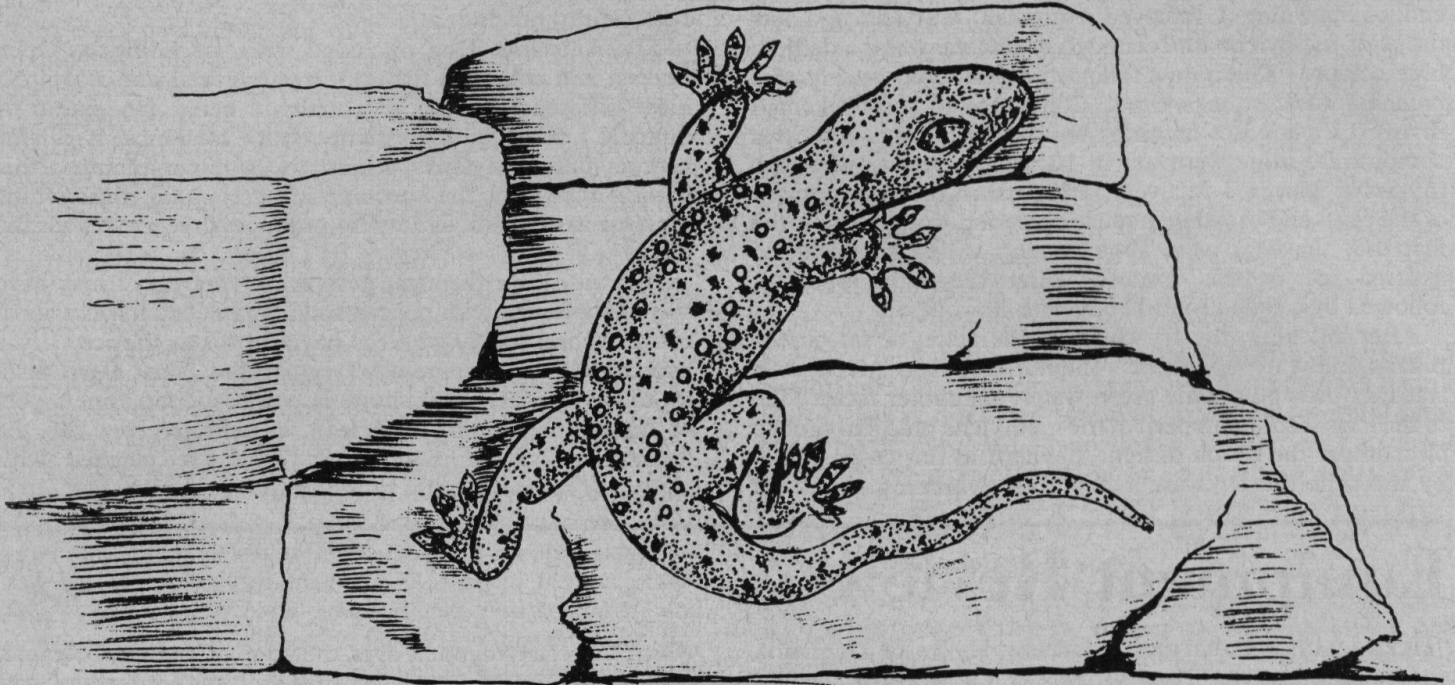
Answer to

FIND THE FISH:

Zebra Danio

Hemidactylus turcicus

By H. G. B. Gilpin, B.Sc.



TOWARDS the end of April this year, I received a large cardboard box from a friend of mine who had spent some weeks in Spain. Cautiously raising the lid, I found it contained eight geckos. All too conscious of the activity of these little lizards and the speed with which they will escape from even a properly constructed vivarium, I viewed the prospect of moving them from the too spacious box with its inadequately protected top with some trepidation. However I need not have worried and the transference to their permanent quarters was effected without the loss of either a gecko or a tail!

They were placed in a thirty inches by fourteen inches by fifteen inches high vivarium, floored with rounded gravel, in which several large flattish stones were half embedded. A row of potted plants along the back had the pots partially concealed by strips of rough bark and irregularly shaped stones. At one end of the vivarium a single, smooth surfaced flint, rich in hollows and small, rounded "promontories," stretched from ground level to within six inches of the domed, metal cover. This cover was equipped with two electric light bulbs, one 25 watt and one 40 watt.

Occupying the vivarium when the geckos were introduced were two young female ocellated skinks and two wall lizards, *Lacerta s campestris*, also females. The skinks and wall lizards were roughly the same size and could be relied upon to live peacefully together for several months until the former grew too big for the safety of the others.

Immediately after their installation, the geckos were given an ample supply of locust hoppers, stick insects and meal-

worms and then left severely alone to give them an opportunity to recover from their journey and acquaint themselves with their new and unfamiliar surroundings.

On examination the next day they proved to be Turkish, or as they are sometimes called, disc-fingered geckos. Characteristically these geckos are three and a half inches long and vary quite considerably in colour from pale, pinkish cream to brown, grey or almost black on the upper surface. Their heads are large in comparison with the body but smaller, more oval and less broad across the eyes than those of the wall gecko, *Tarentola mauritanica*. The scales on the back of the Turkish Gecko are very small and flat and give the surface of the skin a much smoother appearance than that of its larger relative. In addition it has a number, some 40-50 of large, raised, rounded tubercles particularly on the sides and the base of the tail. The tail itself is fairly broad at the base, slender and terminating in a fine point. The scales covering its upper surface are smoother and much smaller than those of the wall gecko.

The underside of the body is a translucent, pinkish white and in the case of breeding females the shape of the eggs can be seen through the skin. The abdominal scales appear hexagonal to the unaided eye but under low power magnification are ovoid and overlap like tiles on a roof. Four to ten anal pores are observable in the males which again serves to distinguish *turcicus* from *mauritanica*, none occurring in the males of the latter species.

The toes of many species of geckos are specially modified for climbing. Those of *turcicus* widen more gently

towards their extremities than those of *mauritanica* and the tips form less saucer-like pads. The undersides are covered with a double layer of laminae which are interspersed with numerous minute hooks enabling the animal to grasp imperceptible irregularities even in a substance as smooth as sheet glass. Each toe ends in a tiny claw.

On arrival there was a considerable difference in size and coloration amongst the members of my little collection. The smallest was one and a half inches long and the longest three and a half inches. The smallest was a pale cream colour with dark brown blotches on the upper parts of the body and brown rings along the tail, the underparts being light flesh colour. The largest was brownish grey with darker patches, no rings on the tail and a white under surface. Of the intermediate sizes, most were pinkish and fairly heavily dotted with irregularly shaped brown spots, which extended along the body to the tip of the tail.

They settled into their new quarters remarkably quickly, indeed coition was observed between one pair within the first few days, but true to the nature of most of their species, proved, as one would suspect from the lidless eye and slit-like pupil, largely nocturnal and somewhat shy. Most of the day they hid behind the rocks, flattening themselves against the surfaces. Towards evening they became more visible, basking on the rocks in the heat of the electric light bulbs, or clinging, often upside down, to the warm lid. Any sudden movement however sent them scurrying to some safe retreat. Their movements were extremely rapid and less predictable than those of the other inhabitants of the vivarium, consequently extreme care was necessary when removing the cover at feeding times.

The geckos fed readily from the start. One would be seen, lurking, immobile, beneath a overhanging stone, until an insect came within range, when it rushed out and sized its victim in its jaws. A few vigorous masticating movements and the prey would be swallowed and the lizard back in its "den".

Although these animals prefer dry conditions in the vivarium, they require water to drink and this can be supplied in a small pot. The vessel should be kept filled to the brim, otherwise insects will inevitably fall into it, and being unable to get out, drown. The geckos will not eat the dead insects and, apart from the loss of the food, the water becomes fouled.

A week or so ago a gecko was seen clinging to the glass side of the vivarium, presenting a clear view of its pink under-surface. On closer observation the presence of eggs in the abdomen was indicated by two relatively large ovals. Subsequently a white, delicately shelled egg was found attached to the vertical glass at the back, about eight inches above floor level. Hopes of it ultimately hatching were dashed by one of the *campestris* which, in the course of an exuberant dash around its terrain, a form of activity to which it was somewhat addicted, managed to dislodge it. So far a second egg has not materialised.

Geckos are renowned for their vocal accomplishments and these Turkish Geckos are considerable performers in this respect. They have been credited with the loudest squeak of all the European species and judging from the efforts of my specimens this claim is quite justified. They have also been described as quarrelsome but so far I have not found them so. On the contrary, they have shown no inclination to bicker amongst themselves, neither have they attempted to interfere with the other species in the vivarium.

My specimens were actually caught in Benidorm and its islands and were found under stones and in fissures in rocks. The species is generally distributed in all the Mediterranean countries and S.W. Asia and has been carried by man to the New World. *Turcicus*, like several other geckos, often lives in close association with man, invading his houses and performing a useful function in feeding upon the insect population.

THEY'VE GOT RHYTHM

By Stanley Fox

THE LIFE rhythms of tropical water-plants are different to those possessed by other life-forms and may appear strange to us. One way that they diverge from other forms of life; is their non-dependence on sleep.

Plants do not require to sleep as we do, (although plants do indulge in a recessive or resting period, after reaching their annual peak of growth). The plants are therefore active 24 hours per day, performing the various functions necessary to their mode of life.

To survive, tropical water-plants must achieve excess photosynthesis/carbon assimilation during the day, this allows the plant-cells to survive during the night. Under poor light conditions the plants cannot attain this excess of photosynthesis; when subjected to prolonged poor light conditions, the plant-cells die, causing death of the plants.

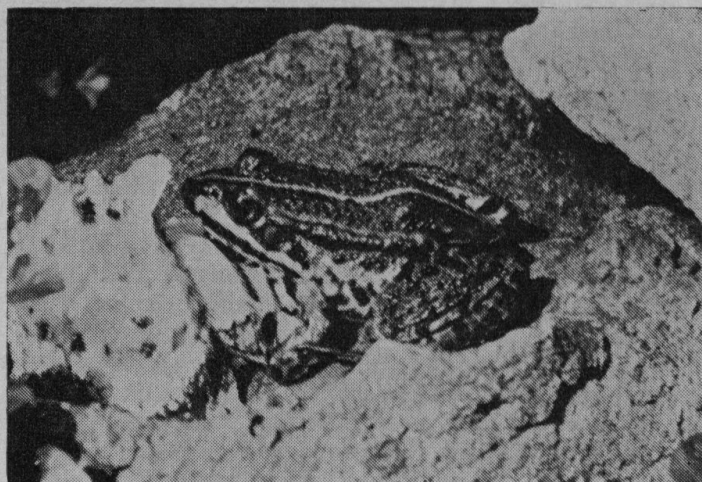
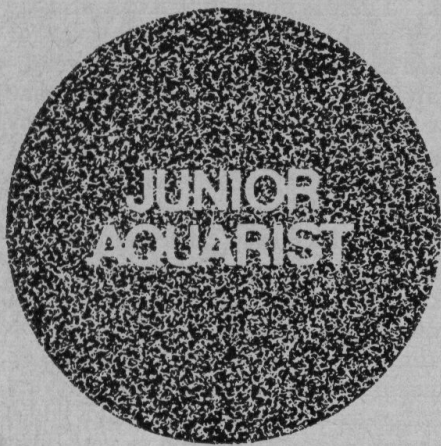
Plants in common with other forms of life respire; their breathing is unaffected by exposure to light, under normal light conditions. Normally respiration takes place at a much slower rate than photosynthesis.

The plant leaves also exhale large quantities of water vapour, this process is known as transpiration.

Therefore the plants ability to live is dependent on these actions; photosynthesis, protein formation, respiration, excretion and water intake. The collective name is metabolism. These actions are further divided into two processes; the building-up of the plant-cells and the breaking down.

Photosynthesis, protein formation and the intake of water, are responsible for the building-up of the protoplasm of the plant-cells, this is named Anabolic activity. Excretion and respiration break down the protoplasm, this is called Katabolic activity. Therefore for plants to grow, Anabolism must at all times outpace in activity, Katabolism.

The sequence of day and night/light and darkness are important to the plants rhythm of life. We all know that light is extremely important to plant growth but, how often do we realize that darkness is of almost equal importance in their life cycle? This is subject to the proviso that tropical water-plants are presented with light for a sufficient number of hours that at least equal, if not exceed, the hours of darkness; excess photosynthesis depends on the duration of light.



THE EDIBLE FROG

By Andrew Allen

THIS LARGE and beautiful frog can be a particularly troublesome character in the indoor vivarium. It is certainly not an ideal inmate, and its brilliant green coloration seems to degenerate rapidly into a muddy brown. Thus it ceases to be a colourful and interesting show-piece, and instead becomes an eyesore to any sitting room or reptile house. Nevertheless, with care, it can be housed in these conditions, though other alternatives are preferable.

The first and most imperative essential is a large aquarium (upwards of 48 inches long), with a safe cover. The aquarium size is a vital point, for this frog is not only an extremely powerful jumper, but has also a particularly flighty temperament. As a result of a sudden movement from outside, it can damage itself badly from a fear-inspired leap, even against glass walls. It has a lowly intelligence, even for a frog, and learns this lesson slowly, if at all, in contrast to the more sensible and deliberate toads. The aquarium should be placed in a fairly, but not excessively, sunny position; for without this commodity the deterioration will be inevitable whatever the precautions.

The environment should be a semi-aquatic one. The aquarium can be divided in half by a log placed diagonally across it. To one side of this should be packed a light, rich soil. Grasses, mosses and many marsh plants should be grown in bountiful abundance. Watercress and various plants that habitually grow in shallow water should be planted in the aquatic half on a typical aquarium base medium. The water should vary between depths of about one and seven inches. This should be replaced often with fresh rainwater, and the moss should also be kept fresh. All the foods generally given to batrachians will be accepted by these frogs, unless, as sometimes happens, they go on a hunger strike. Food will be taken in the water, thus widening the available range. Problems do not end here. Artificial hibernation is both difficult and risky. On the other hand overwintering tends to impair fertility, disrupt the breeding cycle, and lead to an earlier death than normal.

Keeping them in the indoor vivarium is thus fraught with pitfalls (to which we can add a stentorian and raucous croak from the males), though in some cases this alternative may be inevitable.

A greenhouse or a cold-frame are both more acceptable alternatives. The problem of space is thus automatically solved. The sun entering is more than sufficient, and the temperatures rise to beyond 100°F, with beneficial results to the edible frogs. They remain timid, but appear to have no consciousness of the fact that their quarters are restricted. All that is needed is a good, deep pond, well planted with aquatic weeds, a deep forest of vegetation on land, and several vantage points from which to glean every ray of the sun. However, deep shade must also be available. They will thrive equally well in both greenhouse and cold-frame.

I have five adult and several immature edible frogs, in company with other amphibians, in a large adapted cold-frame. It is made of wood and stands on several courses of Thakeham blocks. An old sink is adapted to a pond, and in this the frogs hibernate, although there is also a hibernating chamber on land. The frogs are a visible proof of its success. On most bright days they can be seen sunning on the ledges around the edge, skins glistening a magnificent and verdant enamel-like green.

There is also another very viable alternative. This is to keep them in a perfectly ordinary garden pond. I have two such ponds, near together in my garden. They are in a sunny situation, but with ample dense shrubbery in the background. Three years ago I placed four adults in them, and since then several young frogs have appeared. They rarely venture more than a few feet from the pond's edge, and can often be seen sunning on the overhanging slates. More often all that will be seen are one or more gigantic "plops", as all the baskers dive hurriedly into the water. The pond has thus become a feature of the garden, and the frogs appear to have made no attempts to vacate it.

Certain qualifications must be expressed concerning this method. I would hesitate to attempt it anywhere much North of the Wash. The adults would probably survive, but breeding would be extremely doubtful. Even at Worthing the number of young raised seems to be fairly small. Every mile further North makes the climate harsher and more inhospitable to these sun-loving frogs. It would also be unwise to loose them near to other stretches of water. They might prefer the next-door neighbour's pond to your

own, or migrate en masse to the local marshes and ditches. But provided there is no other water within a short distance, they should settle down well, though there must always be some element of risk. Similarly, though they could easily escape from most reptiliaries, they will probably settle down well within its bounds.

The species that will live amicably with *R. esculenta* in the indoor vivarium are rather limited. Its nearest cousin the marsh frog (*R. ridibunda*) may always be kept with it, as in most cases may the painted frog (*D. pictus*). The common frog (*R. temporaria*) is a suitable companion when adult, provided that adequate dry land is available. Large crested newts (*T. cristatus*) and ribbed salamanders (*P. waltl*) may be possible companions, but only when entirely adult, for it must always be remembered that the edible frog is a noted cannibal. Lizards and toads should be avoided, for they will not tolerate the particularly wet habitat simulated in the indoor vivarium. In the outdoor vivarium the choice is much wider. I suggest that you consult my article in the January edition of the *Aquarist*, which is entitled "Reptile Communities in the Outdoor Vivarium". This suggests a number of combinations, in many of which this frog figures, applying to the three main types of outdoor vivarium. It should not be kept with smaller species unless they are particularly repugnant or very unobtrusive. Mine have not molested tree frogs (*H. arborea*), green toads (*B. viridis*) or baby common frogs and toads with which they have been housed.

Presumably if enough space and deep cover is provided this danger can thus be negated. However I have not dared to try them in my greenhouse where baby lizards might provide a more obvious contribution to the menu.

I have sounded many dire warnings so far, but these should not be a discouragement. The advantages of this frog are many, and tend to outweigh the disadvantages. They are conspicuously beautiful, something that is rather rare in the European Ranidae. Thus they provide a wonderful centre-piece in the indoor vivarium, and become a feature in any outdoor collection of frogs and toads. They are not at all secretive, and, despite their timidity, are nearly always on view both night and day. This is a sharp contrast to most European Amphibians, that spend the daylight hours in some secluded corner, or beneath the pool surface. Unfortunately they tame very slowly, but on the other hand they are fairly generous breeders in restricted conditions. In the right community they seem to set off their drabber relations, and emphasize the intelligence of such creatures as the toads. In addition they are very reasonably priced (currently between 4s. and 10s.), unlike the slightly larger marsh frog.

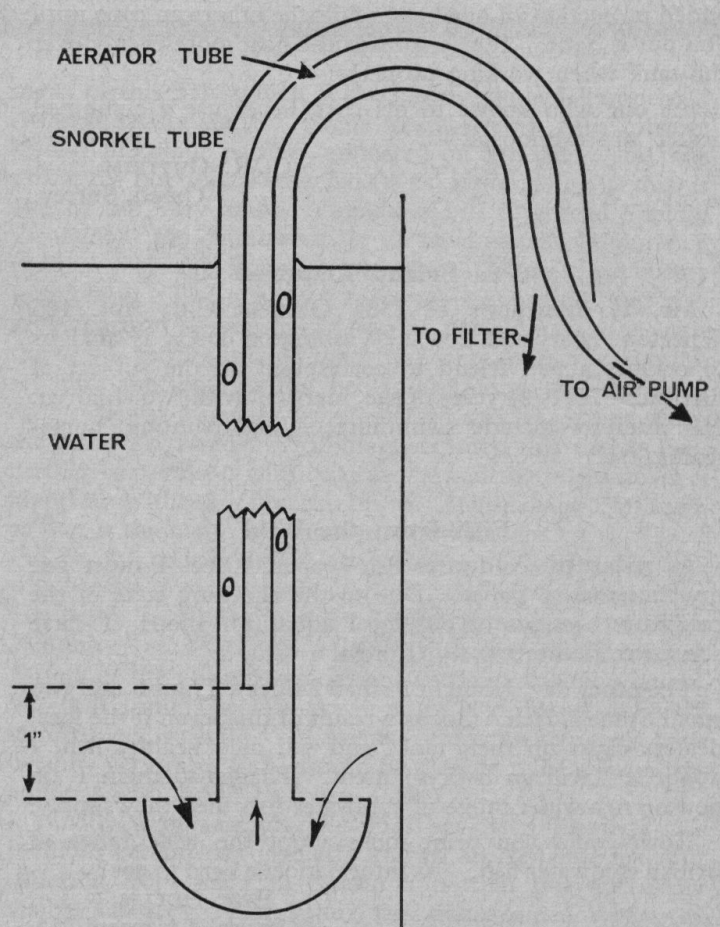
R. esculenta is to be thoroughly recommended for every reptiliary, greenhouse, or other outdoor collection of Reptiles and Amphibia. It is not the Amphibian to keep as a "pet"; and cannot be recommended wholeheartedly for the indoor vivarium. However it will never fail to delight with its wonderful colours, and lively habits.

HOME-MADE AIR-LIFT FILTER

By Stuart Smith (aged 15)

I THOUGHT you might be interested in an air-lift tube for an outside filter which I made, using an old swimming snorkel. The mouthpiece and float are removed and a length of aerator tubing is inserted to within about 1 inch of the bottom of the tube (see adjacent diagram). The tube is supported using heater holders. My filter-box is made of a plastic lunch box filled with nylon filter material and water is returned to the tank along more aeration tubing.

It would be interesting to hear of other Aquarists' home-made filters in your publication.



Herpetological Notes

SAND-BOAS

By Stephanie J. Peaker, B.Sc.



CLOSELY related to the giant constricting snakes of the New World are a number of small burrowing forms found in the arid parts of Europe, Asia and North Africa. These sand-boas attain little more than three feet in length and can be highly recommended for the novice reptile-keeper provided that sufficient heat can be supplied.

Two species are usually available in Britain. The Red or John's Sand-boa (*Eryx johnii*) is of a uniform brownish-red colour and has a triangular-shaped head for burrowing. This species has a blunt tail resembling an amputated stump. Sometimes dealers of the less scrupulous variety advertise this form as the red sand python or baby red pythons, presumably to sell them to the unwary as true pythons which are more often kept as pets and which command a higher price. In fact their requirements are totally different from those of the pythons.

Gongylophis conicus, the Rough-scaled Sand-boa, also from the arid parts of India, is more vividly marked as shown in the accompanying photograph although amongst rocks it is surprisingly well camouflaged. The scales of the hinder part of the body are enlarged and very rough to feel.

Other species of sand-boa are not often seen in Britain although one, the Spotted Sand-boa (*Eryx jaculus*), occurs in parts of South Eastern Europe, Asia and North Africa.

Some herpetologists consider these forms to be difficult to keep but if suitable conditions are provided it is possible to keep these interesting snakes for some years. Their chief disadvantage lies in their unwillingness to show themselves by day since they burrow in the light soil in their vivarium and only appear in the evening. Therefore, a thick layer of light soil mixed with sand and gravel which has been allowed to become thoroughly dry is the ideal floor covering for sand-boas. The temperature of the vivarium must be kept high by day and I recommend that it should reach 85°F but should be allowed to fall at night to 50°F—this course I consider essential for the care of desert reptiles. Heat is best supplied by tubular heaters or a dull emitter and it is a good plan to have switches so that a different thermostat comes into use at night, thus allowing the temperature to fall. Extra light can be supplied by incandescent lamps during the day but should be turned off at night. A weak blue light is useful in a vivarium to observe these snakes after dusk. A large vivarium is not necessary and the only furnishings required are a few rocks and clumps of grass to assist sloughing.

Mice are a good basic diet and I have known one small specimen eat five, one after the other, in rapid succession. The prey is constricted. In temperament they vary; some bite viciously, others are amenable to handling. I have known a tractable specimen bite a colleague on the hand when a mouse was being placed in its cage and it lashed out from its hole in the sand with its mouth open and slashing sideways. Both species mentioned are usually inexpensive



but it must be remembered that they are forms which require a fair amount of heat. Finally, although a water pot should be supplied, it must not be too full so that spillage of water on to the sand is avoided. These snakes cannot stand damp conditions.

Summer is a good time for the reptile collector. One of the most enjoyable tasks at this time of year and one of the most worthwhile is the collection of insect food. Sweeping and shaking hedgerows yields plenty of small insects, etc., which are eagerly devoured by small lizards, frogs and toads. This natural food is particularly valuable for those tropical forms which are housed indoors and which will have to return to a necessarily rather monotonous winter diet.

Another important summer job is checking and overhauling the heating equipment. Everything should be prepared in time for the temperate and sub-tropical forms that are outdoors for the summer but which are kept warm during winter. Also, the heat can be turned off in the tropical vivaria so that checking of equipment can be carried out. At this time of year it is as well to obtain a few spare heaters, thermostats and lamps because a failure in winter may well mean that a tropical specimen may have to be housed on the hearth until a replacement can be collected.

Summer is a convenient time to install low temperature warning equipment. Some ordinary aquarium thermostats will operate at fairly low temperatures and these wired into a low-voltage battery circuit form an ideal alarm system. An ordinary electric bell and battery connected by long leads to thermostats in parallel in each cage can easily be installed. Any heater failure in any of the cages so covered will then signal and a check on the thermometers in all the vivaria will soon show which one is affected. It is a good plan to include a checking switch so that the state of the battery can be regularly checked. One of the main advantages in using a battery-operated system is that in the event of a power failure, the battery will still work when the temperature falls.

Although a warning system involves extra expense, the effort is well worthwhile, particularly for those specimens which are highly susceptible to a fall in temperature. Caymans, for example, and other South American species may die after only a few hours of winter temperatures.

Summer is also the time to repaint vivaria. Emulsion paints are ideal because they dry quickly with a dense finish but those types containing insecticides must be avoided.

Herpetological Notes

By Stephanie J. Peaker, B.Sc

NATRIX

THREE SPECIES of snake in the genus *Natrix* occur in Europe. All are suitable for housing in the outdoor reptiliary and require similar treatment. The Grass Snake (*Natrix natrix*) is often the first snake kept by the herpetologist and this species is found over large areas of Europe. A number of sub-species exist and the range of the whole species is from Asia Minor in the East to the Atlantic and from Scandinavia in the North to Algeria and Morocco in the South.

The Dice Snake (*Natrix tessellata*) is found in Central and Southern Europe and reaches east across Asia to western China. It tends to be more aquatic than the other two species.

The smallest European member of the genus is *Natrix maura*, the Viperine snake, so called because of its supposed resemblance to the viper. This snake is found in south-western Europe, mainly Spain and Portugal and also occurs across the Straits of Gibraltar in North Africa.

All three species live near water and eat frogs, newts, tadpoles and fish. In fact the fondness of this genus for water is the reason why these species are called water snakes by the Americans. In the indoor vivarium, this does not mean to say that they require wet living conditions. Whilst large water containers may be provided, the ground must not be allowed to become wet or skin diseases will soon develop. The humidity of the air should be low enough for the snake to dry off quickly so adequate ventilation of the vivarium is needed. However, this problem does not arise with an open, outdoor reptiliary.

Feeding these snakes may present some problems. Frogs in England are in short supply and fish may be substituted. I have found that goldfish runts can sometimes be obtained cheaply and tadpoles in large numbers make a good diet for younger specimens. The Viperine snake may sometimes accept earthworms.

It will sometimes be seen that the scientific name of the genus is given as *Tropidonotus*, a name used by Schreiber in 1913. The nomenclature has now reverted to that of Linnaeus so that the genus is again and we hope finally called *Natrix*.

PYTHONS

There are a number of records that while brooding, the female Indian Python (*Python molurus*) can maintain a body temperature higher than that of its surroundings and thus incubate its eggs in a manner similar to that employed by birds. The first report of this phenomenon was made by Lamarre-Picquot in a communication to the French Academy in 1832. However, this observation was not accepted and a committee of the Academy concluded that

Lamarre-Picquot's conclusions were hazardous and questionable. Other workers, notably F. G. Benedict, supported the original observations but only in the last few years has conclusive evidence been obtained that the brooding female Rock Python does in fact incubate its numerous eggs.

Observations in the New York Zoo in 1960, 1961 and in 1965 by Drs. Hutchinson, Vinegar and Dowling using modern methods of recording temperature have been made on the Rock Python. If the surrounding temperature fell below 33°C (91.5°F), spasmodic contractions of the muscles along the length of the body took place which raised the body temperature above that of the surroundings and this process has been likened to shivering in mammals.

In the python studied, the greatest difference between the surroundings and body temperature was 4.7°C (8.5°F) and this was recorded at 24.8°C (77°F). Below this temperature the mother could not maintain a difference.

Incubation by other species of python has been recorded at the New York Zoo by the same zoologists and body contractions have been observed in a brooding New Guinean Green Python (*Chondropython viridis*), a finding reported in a German journal.

YOUNG TERRAPINS

Last year in these notes, attention was drawn to the possibility of *Salmonella* infections from baby American terrapins. An extract from a letter published in the *British Journal of Herpetology* (4, p. 64, December 1968) throws further light on this topic. It appears that the baby terrapins are produced by "turtle farms" which are situated mainly in Louisiana. The adults are housed in enclosures which include a shallow pond and are fed with offal from poultry or other animals. Eggs are laid in the soft soil and these are removed and artificially incubated. The babies are kept for a few weeks until ready for shipment to pet shops all over the world.

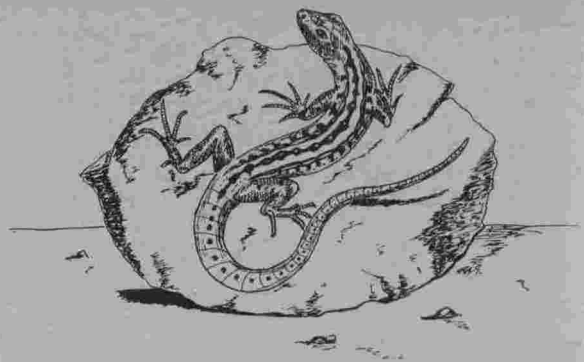
The United States public health service found that a large number of these farm ponds were infested with *Salmonella*, the organism responsible for food poisoning.

I had not realised that these unfortunate young terrapins were in fact bred commercially and I now think that their generally poor condition is not wholly the fault of the importers in this country since these reptiles have a very poor start in life. The same letter states that in Louisiana ten million baby terrapins are sold each year for retail sale in the United States and elsewhere. The losses within the first six months are probably so great that apart from a few thousand or perhaps even a few hundred, almost ten million terrapins are killed by this trade every year.

Breeding

Lacerta sicula *campestris*

By H. G. B. Gilpin



I WAS FORTUNATE enough to find a number of these handsome Lacertids in a Brighton pet shop last April and hastened to secure a couple of healthy looking specimens, which were slightly larger than Viviparous Lizards, for myself. One had a bright green throat, that of the other being pale yellow. In other respects they were almost identical. Each had a bright, grass green back with an irregular line of dark brown patches running down the centre. The green band was bordered on either side by a series of fawn dashes along the lower side of which passed another line of large dark brown spots almost merging into each other. Below this came a further line of dark spots on a fawn background. The tail, long and tapering to a fine point, was brownish as was an area at the base of the tail extending a quarter of the way up the body. The legs were brown, sparsely broken by yellow spots, and the top of the head was olive green.

On reaching home the lizards were placed in a vivarium measuring 30 in. x 14 in. x 10 in. and heated to 70°F. This was already occupied by two geckos (*Tarentola mauritanica*), a Red-tailed Rock Lizard, a Viviparous Lizard and a young Ocellated Skink, bigger than its companions but not large enough to be dangerous. The floor of the vivarium was covered with a two inch layer of rounded gravel and it was furnished with several rocks, cactii, aloe and African Violets. A water vessel was supplied.

The two new-comers soon became familiar with their future home and from the first fed freely on mealworms, small spiders and freshly hatched locust hoppers. After a few days they also ate young stick insects. These make good food for lizards but most species in my experience are slow to take them initially although they eat them avidly after a few days, probably because their relative immobility makes it difficult for the lizards to see them.

The *campestris* were absolutely non-aggressive and appeared to take no interest in either each other or the fellow inhabitants of their quarters. In fact, as vivarium animals they were, and are, a great success showing little sign of nervousness. They are constantly on view and their bright colours and lively behaviour make them an asset to a collection.

Somewhat on the slim side when first obtained, the two lizards steadily increased in bulk, one of them to such an extent as to raise hopes that it would produce a family. Suspicions that one was on the way were confirmed by the

discovery of a pure white egg on May 27th. The egg was deposited on the surface of the gravel. On carefully spooning it out, it was found to measure four eighths of an inch in length and three eighths of an inch across its widest part. It was roundish in shape and enclosed in a membranous shell.

During the following week four more eggs, each almost exactly similar to the first, were produced. Like the first they were dropped, apparently haphazardly, on top of the gravel. At this stage the female delivering the eggs scratched out a burrow under a stone and spent much of her time inside it. No eggs were found in it subsequently and its only use seemed to be as a retreat.

Considering the number of lizards occupying the vivarium and the general activity resulting from their presence there was little likelihood of the eggs remaining unscathed in their exposed positions. This danger has been underlined in the past when eggs left on the gravel have been scuffed about by the other lizards or even, in the case of Green Lizards, buried by the parent several inches under the material covering the floor and subsequently disturbed by her further digging operations. Left in the open, even in a fairly secluded part of the vivarium, a further hazard is the loss of the eggs through undue drying.

In an attempt to give them some measure of protection on this occasion three of the eggs were carefully removed from the gravel with a teaspoon and transferred to a small pot of damp sand. More sand was added until the eggs were covered to a depth of half an inch. The pot was then suspended by a bent wire from the rim of the vivarium and the lid replaced. The supporting wire was thin enough to ensure that the gap between the lid and the rim of the frame was too narrow for even the smallest of the geckos to squeeze through.

In this way the eggs were maintained at the constant temperature to which the lizards were accustomed and were at the same time reasonably safe from accidental disturbance by the lizards. Twice a week, two or three drops of water were added to the sand to prevent it drying out too much.

The eggs left on the gravel soon shrivelled and dried up but in due course the eggs in the pot of sand hatched and on June 25th the first baby *campestris* was seen streaking for cover under the leaves of one of the plants. It was strong

Continued on next page

Experiences in keeping PIRANHAS (*Serrasalmus nattereri*)

By William Mellor

JUST OVER FIVE months ago, I bought six *S. nattereri*. The fish were roughly $\frac{3}{4}$ in. long and about five weeks old. I put them in a 40 gallon tank, lit by a 40 watt Gro-lux, and filtered by a Dynaflo Super Filter half-filled with peat fibre. Temp. 76-78 deg. Fahr.

The piranhas were fed on raw haddock and raw liver twice a day, occasional earthworms and live daphnia as a special treat. The haddock and liver were chopped-up to enable easy swallowing. The fish were very nervous but healthy, and most of the food was eaten with relish. Floating plants were provided for shade; Indian Fern, Water Lilies. Coarse gravel covered the bottom of the tank, but this was removed after a month to facilitate easier cleaning. The back of the tank was darkened by black carpet underfelt.

The fish were silver grey with irregular black spots, fins light red, except dorsal fin (clear), and tail fin (black with white splash in middle). The fins were ragged at first due to persistent nipping, but after a week of good feeding all battling ceased and the damaged fins healed up. After a month the piranhas were $1\frac{1}{2}$ in. and the red in the fins was becoming stronger; after 2 months 2 in., body darkening from back down, swimming in a school, still very nervous.

I tried feeding them "Lucky" cat food and they liked it but very messy. Unfortunately, on 14th August, one

of them jumped out of the tank and wasn't found until later, dead.

Four months old, $2\frac{1}{2}$ in. long. I started feeding them small live goldfish and these they really enjoyed; 2-3 dozen goldfish per week. Very expensive!

Five months old, 3 in. long, eating well (too well!), and very healthy. Egg-shaped. As the body becomes darker the scales seem to sparkle as the light catches them and the belly is tinged golden-red; body spots fading slightly and the dorsal fin is black-edged. The piranhas still swim in a school, but, as from the start, one eye on me watching them, and one eye on their tank-mates; I don't blame them! Still nervous.

At the age of five months they started behaving like young Cichlids; circling each other, bodies vertical, fins quivering, charging and ramming each other with their mouths closed. From their behaviour I reckon I might have two males and three females. No fins are torn nor scales missing.

Now that the piranhas are six months old and perhaps approaching maturity, things should begin to get interesting.

I have evaluated the following points concerning young piranhas from the past six months of keeping them.

(a) Feed small young piranhas on small chopped-up pieces of fish or meat that can be easily swallowed. It is useless to throw in a largish piece of meat and expect them to tear it to pieces; when I examined the jawbone of my dead piranhas it was very brittle and fragile; the only exceptions to this rule are raw filleted haddock and raw liver, the former being flaky and the latter having the consistency of jelly.

(b) Keep the tank covered as piranhas are good jumpers. Preferably use floating plants as this is more natural.

(c) Piranhas like warmth, so Temp. at 75-80 deg. Fahr.

(d) Remove uneaten food as soon as possible.

(e) Frequent water changes are extremely beneficial; I remove half the water in my tank twice weekly (usually Wednesday and Sunday), and my filter works continuously.

(f) Give piranhas a good basic food, preferably fish, but don't forget the occasional earthworm or any insects you may find. I once had a 7 in. red piranha that used to go crazy about live daphnia, snapping them up one at a time. Most fish like occasional daphnia. No piranha I have ever had would touch Tubifex worms. Variety is the keyword when feeding fish.

I plan to raise my piranhas to maturity and try to breed them without having to split them up into separate tanks.

Perhaps other readers may find this article interesting and it may encourage more people to write about piranhas.

Continued from previous page

and very active and spent much of its time running over the rocks in the open part of the vivarium, retiring smartly into a convenient crack or fissure at the too close approach of one of the adult lizards. A second baby arrived on June 26th and a third on June 27th.

The newly born lizards were about two and a half inches in total length, the slim tail exceeding that of the combined head and body. Basically olive green in colour they were marked with four longitudinal lines of tiny, pale yellow spots and carried a darker olive dorsal line passing down the middle of the back. From the beginning the young lizards did well and fed readily on tiny spiders, very small mealworms and other forms of minute insect life. Unfortunately, eight days after the birth of the first one, I had to leave home for a couple of weeks and although all the adult lizards flourished, in the competent care of my temporary "stand in," the babies were too young to survive the experience.

LIZARDS IN MALTA

□
By H. G. B. Gilpin, B.Sc.
□

MALTA, DURING MY stay there in July, was blessed with a temperature ranging from 85°-90°F., a state of affairs favourable for the existence of a considerable, very active, lizard population. We were staying in a bungalow near Mosta, almost in the centre of the island, which faced on to a sun-drenched garden enclosed by a hedge and two rough, dry stone walls. Geckos, mainly *Hemidactylus turcicus*, but some *Tarentola mauritanica*, abounded on both the garden walls and the outside and inside walls of the bungalow.

It was interesting to see how firmly the geckos were bound to a regular pattern of life. Early in the morning when the sun was shining but the temperature, though high by English standards, well below the level it reached at mid-day, several were to be seen on the dry stone wall at the far end of the garden. For the most part they remained motionless for considerable periods but they were acutely conscious of any movement in their vicinity and disappeared with celerity into the nearest fissure the moment one approached within a distance of ten feet.

Towards mid-day and until about three o'clock, when the heat drove most humans indoors for a siesta, the geckos usually retired into the crevices between the boulders, coming out again as the first shadows fell across the wall. They were most active and most numerous in the evening and soon after dusk seven or eight were invariably to be seen on the exterior walls of the bungalow, remaining there until after ten o'clock at night. Most probably these were attracted by the night-flying insects drawn to the area by the light streaming from the windows. Switching on the light also brought out a number of geckos from their hiding places inside the bungalow.

During the day these remained hidden behind pictures, at the back of infrequently used shelves and wardrobes and in the less accessible reaches of kitchen furniture. Once out in the open they scampered over the walls and across the ceiling, clinging firmly to the slightly roughened surfaces with the aid of the innumerable microscopic hooks on the underside of the feet. Very occasionally a gecko would lose its grip and drop to the ground, in one instance breaking its fall by landing on a visitor's head. These involuntary

descents did not appear to damage the animals in any way and they scuttled off afterwards to the nearest cover.

These geckos proved uncommonly difficult to capture, with the single exception of one individual, who took refuge behind a curtain. It carelessly left its tail exposed and by gently grasping its body, through the material, the animal was secured with its tail intact. The only other gecko we caught at all easily was found in a stable where a number of them were waxing fat on the abundant spider population. In its haste to escape it ran head first into a particularly thick and resistant cobweb and was secured before it could extricate itself.

Each of the geckos living in and around the bungalow had its own, fairly limited, territory from which it rarely strayed. Once these areas had been discovered, one could rely on finding its inhabitant at almost any hour of the day. One big grey *mauritanica* was in permanent residence behind a crate standing against the back wall. If one approached quietly it could be seen clinging to the wall, basking in the morning sunshine, within a foot or so of its shelter, into which it darted the moment it detected the presence of an intruder. Another had taken up its quarters under the stairway leading to the flat roof and could be seen, any time one cared to look, during our entire stay at the bungalow.

The geckos living on the long wall at the bottom of the garden confined themselves each to a particular area. The space occupied by an individual was comparatively small, no more than a few feet across, but it was defended with considerable vigour by its established owner against intruders. Occasionally a gecko would stray into a neighbour's territory. When this happened the resulting battle was fast and furious. The actual damage done however was slight. In the various encounters I witnessed the invader was invariably driven off by the "rightful squatter" without either suffering any appreciable damage. The presence of several lizards bereft of their tails suggested though that the encounters sometimes ended less successfully for one than the other.

The garden appeared to provide ideal living accommodation for geckos, with few natural enemies to take toll of their numbers. The only predator I saw, offering a possible hazard to their safety, was a slim black snake, about two and a half feet long, which I glimpsed one morning as it disappeared expeditiously under a low growing vine, no doubt disturbed by my approach. Unfortunately, my view of this reptile was too fleeting for positive identification. Untoward casualties did sometimes occur, as in the case of a half grown *Hemidactylus turcicus* which, in attempting to pass through a crack in the window frame, became jammed fast and died before its presence was discovered.

Although other species of lizards, particularly Lacertids, are commonly met with in Malta, none other than geckos were seen in the garden during my visit. Earlier in the year, before the ground had thoroughly dried out, a fair number of skinks—exclusively *Calceides o. telligugu*—were to be seen, indeed this was the source of my present breeding pair of these handsome lizards. It appears that they require some degree of moisture in the soil and the arid condition of the ground in August had compelled them to burrow deeper than usual and none were visible on the surface during the time I was able to watch for them.

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A Commercial Breeder's Notes on **GUPPIES**

By F. L. Vanderplank

ALL TOO OFTEN articles are written by people who have little experience in the subject; sometimes they have bred a fish not previously bred in captivity and then their limited experience is of value to all, but frequently articles are written by comparative beginners on breeding say guppies, angels and other fish that are bred in huge numbers commercially, and this is due to the indifference or refusal of commercial breeders to write about their livelihood; we have to be thankful to those who do write. I have been breeding fish here and in the tropics for the past 40 years, and still wonder whether I know enough about the subject to write with any certainty. At the moment I am concentrating on a few species of fish and guppies is one of them.

Last year I bred and sold over 15,000 exhibition quality males, and culled twice this number, so on this basis alone should know a little about guppies. As a qualified and professional (retired) Geneticist, I contend that a great deal of bunk is talked and written about the genetics and methods of breeding guppies. To give the detailed experiments I have carried out on this subject would be boring and I doubt whether it would be of any help, but my experiments and experience have proved to me as a commercial breeder that pure soft water is fatal to guppies, slightly acid water with a low salt content is also detrimental and that, in fact, guppies do best in hard water with a fair, or even high, calcium content and require all the essential trace elements; to ensure good growth and good colour, I regularly add trace elements to the water. My own guppies are in cement tanks from 300 to 1,000 gallons and the pH varies between 8.5 and sometimes rises as high as 11.0 without any trouble to the inmates. pH is regularly tested using an electric pH meter costing over £90 so is not a toy everyone

can afford, but as a commercial breeder and writer it is essential for me to be able to study changes in the pH without all the "palaver" of using indicators in test tubes, etc. Should the fish be overfed and the water start to become polluted, the pH drops and as the bacteria increase, the water becomes acid and this is when the trouble ensues. Normally my 6 to 10 thousand guppies are kept at 78-82°F, but the temperature is dropped every two or three days to 60°F when dirty water is syphoned off and clean tap water (pH 8.5 DH. 29°) is added. Fortunately guppies are not oversensitive to chlorine, as some fish are, in fact guppies can be adapted to live in sea water (pH 7.8-8.4). One very interesting point is the relationship between foods and their behaviour. If guppies are bred on dried foods containing three-quarters carbohydrates (starches, sugars, etc.) to one-quarter protein (dried shrimps, etc.) they do not generally eat their young, and are slow growing and are not aggressive, but when fed on raw liver, live foods such as daphnia, tubifex, micro and other worms, also mosquito larvae, they become very aggressive, grow quickly and eat their young, if they get the chance. Of course, in nature there are not hard and fixed codes of behaviour, starved or mineral short guppies fed on dried foods will still eat their young, and guppies which have masses of live food may not bother to eat their young. The slowness of growth and lack of aggressiveness in guppies fed on dried foods can be corrected to a large extent by addition of a single mineral (chemical) but this is one of my few trade secrets, and probably accounts for the reason why breeders are so unsuccessful here in producing first-class guppies by the thousand, instead these are imported from abroad where they are bred in very large ponds or amply supplied with plenty of running water of the right quality and temperature. Split caudal fins are a perpetual subject of correspondence within aquatic circles, naturally guppies with split tails are useless to a commercial breeder like myself and such unfortunates end up in the Oscar tanks (the quickest way I know of killing a guppy, therefore the least cruel). Aggressive guppies nip the tails of other inmates; live food such as tubifex although excellent for growth produces a lot of bacteria and with them split fins. Split tails occur most frequently in soft and acid water, with live and very high protein foods and with deficiencies of essential minerals, so to prevent split tails, which only occur with about 1 per cent of my guppies, I use a hard water (pH 8.4 up to 11.0), regular additions of trace elements and a well-balanced dried food, with a little fresh raw liver 4 or 5 times a week (the liver is less than one-twentieth of the weight of dried food supplied). Guppy genetics are a very complicated subject and if there is sufficient demand I could make a start with this large and complex subject in a later article.

Lizards in Malta—continued

The magnificent San Anton Gardens near Birkakara provided ample opportunities for watching lizards. Many Lacertids young and adults alike, including *Lacerta sicula cetti*, scampered across the sunny pathways and here and there geckos could be seen clinging to the rough bark of tree trunks. Most of the geckos congregated in the open fronted glass houses used for the propagation of plants. Here really large specimens of *Tarentola mauritanica* clung to the natural stone walls at the back of the buildings and to the wooden frame-work of the roof. Like those in the garden of the bungalow, they were nervous and although they remained motionless, staring with unblinking eyes at a visitor if he stayed a respectful distance away, any attempt to approach within arm's length sent them hurrying away.

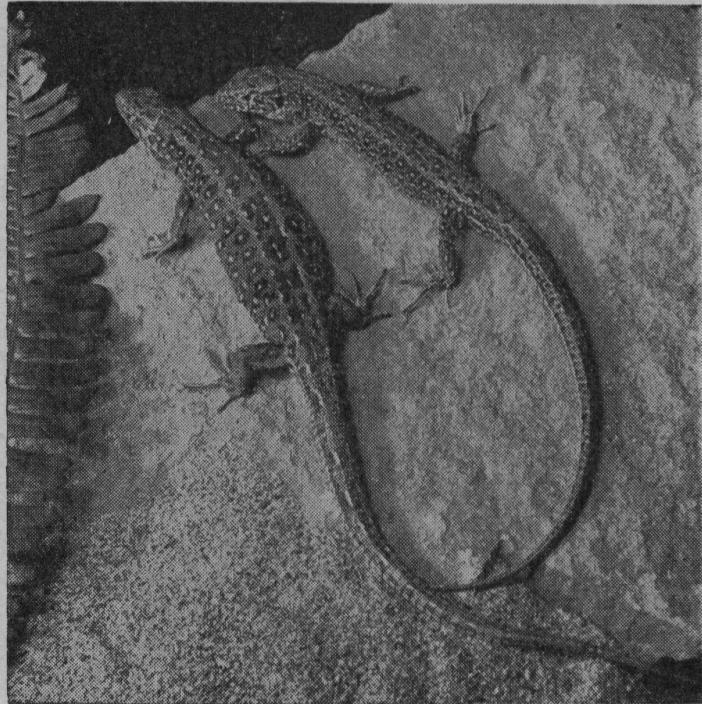
THE HUNGRY HERPETOLOGIST

on holiday in Northern France



By Andrew Allen

Lacerta agilis male uppermost and female



DOUBTLESS there are many Reptile enthusiasts like myself, who, when on holiday, experience a desire to overturn stones and probe in the mud of foreign ponds. Sometimes they may find that this desire overwhelms the feeling of duty that makes one enter a Chateau or admire a Cathedral. The Continent is certainly the place for the amateur herpetologist to indulge in his anti-social tastes. For these fellow spirits this article is written.

Many holidaymakers heading to the Spanish sun whistle through Northern France without a backward glance. But it has a rich Herpetofauna, wider than our own, and of exceptional interest. What can be more pleasant than combining a bit of sightseeing, a spot of "Reptile-watching" and the sordid pleasures of the gourmet and the glutton? I have spent more than eight weeks in Northern France over the past two years and have enjoyed the combination immensely.

What species can be found? Our own common lizard is naturally present, but occurs in far greater numbers. It is fairly common throughout the region, but especially plentiful in the Loire country. Many are the days that I have sat on a boulder, the wide and majestic Loire at my back, and the mouldering wall of some ancient mansion, ivy-covered—and lizard-covered too—in front of me. The locals tended to consider my fixed attention on the old wall as indisputable evidence of English madness, but treated it with good-humoured condescension. This "activity" is a foolproof excuse for laziness, for it is "all in the cause of Science!" In high Summer these lizards can be found on the walls of castles, churches and houses

throughout the North, and they are a lively and engaging species to watch.

According to various authorities the Wall lizard (*L. muralis*) is found in Northern France. However, I have never seen any specimens North of the Loire. I have only seen two or three individuals among the thatch in the glowering Chateau of Loches. This species is best seen in the warmer climes of Mediterranean regions, or Central France.

Sand lizards (*L. agilis*) are not generally to be expected in this region. They occur mainly in the Eastern part—Artois, Picardy, the Belgian border country, Lorraine and parts of Alsace. They live in a wider range of habitats than in England, being found in hedgerows and woodland borders.

The green lizard (*L. viridis*) can be found throughout most of this region, except for the North-Eastern corner. It is found roughly to the West of a line ranging from the Seine estuary, Rouen, Paris, Troyes, to Belfort. Individuals can be found throughout the Northernmost part of this corner, especially in Brittany, and of course the Channel Islands where Wall lizards also occur. They are widespread around the Loire. Here they can be seen sunning on the minor roads, sometimes not even bothering to move on to the verge when a car passes. They live in hedgerows and are liberally dispersed along banks, and in sunny woods and heathland. They are an impressive animal in the wild, and a joy to watch, with their fine colours and lively movements. One baby lizard, a few weeks old, courageously attacked my fingers when I tried to deflect it from the path of an oncoming tractor on a minor

road near Tours. They are significantly more common at the sea end of the Loire than in the Eastern part.

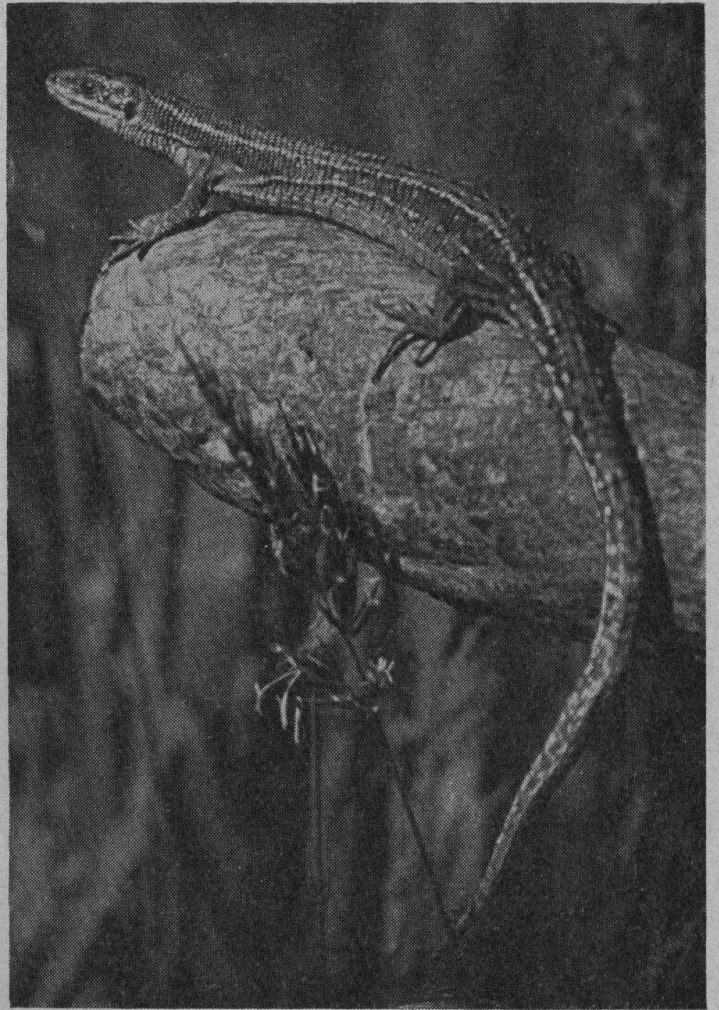
The slow-worm is consistently abundant, more so than in England, though it favours the same types of habitat.

The snakes of the region are little more prominent than in England. Grass snakes (*N. n. helvetica*) abound in damp places everywhere. The adder (*V. berus*) is widespread in the drier areas, especially in the sparse, heathy woodland South of the Loire, on the moors of Maine and Brittany, and sunny enclaves in the chalk hills of Normandy. Over most of its range, excepting the extreme North, it overlaps with the Aspice Viper (*V. aspis*), which is most common in the West, but makes local appearances in the Vosges mountains. The French almost worship the "Aspique," whilst they deride the slower "Peliade." They suffer from the same persecution mania in respect to snakes as do our countrymen, but every specimen killed, usually after a heroic struggle, is claimed to be an "Aspique." The aspice viper is certainly more lively, but often steals the thunder from its more sedate cousin. I have examined bottled "Aspiques," and been able to pronounce them "Peliades." The danger of snakebite in this part of France is considerably greater than in England, but is still a matter for little concern. Care should be taken, especially in drier parts of the Sologne.

A number of newts inhabit the region, including our own Smooth, Crested and Palmate species. The last mentioned is especially common, often in company with the other two. It may be found in the brackish waters of the Breton and Vendean marshes. The Alpine newt (*T. alpestris*) may also be encountered. The beautiful marbled newt (*T. marmoratus*) is present, and may be found as far north as Paris. However, newts are no more readily encountered than in England. The Fire Salamander is local in the North, though I have never found any specimens. It is more common in the eastern areas such as the Vosges mountains.

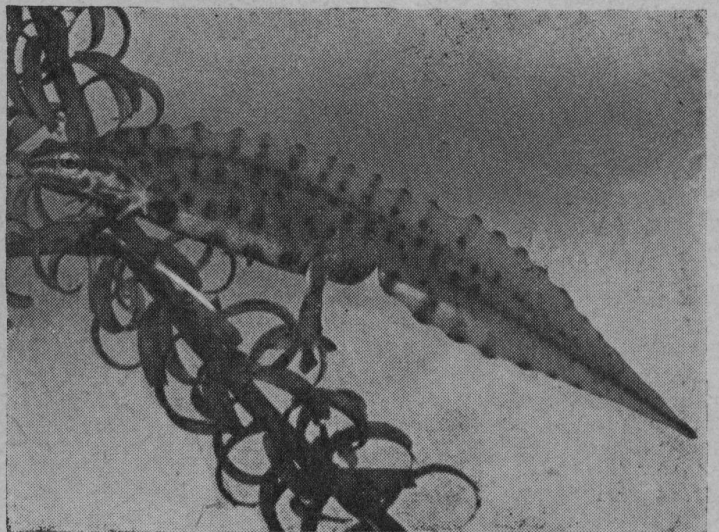
The Yellow-Bellied toad (*B. variegata*) occurs near Paris, but especially in the hilly country of the East, from the Belgian border and Ardennes to the Vosges mountains. The Mid-wife toad (*A. obstetricans*) is distributed widely, especially in the East, under stones, but is not often encountered due to its nocturnal habits. According to some authorities the Spade-foot toad occurs right up to North-Eastern France but I never encountered any specimens, nor had certain French naturalists to whom I spoke. *Pelodytes punctatus* is widespread, especially in low areas, where it lives after the manner of the Edible frog. I have found many in the large lakes of the Forest of Orleans, but it occurs right up to the Belgian border.

Both the common toad and Natterjack (*B. calamita*) are widespread in the region, but are no more prominent than in England, as is the case with the Com-



Common Lizard (top)

Male Common Newt (lower)



second and I was without the use of one hand. I can but hope that movement of my fingers, and my sense of touch may return, in time. Such accidents only happen to other people—or so I had thought previously; friends, they don't! I've shown that! I may sound like a typical pedagogue, but I have good reason for my warning. I'll end now, as I have been typing this last few dozen lines with one hand, and it's quite a strain. I hope that Mr. Perkins will be able to read my rather erratic typing. Perhaps, by the time I come to type next month's article, I'll be able to make some use of my left hand again. Until then I'll leave you with a few more questions, and make a one-handed attack on my Christmas dinner.

TORTOISES, TERRAPINS AND TURTLES

Extract from the *British Medical Journal*, London.

Any discussion of the occurrence of *Salmonella* spp. in reptiles is likely to be confused by popular nomenclature. The terrestrial vegetarians (*Testudo* spp.) which we in Britain call tortoises are "turtles" in the U.S.A., while the aquatic carnivores (*Emys*, *Pseudemys*), often called water tortoises, are now commonly known as terrapins in both countries. Both are kept as pets, and both have been responsible for salmonella infections in man. About 85 per cent of imported tortoises harbour salmonellas in their bowels, and the figure for terrapins is not much lower but varies more between one batch and another.

Tortoises are caught wild in Morocco or Yugoslavia. They are naturally coprophagic, and once infected they may harbour the organisms for years without suffering any apparent ill-health. Most of the terrapins which reach the trade have been reared artificially in terrapin farms in the southern U.S.A., where they are fed on meat offal of all kinds, some of which has been shown to contain salmonellas. When awaiting sale in Britain they get scraps of meat and meal worms. How long the terrapins can harbour the organisms no one seems to know.

The danger to man from these sources cannot amount to much. We do not know how many terrapins are sold in Britain, but a few years ago it was calculated that 300,000 tortoises were imported each year. In contrast to this the total number of reported human infections derived from these reptiles in all parts of the world amounts to perhaps 100 from terrapins and less than 50 from tortoises. It is, however, characteristic of infections from both sources that they have been mostly

Let's have your opinions on the following:—

(1) What is the best outside filter, costing up to about 30s. 0d., for a tank of about 30 in.? (2) Where did you get the rocks with which you have decorated your aquarium? (3) Have you had any experiences of using wood, from trees, as decorations in aquaria? (4) Experiences, please, on the breeding of angel fish. (5) Have you had any experiences of raising plants or fishes in greenhouse tanks? (6) What dried foods do you use for baby fish? (7) What new item of equipment would you like to see marketed for the aquarist? (8) What do you think of air operated aquarium cleaners? (9) What is your favourite floating plant, and why?

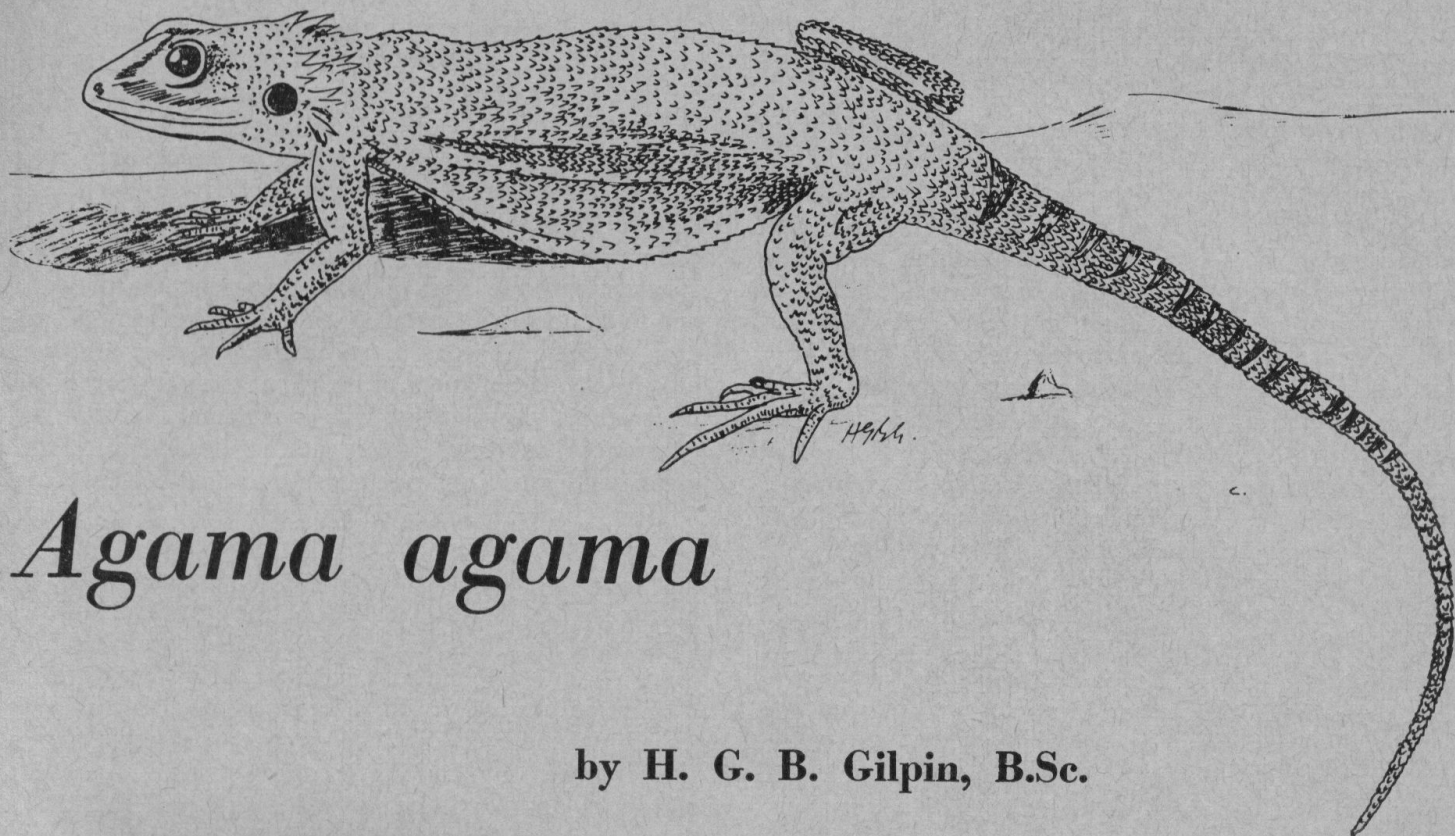
of young children, as in a case recently reported from Doncaster.¹

Tortoises are not cuddly, but the inquisitive child who explores their anatomy in detail is liable to pick up some salmonellas on his fingers. Furthermore, the tortoise who basks on the lawn is likely to leave his faeces there and a child may mistake one for a liquorice all-sort. The danger from terrapins may be greater. Most are kept in aquaria indoors, and if the animals happen to be infected the water will be contaminated. No one is likely to drink aquarium water except, perhaps, dogs and other pets; but it must be changed from time to time, and the obvious place for its disposal is the kitchen sink. He is a handy man who can do this without splashing, and he would certainly contaminate his hands.

Though the danger to health from these animals is a minor one, children must be protected as far as possible from the consequences of their own foolishness. There are reasons for forbidding the importation of tortoises, but these are based on arguments for the preservation of wild life rather than on health: in parts of Yugoslavia *T. hermanni* has become rare. Similar arguments cannot be advanced for terrapins since they are bred for the trade. It might be possible to treat all animals with an antibiotic before sale, but the cost would be high and, from the experience of a few trials, the outcome unsatisfactory. It is probably wiser to make it generally known that these animals are a potential source of disease; that they should not be handled more than is necessary; and that anyone who handles them should wash his hands. The aquarium water should not be brought into the kitchen but emptied down the lavatory or an outside drain. There is, however, little need to cry "wolf." Our dogs and cats share our lives far more intimately than do these reptiles, and at least 1 per cent of them are carriers of salmonellas.²

¹ Jephcott, A. E., Martin, D. R., and Stalker, R., *Journal of Hygiene*, 1969, 67, 505.

² Cruickshank, J. C., and Smith, H. W., *British Medical Journal*, 1949, 2, 1254.



Agama agama

by H. G. B. Gilpin, B.Sc.

NEARLY TWO YEARS AGO I wrote to an advertiser asking him to send me a number of lizards. They arrived in due course packed in a cloth bag, a quarter filled with dry moss, enclosed in a cardboard carton. Amongst them was a female *Agama agama*, a member of a family containing some fifty species, forming the Old World counterparts to the Iguanas of the New World. They differ from these in the location of the teeth, those of the Agamas being fused to the crests of the jawbones, whilst in the Iguanas they arise from the sides of the jawbones.

Common Agamas are widely distributed in Africa, occurring in the bush, grasslands and clearings in forests. They also associate closely with man, living in shady village trees and invading the thatched roofs of native huts in large numbers.

About twelve inches long when mature, these lizards exhibit considerable variation in colour. In the day time the bodies and legs of dominant males are grey to blue in colour, the head being bright red and the tail banded with red or orange. Sometimes there is a white line down the back. The throat and underparts are yellow. At night when they congregate together in some sheltered retreat the males become uniformly dull brown. Weakly or subordinate males are dull brown all over.

The females, rather smaller than the males, are usually brown with a pale dorsal line or dark spots.

My specimen was a dull, greyish brown, blotched with darker brown with some yellow spots on the back. On arrival she had vermilion flashes behind the forelegs but these had disappeared by the following morning, reappearing and disappearing from time to time subsequently. The tail was banded with dark brown and rather more than one and a half times the head and body length.

The relative tail length of this species varies with age. In young specimens it is twice the head and body length but in older lizards it is proportionately shorter. In males of five inches head and body length, growth of the tail ceases.

The eyes of the Common *Agama* are prominent and the lids movable. The head is rounded and the mouth wide. The auditory hole is large and edged with spike shaped scales.

Under natural conditions these agamas eat a wide range of foods. Much of their diet consists of ants, both winged and wingless, but they also consume other insects. During dry seasons they eat large quantities of vegetable matter but the nutritional value of this is considered doubtful. In captivity they are gross feeders and care is necessary to prevent them from overeating, with possibly fatal results. My female, within three days of her arrival, was feeding freely on locust hoppers and gentles and later took bluebottles, woodlice and earthworms with

enthusiasm. She rapidly became tame enough to handle and after a week or so accepted food from the fingers.

The behaviour of agamas when approaching their prey is characteristic. The animal raises itself on its comparatively long legs, with its body well clear of the ground, erects its tail stiffly over its back and jumps forwards. They are active animals and their jumping powers are at all times considerable. I often saw mine make a standing leap from one end of the vivarium floor on to the electric light bulb suspended from the cover two feet away. Her aim was excellent and not once did I see her miss her objective.

The breeding season of the Common *Agama* is from March to May, the females producing their eggs, five to seven in a clutch, from June to September. They are polygamous, the males acquiring six or more females apiece. When courting, the males assume their brightest colours, stand in front of the females and bob their heads vigorously up and down. This head nodding routine is also followed when the animals are approached by a possible adversary, accompanied by a side to side wagging of the tail. After which, if the enemy appears to be too dangerous, the *Agama* suddenly beats a smart retreat.

The males fight vigorously amongst themselves in the breeding season and in defence of their territories, standing side by side and lashing each other with their tails. I have not kept more than a single Common *Agama* in a vivarium at any one time so cannot say from personal experience whether or no they are aggressive towards each other in con-

finement. Judging from their attitude towards each other in the wild however I should hesitate to keep a number together in a limited space for more than a short time.

With other species, of roughly equal size, in a vivarium they have proved completely non-aggressive. I have kept a single specimen at different times in company with Green Lizards, Skinks and Crag Lizards without even a mild disagreement breaking out to destroy the harmony of the community. Common *Agamas* are excellent vivarium inmates. Although dull in colour for much of the time, their appearance is interesting, they are diurnal, extremely active and constantly on view. They neither hide behind the vivarium furnishings nor burrow in the floor covering.

Heat is necessary in confinement, 75°F. being satisfactory. A fairly large vivarium is advisable. The one I use is three feet long by twelve inches wide by fifteen inches high. In view of the jumping abilities of these lizards it is wise to use a tall vivarium rather than a long low one and it must be covered with a lid, preferably containing a feeding hole, large enough to admit the hand. This is best protected by a sleeve closed by an elastic draw string. A couple of inches depth of fine, rounded gravel suffices as a floor covering and for furnishings a bark covered branch and a few large stones can be introduced. The lizards will appreciate the placing of a flat topped rock in such a position that it will catch the direct heat rays from an overhead electric light bulb.

Water is a necessity and they will take it from a pot, but it is essential to keep the general condition of the vivarium dry and free from dampness.

New-14,000 Acre Recreation Centre

continued from page 370

course and water ski slalom course could be laid out together with an Olympic rowing course.

Horcott Lakes, situated on the southern edge of Fairford and already popular with tourists, could be developed into three larger pits for sailing and angling and if the Fairford Aerodrome ever became redundant, the large complex of buildings might be used to provide a recreational centre. A new country park to be known as Thornhill Park is suggested to provide quiet relaxation, walking by the water, fishing and facilities for observing wildlife and plants.

On Claydon Lakes a dinghy sailing lake should be fully developed by about 1980. A series of small cruising lakes inter-linked by channels and, perhaps connected to the lock near the Thames at Lechlade could be established. Some of the islands created could be developed with waterside inns or hotels and others could become bird sanctuaries. The Lechlade

Ponds could, also, become a nature reserve. Routes are suggested for bridle roads and footpaths throughout the Park.

The phasing of the proposals for the Cotswold Water Park will depend on two major factors; the rate of gravel extraction to create further lakes and the availability of capital investment to provide ancillary facilities. Although the potential recreational demand is very large, the facilities are limited to the overall extent of future gravel workings. But the outstanding major factor is capital investment.

Many sporting activities could, the Cotswold Water Park Joint Committee believe, take place on the lakes without large investment. But the provision of facilities for the general public rather than for the active sportsman will require considerable public investment. The draft master plan concludes:—

“If private enterprise develop some areas for the public enjoyment and if some small charge is made for access to other areas available for the public, then the financial burden falling upon the authorities could be quite modest.”

HERPETOLOGICAL NOTES

By Stephanie J. Peaker, B.Sc.

Boas

I HAVE BEEN ASKED by a reader to comment on boa constrictors or as they are more correctly called Common Boas (*Constrictor constrictor*). Young snakes of this species can often be obtained from dealers who import them from tropical South America. Provided they are given the correct treatment they will thrive and quickly grow into healthy four to six footers. The Common Boa is found from parts of Mexico to as far south as northern Argentina and mainly inhabits tropical forests. Before buying boas it must be realised that a vivarium heated to 75-85°F is necessary to maintain this species throughout the year. If buying them in winter it is as well to collect young specimens from the dealer and protect them from chilling on the journey home by providing warm hot water bottles. It is also advisable to check with the dealer that they have been kept warm at all times and that the ones bought have been seen to feed.

I prefer to keep several snakes in the same vivarium since they encourage each other to feed and two or three small boas can be kept easily in a cage three feet long, two feet wide and two feet high. Heating is best provided by tubular heaters wired to a thermostat. The snakes must be prevented from coming into direct contact with the heaters since they can easily be burned. A good way to instal the heaters is to separate off a small area of the cage using perforated hardboard and have the heaters in this compartment. Artificial lighting can be provided but bright lights are not necessary for these forest dwellers. Smooth, clean sand and pebbles make a good floor covering for the vivarium but peat is also attractive to show off brightly coloured species like the Common Boa. Thick branches can be provided for the snakes to climb amongst and although not strictly necessary, I prefer to provide some form of shelter.

Mice are ideal as food and it is as well not to buy specimens smaller than two feet in length since small mice are needed at this stage and can be difficult to obtain. Food should be given to young snakes as often as they will feed. If any difficulty is experienced with sloughing, a soak in tepid water will usually help.

A sub-species of the Common Boa, the Imperial

Boa (*Constrictor constrictor imperator*) is sometimes seen on dealers' lists and is also suitable for the tropical vivarium.

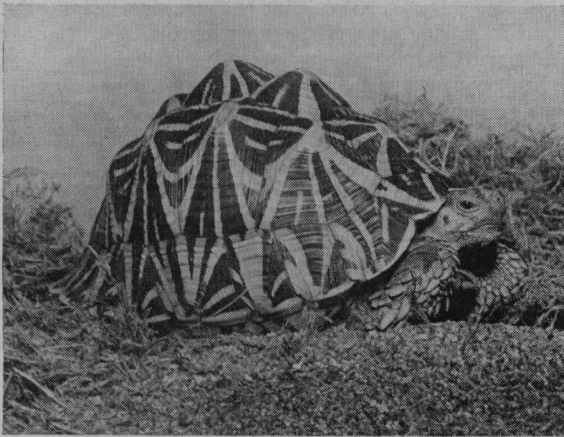
The most expensive part of keeping tropical reptiles is keeping the vivarium warm and if a cage is being kept at high temperatures, other suitable species can also be included. Small pythons can be kept with boas and I saw a number of young African pythons offered recently by a London dealer.

Xenopus

Rapidly losing popularity in laboratories is the South African Clawed Frog (*Xenopus laevis*). Many thousands were kept a few years ago for human pregnancy tests but with the development of a simple chemical method, the Clawed Frog is out as far as medical laboratories go but doubtlessly will still retain its popularity with herpetologists. The East African Clawed Frog may also be available as is sometimes called Muller's Frog (*Xenopus mulleri*). A species I have not kept is *Xenopus gilli*, a South African species only discovered in 1926. Clawed frogs are so-called because their three inner toes have small curved claws. These can be very sharp and may scrape the skin of the unwary hand picking the frogs up. Clawed frogs make an eerie sound that can be likened to hitting an empty cup with a tea spoon. This noise is usually made at night. The Clawed Frog is clumsy on land but in a large tank of water is swims brilliantly using its webbed feet to manoeuvre. Incidentally one of the major causes of death in these frogs is injury caused by dropping them. They are very slippery and a large net is perhaps the safest way to transfer them from tank to tank.

Starred Tortoises

A large number of Starred Tortoises (*Testudo elegans*) from India have appeared on the market at a very reasonable price. It must be remembered that this is a tropical species requiring continuous heat during the winter months. Since tortoises are rather



Indian starred tortoise

active animals, they need large enclosures which can be expensive to heat. Unless a tropical tortoise

enclosure is built specially for this and similar species I suggest that this very attractive tortoise should not be purchased. I hope to deal with the care of tropical tortoises more fully in future notes.

On the subject of tortoises, it is worth remembering the care the common Mediterranean species need on waking from hibernation. The eyes, nose and mouth should be washed with warm water and if the eyes are at all blocked with mucus a solution of boracic powder in water should be used to bathe the eye-lids. The tortoises can then be left to paddle in a shallow bowl of water and many will take the opportunity to drink. A greenhouse is very useful to keep the tortoises in during the first few cold weeks of spring and this treatment sets them off to a good start and large quantities of food may be eaten at this time. Plenty of drinking water should be available. As the weather becomes warmer, the tortoises can be put in their outdoor enclosure for the day and eventually left out all night. It is worth remembering that these reptiles appreciate having a snug shelter for the night and which they can enter to avoid rain.

“CHAMPION OF CHAMPIONS” Contest

THE PREMIER award for fish-keepers will be contested for the fourth time at the British Aquarists' Festival to be held on the 10th and 11th October at Belle Vue, Manchester. The preliminaries for this exciting event are already under way, and we wish to make a special request to Club Secretaries for full co-operation in notifying us promptly of their Open Show date.

This is most important to ensure the smooth running of the national contest, and to avoid disappointing delays in awarding the gold-plated pin to winners of "The Best Fish in the Show" competitions. It is these winners who qualify as entrants for the "Champion-of-Champions" Contest at Belle Vue, and it will greatly assist the organisers if Secretaries will forward the entry form for the "Champion-of-Champions" Contest **within five days after the Show date.**

Secretaries who have not received this entry form are urged to advise us promptly, and a copy will be sent, together with details of the Contest and the gold-plated pin for presentation. Forms have been sent to Secretaries where the Show date is known, but there are many Clubs still to be covered. The closing date for "Champion-of-Champions" entries is 21st September, 1970, but it is important that we have prompt advice of

"Best Fish in the Show" winners on the completed entry forms without delay.

To summarise; will Secretaries please advise us of the date of their Open Show. We will send entry form, full details, and the gold-plated pin for presentation to "Best Fish in the Show" winner.

Complete the entry form when winner is known, and send it within five days to "Champion-of-Champions," *The Aquarist and Pondkeeper*, Half Acre, The Butts, Brentford, Middlesex.

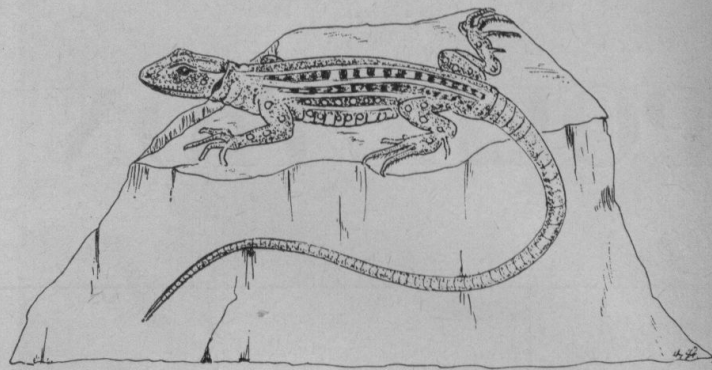
Winners of "Best Fish in the Show" awards who have not received an entry form may apply for one by writing to us at the above address.

Entries for the Contest must be single fish (not pairs, etc.).

Other important points that should be made clear: to qualify for entry in the "Champion-of-Champions" Contest, the "Best Fish in the Show" award must have been won at an Open Show (and by this is meant a show open to any member of the public and not by invitation only), and also where show schedules are available. Winners at Table Shows and Table Shows open by invitation are not eligible to enter the "Champion-of-Champions" Contest.

The Fringe-Fingered Lizard

By H. G. B. Gilpin, B.Sc.



THESE MODESTLY coloured but attractive little lizards are the only members of their genus to occur in Europe. They are found in southern France, Spain and Portugal and also in North West Africa.

Although no more than 7 to 7½ inches in length and Lacertis in shape, the Fringe-Fingered Lizard (*Acanthodactylus erythurus*) is a strongly built animal with a tail almost twice the length of the body. This appendage is finely pointed but in a healthy animal somewhat thickened at the root, probably due to the presence of fat, stored against periods when food is in short supply.

The ground colour on the upper surface is usually a light, buffish brown, sometimes merging into green along the back. Longitudinal lines of yellowish-brown spots extend along the body to the base of the tail. With increasing age these spots merge into irregular patches. I have not seen any newly born specimens but these are said to be black dorsally, with a series of white lines passing down the back, with red underparts. Most of the adult males I have seen have carried a row of intensely blue circular spots along the edges of the abdominal scales. The mature females retain a reddish coloration under the tail.

The head supports two large shields over the slightly prominent, piercingly dark eyes and the scales on the temples are small and roughly polygonal in shape. Those on the back become coarser as they approach the base of the tail than they are in the neck region.

Acanthodactylus favours an open, sandy habitat, fully exposed to the sun. It is plentiful on coastal dunes, particularly those adjacent to scattered pine woods or associated with sparse undergrowth or patches of dry scrub. To adapt them to life on the dry, sandy surface of their surroundings these lizards have tiny leaf-like fringes along their toes which effectively prevent them from sinking in the loose soil and enable them to traverse it with amazing rapidity.

I encountered these lizards in considerable numbers last year on the island of Gozo, some 40 minutes by

boat from Malta. It was a baking hot day with the sun streaming down and the temperature well into 90°F. After lunching in Marsalforn, we drove along the coast road towards Obajjar and, our attention caught by three lines of tamerisk trees, stopped a little way outside the town. A raised flower bed, enclosed by stone walls some 30 inches high, extended for a considerable distance between the trees, separated by a broad stretch of sand, studded with large stones, from the edge of a boulder-embedded cliff, descending steeply to the sea below.

We were examining some burning bushes fighting their way upwards from the dry, powdery soil of the flower bed, when we suddenly realised that the ground was alive with lizards. Evidently the heat suited them admirably as, although they remained in view as long as we kept still, the slightest movement on our part sent them scurrying away in all directions. After a frantic dash of half a dozen or so yards they came to an abrupt halt, with outspread legs and head and shoulders raised, alert for the least gesture.

Considering the number of lizards visible at any one time, I had high hopes of securing a few specimens. The excessive heat, entire absence of any aids to capture and the speed with which they darted into cracks behind immovable rocks, however, rendered our attempts largely abortive. We did, after half an hour of perspiring effort, manage to secure one fully mature male *Acanthodactylus*. He was popped into a plastic bag—one of a supply kept in the car for such occasions—which was secured at the top with a rubber band and plentifully perforated with pin holes, and carried back to the bungalow on Malta where we were staying.

Once there, the need arose for some suitable container to hold the lizard for the remainder of our stay. Fortunately the bungalow was on a nursery and I was able to obtain some large sheets of horticultural glass and a roll of two-inch-wide sticky tape, of the type

used to join sheets of plastics material together, to provide a protective covering for the plants. It was a simple matter to bind the edges of four sheets of glass into a rectangular box, by taping the abutting edges, and then to attach a fifth piece of glass as a base.

Feeding presented no problem as the garden abounded in a variety of insect life, ranging from small flies up to locusts and the occasional praying mantis and the Fringe-Fingered Lizard quickly settled down.

These lizards make very satisfactory vivarium inmates. They are lively and active and feed freely on small locust hoppers, spiders and mealworms. Grasshoppers are pursued with particular enthusiasm and probably form a large part of their diet in the wild. I give mine a pot of water but have not yet actually seen them drink. They are kept in a vivarium two feet by one foot by one foot, the floor of which is covered with a one and a half inch layer of coarse

sand, with a few moderately large rocks arranged along the back, interspersed with several succulent plants. They have not buried themselves in the sand so far but take refuge at times beneath or behind the rocks.

For the most part they remain in the open where, provided one keeps reasonably still, they are content to remain on view. They are however inclined to be nervous and disappear with astonishing speed into some predetermined retreat when startled.

Acanthodactylus requires additional heat in this country and I have found a 25 watt bulb raises their quarters to a temperature satisfactory to their needs.

When kept with other lizards, such as *Muralis*, experience has shown it is advisable to make sure they are fully grown, as *Acanthodactylus* has proved somewhat aggressive towards lizards which are smaller than, but almost as large as, itself.

POLLUTION continued from page 85

Sulphuric Acid.

Produced by (1) Thio-thio-oxidans, is highly reactive and may be short lived, depending on the contents of the aquarium; it dissolves any calcium compounds such as shell, decorative marble or lime stone forming calcium sulphate, it will also dissolve iron from the tank frame, rust and the iron oxide colouring matter from sand or gravel forming soluble iron sulphate. A temporary lowering of the pH value towards acidity will be shown. This acidity, through over-feeding, is recorded in an article entitled "Guppies," by F. L. Vanderplank in *the Aquarist*, January 1970, issue page 291.

Sulphuretted Hydrogen H₂S.

Produced by Vibrio Desulphuricans (2) is a gas with an offensive odour, it is soluble in water to a greater extent than oxygen, it also reacts with the dissolved oxygen so necessary for the health of fish and plants. H₂S is generated in the absence of air, that is below the gravel, where it converts the iron sulphate into black iron sulphide which is insoluble in water. Iron sulphide not only blackens the gravel but will, in time kill the plants by destroying the root system.

Excess H₂S becomes occluded in the gravel and should be expelled by the occasional use of the "under-gravel biological" filter. In Nature the escape of H₂S into the air is the only means of reducing the sulphur compound content of the water.

The bad smell of all putrifying matter is due to this gas, so this condition is not just the aquarists' worry, but can be recognised in stagnant water in ponds, canals, rivers, water butts wherever there is pollution. The iron sulphate/sulphide reaction can be represented

as: $\text{FeSO}_4 + \text{H}_2\text{S} = \text{FeS} + \text{H}_2\text{SO}_4$ Iron sulphide + sulphuric acids.

In hot climates at certain times of the year, conditions are right for other salt water sulphur bacteria to become active, causing widespread destruction of fish and seaweed. One such place is Walvis Bay off South-West Africa, where dead fish pile up on many miles of beach, the smell of which is only slightly worse than the smell of the H₂S blowing in from the sea.

Caustic Soda

Produced by Thio-Beggiatoa in alkaline and only produced in small quantities at a time; it reacts with the carbon dioxide always present in a well-planted aquarium forming the less alkaline carbonate and bicarbonate. This alkalinity is short-lived, being neutralised by the sulphuric acid produced by (1) Thio-thio-oxidans.

The remaining members of the known fifty types, whilst conducting the same sulphur transformations, exist and react in any conditions found on earth.

Strains are known which tolerate high pressures, high salt concentrations, and temperatures as high as 160°F. Many are coloured, varying from green to bright red. These coloured strains need solar energy and usually consume organic matter, so where sulphur compounds exist the sulphur bacteria are active and more often than not the products are more harmful than otherwise.

In this article I have endeavoured to show the cause of variations in aquarium water conditions and how they control the health of fish and plants.

It would be pleased to answer any questions of this subject in the *Aquarist*, subject to the approval of the Editor.

Herpetological notes

By Stephanie J. Peaker, B.Sc.

PROBABLY the best way to house most European lizards is in an outdoor reptiliary. I am showing diagrams in these notes to illustrate how one can be constructed and during the summer months I shall describe the species suitable for keeping in such an enclosure.

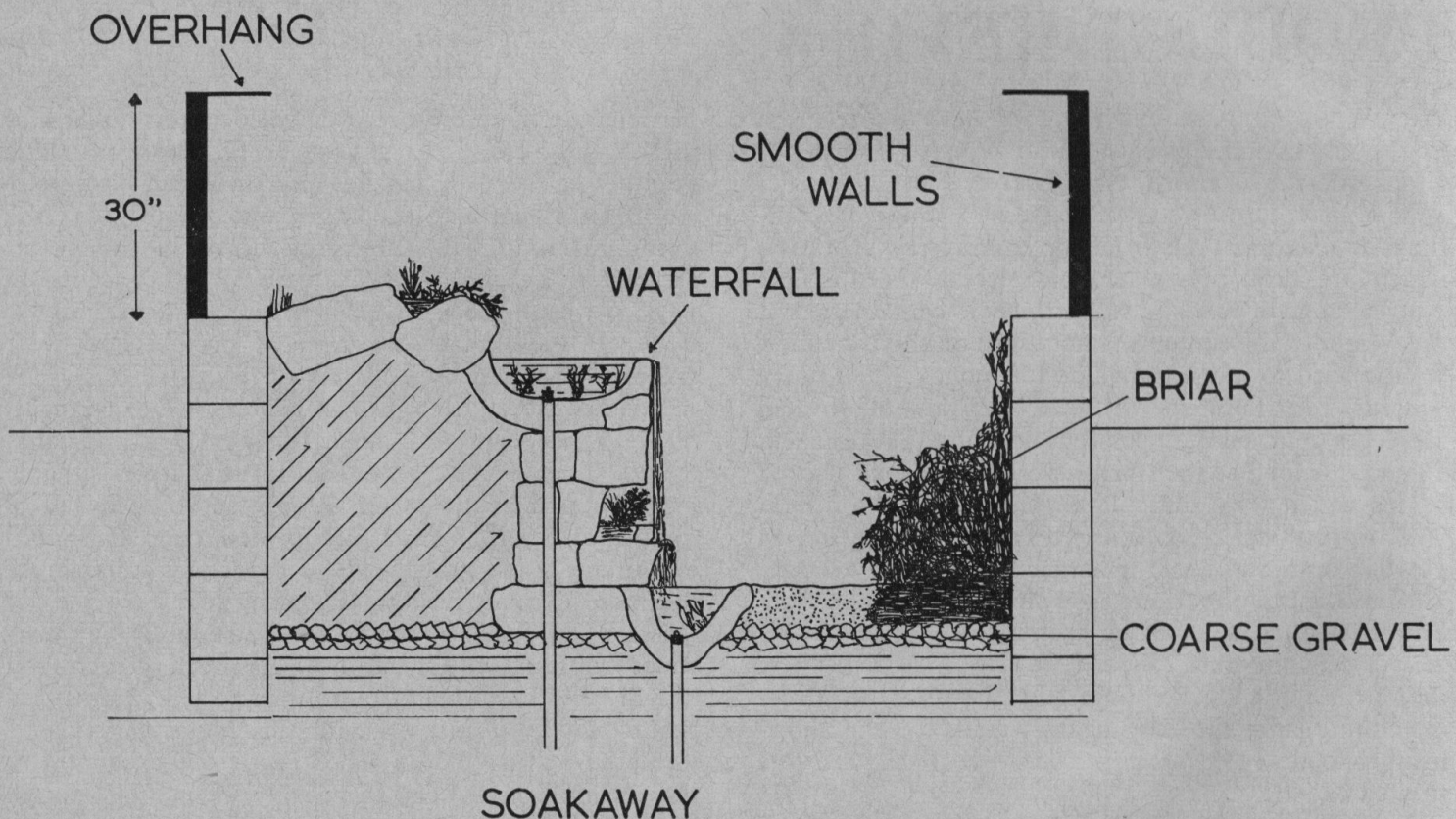
The reptiliary should be as large as possible and it must be remembered not to make the walls so high that they shade most of the area from the sun. I should also make it clear that the height of the walls shown in the diagram is not suitable for a reptiliary for snakes. If the area enclosed is large, as many different types of habitat as possible should be made. Different lizards like different surroundings and a mixture of rocks, grass and sand together with a small bush means that a number of species will soon settle in. In the diagram I have shown an area higher than the rest with a waterfall to a pool in the bottom. While a pool is

necessary, this split level arrangement is not but it makes a more interesting display. Incidentally, the soil dug out of the pit can be used in a tortoise enclosure to provide hillocks over which tortoises like to scramble.

I recommend setting up a lizard enclosure well before the inhabitants are introduced so that the plants become established and natural shelters are formed.

In some areas a wire-netting cover will be necessary to guard against cats and in northern areas part of the enclosure can have a glass roof in spring and this helps the lizards to warm up quickly in the morning sun. Smooth-sided walls are essential to enclose lizards and gloss-painted hardboard facing inwards is ideal for small enclosures if it is securely fastened to a strong wooden frame.

The biggest problem with an outdoor reptiliary is what to do in winter. If the reptiliary has a good



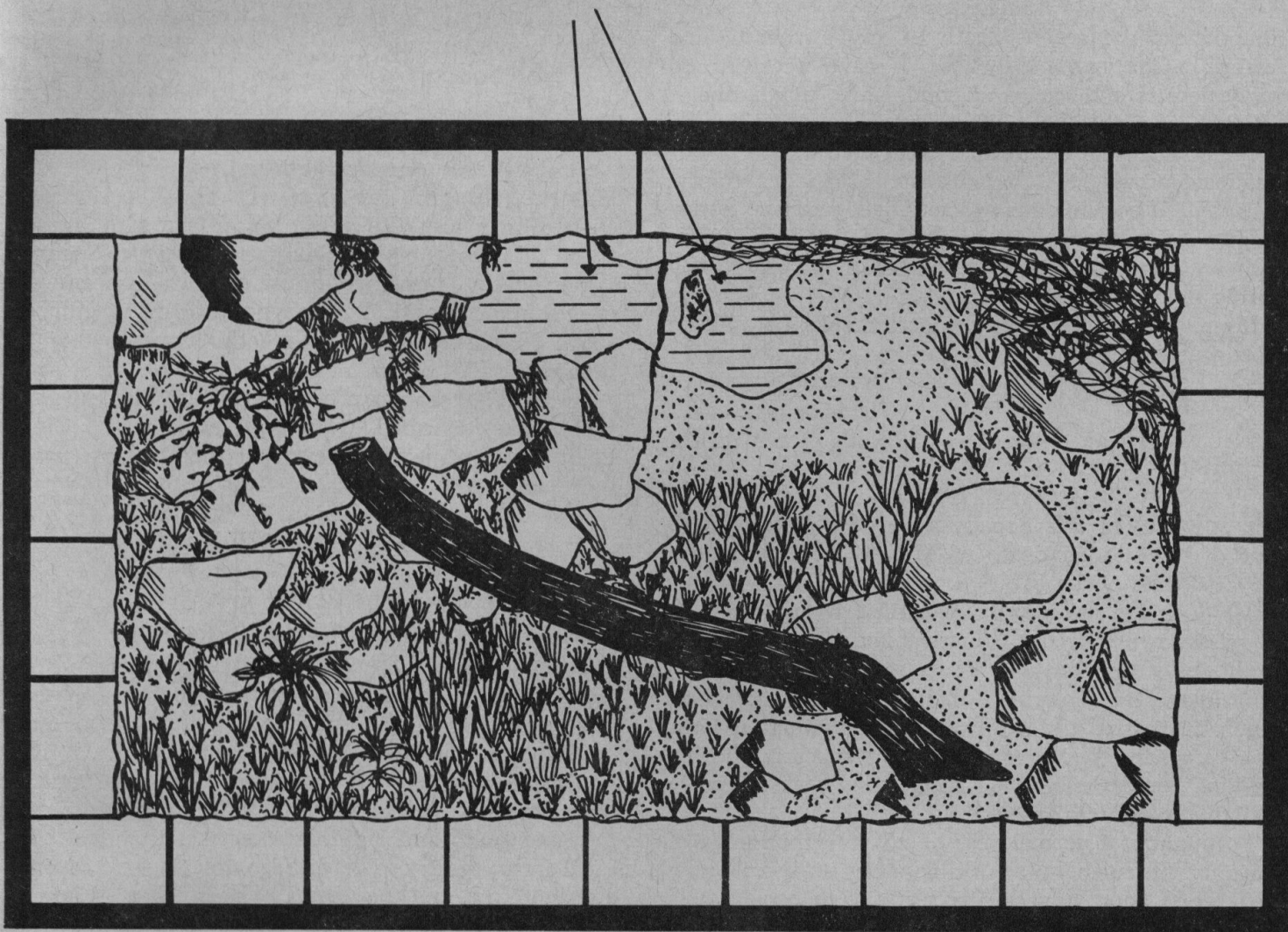
rockery and is well planted it is possible to let at least some of the inhabitants hibernate. This course can be helped by piling straw into the enclosure when the lizards have disappeared for the winter. It is not a good idea to cover the reptiliary with glass during the winter as the winter sun may heat the ground sufficiently to rouse the lizards and this can be disastrous if more cold weather arrives.

In a large reptiliary in a country district the lizards

will obtain a good deal of natural food. Insects fly in and are quickly caught by the active lizards. Mealworms and earthworms, hedge sweepings, spiders, etc., can be given and many lizards will accept food from the hand or large forceps.

Although not often seen by day, a colony of newts or small toads (fire-bellied toads, for example) will provide interest at dusk and with luck will breed regularly if allowed to hibernate.

POOLS



GRASS

SAND

ROCKS

LOGS

like painfully cleaned aquaria. A good mulm layer is quite convenient to them, in which they will turbulently search for food. Heating is not necessary in their tank; at 50°F they swim as well as at 75°F. They don't know about pH and dH. These are words belonging to a foreign language. Aerating also does not find any use in their tank as the fish are capable of intestinal breathing which permits them to live in dirty waters very poor in oxygen. Packed in humid moss, they can be transported for several hours and on arrival they are still alive. The most important point for keeping the American catfish is feeding. Give it solid food and never forget that it needs a great deal of nourishment! Concerning its voracity, I have a neighbour who always goes catfish-fishing with only two earth-worms. The first is the bait, the second is a spare. As soon as he has caught the first bullhead he kills it and cuts it to pieces. With these pieces of catfish-flesh he catches the others! This is already known with sharks, but they belong to a different field. Also provide for shadowy hiding-places and districts in the tank. Regarding reproductions: we know that the males take care of the youngsters but my fishes are still too young and I hope to be in a position

to give further information on the topic when they are mature. The breeding should not be very difficult in larger tanks. When young, the American catfish can be kept in the community tank, but never with smaller fish which it may consider as prey. It is peaceful with larger fish or fishes of its own size. In this event, feed it at night when all is dark and the other inhabitants of the aquarium have gone to sleep. However, the fish feels better in a special and proper aquarium and you will learn much more about it in such a special tank. *Ameiurus nebulosus* is a coldwater fish without the beautiful colours of our tropicals but its interesting behaviour and quite undemanding habits make of it THE aquarium-fish. A hardy and enduring fellow whom you should try to keep. You would not regret it!

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FIRE SALAMANDERS

By Kerrogan Smith

FIRE SALAMANDERS have suffered in the past from the myth that they could survive in a fire. The myth was probably based on the colours of this amphibian, black with yellow spots or stripes, but in fact the coloration is of great service to these Salamanders. The Fire Salamander spends a lot of its time in the dark and light under small plants, where the broken black and yellow is a great camouflage! In their nature these animals are not at all aggressive; only six inches long, they are slow-moving, scale-less with soft flesh. Salamanders cannot bite and seem very vulnerable at first glance; however, they secrete an invisible poison called Salamandrin which deters most of its natural predators.

When I first acquired my pair I noticed that they seemed to ignore worms which were still, but moving worms and other insects were welcomed foods. This led me to wonder how bad their eyesight was, and so I endeavoured to find out. I first of all dragged some dead mealworms along in front of them, and the Salamanders were not slow to eat these. Whilst they were stalking these dead insects I could detect no unnatural reaction from the Salamanders. Next I

decided to determine whether Salamanders will devour any small moving objects. For this experiment I dragged a spent match in front of the Salamanders. They did indeed stalk the matchsticks and were not always willing to release the captured wood. After a few experiences with a matchstick on an evening the Salamanders would stop stalking them; they even ignored living insects. Next day they would again take insects and matchsticks, having completely forgotten the day before.

As a result of my experiments I think it is quite clear that Fire Salamanders have very poor eyesight. They can detect movement, but not any details. Fire Salamanders do, therefore, only attempt to eat moving insects because when they are still Fire Salamanders do not notice the insects, no matter how close the insect is. Also, if an insect that the Salamander has been stalking stops, the Salamander soon loses interest.

There appear to be a number of lizards which also behave like my Fire Salamanders, and it is interesting that a number of insects do stand still when predators are close by, obviously in the hope that the predators will pass by.

HERPETOLOGICAL NOTES

By Stephanie J. Peaker

FEEDING CAYMANS

FEEDING caymans, alligators and crocodiles is usually a simple matter. Two to three feet long specimens can be given raw meat several times each week. If this is placed at the water's edge the animals will be accustomed to finding it there. Freshly-killed mice or young rats should also be supplied regularly to provide roughage and a natural source of vitamins and minerals. In addition, a water-soluble vitamin preparation can also be given by injecting a small amount into the meat from a hypodermic syringe. Tablets of calcium phosphate, calcium gluconate and vitamin D are available at chemists and these can be pushed into the meat or powdered and sprinkled over it. Calcium deficiency is very common in rapidly growing young crocodilians and this treatment, together with the provision of a few minutes of ultra-violet light, usually prevents the disease.

Several hours after food is given any remaining should be removed so that the water does not become putrefied. Green water itself, though, is not harmful and, in fact, may be useful since *algae* contains vitamins which may be ingested with the food.

Sometimes, newly-arrived small specimens will refuse to feed. If they refuse food to an extent such that they appear less rounded than usual, and if raising the temperature has no effect, force-feeding may have to be carried out. Strips of raw meat (injected with vitamin and mineral supplements) can be placed at the back of the mouth and carefully eased down the gullet with a small, very smooth, handle of a spoon or a chemical spatula if one is available. After several treatments like this and good, warm conditions, the reptiles will often feed voluntarily with no further trouble.

WHEN THEY GROW

Many owners try to persuade zoological gardens to accept caymans and other crocodilians which have been bought as hatchlings and outgrown their quarters. Unfortunately, zoos can only accept a few such animals since they simply do not have the available space. We had a crocodile pool which could be used for specimens up to the size of about three feet and was simply an area of greenhouse containing a concrete pond with a wooden fence around it. The walls of an enclosure such as this should be of smooth, painted wood or metal to prevent the animals from climbing

out. Apart from a pond, a mixture of sand and gravel makes the best floor covering because this can easily be hosed and raked clean. Any plants in the enclosure should be sturdy and well-established. It is important that the pond should be equipped with an efficient drain and soak-away system so that it can be cleaned with the minimum of effort. The pond can also be faced with smooth concrete so that *algae* can be scrubbed away.

Heating is difficult to arrange for the larger aquatic reptiles. Because of their low-price, the usual glass-tubed aquarium heaters are often used but can easily be kicked against the side of the pond and broken. After making unsuccessful attempts to protect the glass with tubes of perforated zinc, the following system was devised. A heater holder (two clips on a plastic strip) was screwed to a wooden block and the heater clipped in place. Other pieces of wood were screwed in place to give the heater protection at each end and on two sides. The whole set-up was then screwed to a wooden pole and attached to a wooden bracket on the side of the enclosure by a bolt. The heater could then be swung out of the water while the pond was cleaned (remembering to turn off the heater first). A thermostat was found not to be necessary for the heater, the wattage of the heater depending on the size of the pool and the outdoor temperature.

The air in the enclosure can be warmed by tubular heaters, well protected so that the animals do not burn themselves. Incandescent lamps can be provided. To prevent heat-loss in winter, a double layer of polythene sheeting placed over the enclosure is useful.

DAY GECKOS

Madagascar has many zoological oddities. Not least amongst them are the day geckos (genus *Phelsuma*). They have two unusual characteristics; they are active by day as their name implies and they are bright green in colour. There are a number of different species and each has a characteristic pattern of colouration. This pattern is often striking—a combination of red and yellow spots, blue areas, etc. They need a high temperature (at least 80°F) and because they also need a high humidity, the vivarium can be planted with tropical plants and made to look extremely attractive. Another unusual feature about this group of geckos is that apart from eating small insects and similar animal food, they also eat soft fruit. K. H. Switak of the Steinhart Aquarium in San Francisco reported a very convenient method of supplying fruit to these animals. He found that the bottled, strained fruits and vegetables used for feeding human babies are readily accepted by day geckos. Two specimens of *Phelsuma madagascariensis*, a large member of the genus, were found to prefer peaches and apricots. Unused baby food can be stored in a refrigerator until use.

kind. It must be stressed that the chemical should never be used in a planted aquarium as it has the most adverse effect on aquatic vegetation, reducing them more often than not to a mere skeleton of their original form and beauty. It also has the disadvantage of staining the aquarium compost, sometimes permanently. Methylene blue should never be used to treat the "scaleless" species of fish, notably the loaches, as it has the effect of a poison, eventually bringing about their death. It has been suggested on many occasions that the use of methylene blue renders fish sterile and although this has not been my personal experience, it does possibly add weight to the advice that the chemical should only be used as a last resort attempt at a cure, and certainly not until other, safer, methods (notably proprietary cures) have been tried and proven ineffective.

It is nearly two years (March, 1969) since I contributed to this magazine an article entitled "Aid for Society Secretaries," indicating sources from which films and slides on aquatic subjects were available for hire. Since that time, even up to the present day, I have regularly received letters from club secretaries who apparently missed this contribution, and in an effort to forestall any further additions (pleasant though they are) to my already heavy postbag as a

society secretary, I present below a precis of the probable desired information.

Films:

"Malayan Seashore," "The Story of the Trout," "Coral Wonderland," "The Salmon's Struggle for Survival," etc., are obtainable from the Central Film Library (a government-sponsored organisation) at any of their three offices in Great Britain—Government Buildings, Bromyard Avenue, Acton, London, W.3.; 42 Park Place, Cardiff and 16-17 Woodside Terrace, Charing Cross, Glasgow, C.3.

"Beneath the Seven Seas," "In the Swim," "River of Life," etc., are obtainable from the Rank Film Library, Aintree Road, Perivale, Greenford, Middlesex.

"Between the Tides" is obtainable from the Chief Officer (Films), British Rail Board, Melbury House, Melbury Terrace, London, N.W.1.

There are several sources from which slides are obtainable on hire, including Mr. R. E. Hampson, "The Headlands," Scotland Lane, Horsforth, Leeds; Messrs. Highlands Water Gardens, Rickmansworth, Herts; Mr. A. Robbins, 29 Cootehall Road, Crawfordsburn, Helen's Bay, Northern Ireland; Messrs. Brentwood Aquatics, 274 Warley Hill, Brentwood, Essex; Mr. R. Jamieson, 2 Laurel Bank, Kirkcaldy, Fife and Mr. G. H. Jennings, 2 Gatcombe Road, Tufnell Park, London, N.19.

KEEPING TERRAPINS

by W. J. Wright

TERRAPINS, or water tortoises as they are sometimes called, are becoming very popular in Great Britain, but unfortunately few people know how to care for them properly.

There are many different species of terrapins imported today, some tropical, some hardy, and some semi-hardy, but all require fresh water to live in.

Feeding

Feeding is a very important part in a terrapin's life, not only because it must eat in order to live, but also because incorrect diet can soon spell disaster for any terrapin. They can eat only when in the water. These creatures live mainly on flesh, and although in its wild state it lives on live creatures, such as small fish, worms, etc., in captivity a terrapin will eat raw meat, raw fish, offal, daphnia, etc.

For the baby terrapins, however, all meat, etc., must be finely shredded. Herring and liver are especially good for terrapins, as these contain vitamins

and minerals essential to health. A small piece of lettuce or pond weed two or three times a week also helps to keep the creatures healthy. They must be fed daily, and must be fed well. Stale food must not be allowed to remain in the tank, otherwise it will foul the water causing possible ill-health.

It is essential that finely crushed cuttle-fish is added to the diet often, as this helps to prevent softening of the shell and other deformities. Cod liver oil, or some similar oil must be given frequently, as this helps to prevent blindness which may occur if vitamin A is not provided, and this together with vitamin D is found in these oils.

Living Quarters

These are most important and depend on the species of terrapin kept. The hardy species, such as the European Pond Tortoise and the Spanish Terrapin,

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of the under-gravel filter is that all the fishes' wastes are ultimately converted to soluble salts, mostly nitrates and phosphates. These which are not utilized by algae as food, are automatically disposed of by one third water changes at three to six months intervals—the precise interval between changes being determined by the loading of the tank.

Two Tips Regarding Filter Gravel

- (1) *Never* throw matured sea aquarium gravel away. It can be used to "seed" up the u/g filter of a newly established tank, thus reducing the maturation period needed for the gravel from weeks to days.
- (2) *Never* wash matured gravel from the u/g filter of a sea aquarium in *tapwater*. This will kill off the nitrifying bacteria. Always have some old sea water stored for washing matured gravel in.
- (3) Those who possess a power filter (in addition to the u/g filter) may "backwash" the gravel in their filter by periodically inserting the power filter's water delivery tube *down* the airlift of the u/g filter. This simple servicing procedure should completely remove the need for stripping down a u/g filter.

Which do you consider to be the best equipment for controlling pathogenic "disease-causing"

organisms in sea water—an ozoniser or an ultra-violet sterilizer?

Both ozone gas and ultra-violet radiation are means of controlling pathogenic organisms in the sea water of your aquarium. Ozone, since it goes into solution in the sea water to a limited extent, has a far reaching effect on bacteria and other pathogens. Ultra-violet radiation will only destroy those organisms which are exposed to it at close range i.e. those in the water which passes through the irradiation chamber of the u/v sterilizer. It is also true to say that all the u/v sterilizers on the market at the moment employ the Philips TUV 6 radiation source. These bulbs produce only some 80 microwatts of radiation at the lethal frequency—an amount of u/v probably insufficient to have any worthwhile lethality, in view of the limited exposure period. The TUV 15 is very large (about 18 in. long) and requires a ballast control gear to run it, but is a much better tube, producing some 3 watts of lethal frequency radiation.

All things considered, an ozoniser is a more worthwhile buy than a u/v sterilizer, although the latter, if properly designed with regard to both the amount of ultra violet radiation emitted and the period for which the water is exposed to that radiation, (as controlled by the water flow rate through the sterilizer), is an effective means of controlling disease-causing organisms.

KEEPING TERRAPINS

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can be safely kept out of doors all the year round, providing suitable conditions, such as I will mention later, can be provided. Tropical species, however, must be kept in heated tanks all the year round, as even in the summer months our climate is probably much too cold for them. They need a constant temperature of 75-80°F. The semi-hardy species, such as the N. American Red-ear, and the Yellow-bellied terrapins, can be kept out of doors in the summer if the weather is warm, but during cold weather they also must be kept indoors, in a tank, in a temperature of 70-80°F.

Whichever species you have that is suitable to keep out of doors, it must, of course, be provided with a pond, or sunken tank, into which it can retreat, and whether kept in a pond or in a tank, it must be provided with an island onto which it can easily climb, to sun itself, or to dry itself as they sometimes like to do. If a pond is provided your terrapins can, of course, come onto the edge of the pond, in which case an island is not necessary, but it is advisable to fence the pond otherwise they will wander away, and small specimens, even up to three or four inches in length, must be protected from dogs, rats, and big birds.

Small terrapins, whatever the species, are best kept in a tank all the year round, heated to a temperature of 70-80°F. when necessary. It must be remembered that where artificial heat is provided, with the recognised heaters, a thermostat must always be connected. Sunlight is very beneficial to terrapins, but some form of protection from this must be provided so that they can move from the sun if it gets too hot as too much direct heat will kill any reptile, as will too cold a temperature.

If you keep your terrapins in a tank, either a proper filtering system must be used, or the tank must be cleaned out often to prevent bad smells, and most of all to prevent the terrapins becoming prey to disease. And again an island must be provided.

Hibernation

The tropical species must not, on any account, be hibernated, otherwise they will die. This also applies to sick terrapins, and those with an under-shell measuring less than 3½ inches in length. These must all be kept in a tank throughout the winter months in a temperature of 75-80°F., and must be fed as during the summer months.

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The type of food does not appear to be so very important as far as the development of the fish is concerned. The chief test is if they eat what is offered. Remember that goldfish will eat anything a pig will eat and plenty more besides. The diet can be varied with types of live foods. I favour white worms (*Enchytrae*) and garden worms. In the early stages these are mashed and then chopped up as the fry grow. I never use any live foods from water sources, I know that many breeders do and so they can, but one day they may get a bad crop of pests or diseases and wonder where the crop came from. If any forms of live foods can be obtained in freeze-dry condition then I imagine that these would be quite safe. Whether you would be able to afford

to feed a large number of fry on such foods depends on the depth of the pocket. Some fry foods are getting so expensive that one needs to be almost a millionaire to be able to use them. I recently paid 4s. for a tiny tube of fry food which could have been placed in a desert spoon quite easily and which my fry ate in a day or two. There is one point about this very dear food and that is the breeder is tempted to experiment with many other types of food which are quite well taken by goldfish and it pays the breeder to experiment with all types of human foods to find out which his fish will take.

I have just tested the 4s. fry food container and find that it actually holds just two desert spoons of dust-like food.

KEEPING TERRAPINS

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The hardy species which have been kept out of doors during the summer months, can be safely hibernated out of doors, providing they are in a deep pond which has several inches of mud at the bottom into which the terrapins can burrow, but they must be well away from frost, ice, etc., otherwise they will die.

If no deep pond is available, it is wisest to hibernate the terrapin indoors, and the simplest and most satisfactory way is to have a large metal or plastic container, and in the bottom place a layer of a mixture of fine soil, moss, leaves, etc.; place the terrapin on this and cover it with a further layer of the mixture three or four inches deep. **DO NOT USE CLAY**, otherwise the clay will harden and seal the terrapin in an airtight casing.

Place the container with terrapin in a cool, draught-proof place, such as a cellar or shed, and leave it there until the spring arrives and the creature awakes. Until the weather becomes warm leave the terrapin indoors, but bathe the eyes and mouth with warm water to make sure that they are free to open. Do not attempt to wash the terrapin until the weather is warm enough.

How do we know when a terrapin is ready to hibernate? Well, of course, the terrapin which has spent the summer months indoors will not show signs of hibernation because it is in the warmth.

The terrapin which has spent the summer months out of doors, however, will show signs of wanting to hibernate and these will be noticed about October, when the cooler weather comes. The terrapin will lose its appetite, and will become sluggish. These signs will increase and about the end of October, or

early November it will be safe to put it into its winter quarters. Putting it into hibernation too early is not always advisable, for two reasons. First, if we should get a warm day the terrapin may want to eat owing to the rise in temperature, and secondly, if the temperature is not cold enough the terrapin will not settle, and will simply struggle to get out and in so doing will use up energy, which it will need during hibernation. Keep an eye on the hibernation quarters until you are sure the creature has settled in case it falls onto its back, or comes to some other harm.

Hibernating terrapins require no food or drink during hibernation, but it is essential that they are well fed during the summer months so that they can store sufficient food to last through the hibernating period.

Many people like to put their name, or some mark on a terrapins shell, in paint or varnish, but this should NOT be done, as it can result in the shields of the shell coming off, and also it can come off in the water, poisoning the terrapin.

Finally, if your terrapin develops some illness or injury, take it to a veterinary surgeon who will prescribe the necessary treatment for it.

PRICE OF "THE AQUARIST"

It is regretted that because of increasing costs in production and distribution of periodicals, the publishers of *The Aquarist* have to increase the price of the journal to 3s. 6d., starting with the January issue. Subscribers will be notified of the new rates when current subscriptions come to an end.

THE GREEN LIZARD

(*Lacerta Viridis*)

IN CAPTIVITY

by Andrew Allen

THE GREEN LIZARD is one of the brightest and most lively members of the European Herpetofauna, and one that is easily obtainable in this country. It is the second largest European lacertid, and a specimen worthy of any collection. But the mortality rate in England must be enormous, as the lizards are housed in inadequate quarters and fed on unsatisfactory diets. It can be the most beautiful centrepiece of a vivarium or community, or can become a fickle specimen prone to illness.

It is easy to go wrong from the very start, in the selection of the lizards. When I first bought two individuals from a pet-shop, many years ago, I was handed two large, fine specimens, apparently in the peak of condition. But they were both males and harried each other unmercifully, while one was very old, and possessed of small blood-red ticks. They both died quickly, almost inevitable from the very start. So unless you can provide more than twenty square feet of floor space, choose only one male. All specimens, male or female, should be fairly young, and should be checked for ticks or other external parasites.

Having bought them, where are you going to keep them? If you have a vivarium or aquarium of four feet or above in length, then you will be able to lodge a true pair indoors. Place the vivarium in a sunny window, and provide it with one or more 60 watt light bulbs (out of reach of the lizards), to maintain the day temperature somewhere about the eighties Fahrenheit. A tight-fitting lid should be provided, with ample perforated zinc for ventilation. Interior design can be to your own tastes, but certain points should be noted. Drinking water is necessary, but in the indoor vivarium it need only be in a small dish a couple of inches in diameter. The flooring can be either a mixture of soil and peat, or ordinary aquarium gravel. The former should be of such a consistency that the lizards can construct their own burrows in it. A central flat stone should be placed beneath one of the light bulbs, and branches provided for climbing. The plants, which may make or mar an arrangement, should be chosen for their acceptance of fairly dry conditions. Cacti, succulents and variegated ivies are good choices.

There are problems about keeping *L. viridis* indoors, for it may resent the restricted conditions. The winter months are a cardinal problem. You can keep the

lizards awake throughout the winter, but you have the worry of knowing that you are shortening their life span, and disrupting their natural breeding cycles—possibly with unfortunate results. The other alternative is to hibernate the lizards “artificially.” This would consist of removing the light bulbs and accustoming the lizards to cooler temperatures in October, removing them to a cooler situation, and, when they become a little drowsy, filling the vivarium with dry leaves and removing it to a cold, but frost-proof, shed or garage. In the spring the vivarium should be constantly checked, and transferred indoors when the lizards show genuine signs of waking up. If the vivarium is too heavy to be manhandled into a shed, the lizards can be hibernated in a suitably padded, escape-proof wooden box. On awakening they should immediately be provided with drinking water and appetising food.

Keeping these lizards indoors is thus a somewhat risky business, fraught with pitfalls, and one that I cannot fully recommend. If possible it is far better to keep the lizards in more spacious outside accommodation, under considerably more natural conditions.

There are two possible types of outdoor accommodation. The first of these is the outdoor vivarium group, represented by greenhouse and lizard house. The greenhouse is an excellent way to keep this lizard, and allows the full development of a community. The lizards will enjoy the sunshine and warmth, and will hibernate naturally. Encouraged by their surroundings they will mate and breed, and demonstrate most of the habits exhibited in the wild state. They will become far tamer than in the indoor vivarium, despite the fact that they are no longer entirely dependent upon hand feeding. I have had no losses during hibernation over a period of more than five years of keeping green lizards in a greenhouse; for they choose their own hibernacula, which are eminently more suitable than any we could choose for them ourselves.

An equally good outdoor arrangement is the reptiliary, though great care must be exercised in its design and construction. The outer walls should be three feet high, and as smooth as possible. The ledge or overhang, the really vital part, should protrude nine inches into the vivarium, and be absolutely glass-smooth, without even the tiniest cracks. The reptiliary

must be in a position where it will catch every last ray of the sun, and away from any trees. All plants should be ruthlessly sheared off at about one and a half feet from the ground. Green lizards are superb and agile climbers, and a poorly designed reptiliary will give them very little test. If they manage to escape early on, then your money will have been wasted; but if they only escape once they have become established, then the likelihood is that they will return. If they do not manage to escape, the reptiliary will satisfy their every need, providing abundant sunlight and natural food from outside. Deep, well-drained soil must be available so that they can construct hibernacula in dry places well below the frost line. Even better, build a hibernating chamber which will guarantee immunity from the worst excesses of our coldest British winters. In a large reptiliary you will have ample opportunity to integrate the lizards into a wider community, and a large pond will not be out of place.

If you wish to associate these lizards in a community in greenhouse, reptiliary or outdoor vivarium, then my article on the subject in the January 1969 issue of *The Aquarist* may prove of assistance. If you wish to keep them with other reptiles in the indoor vivarium, then your choices are far more limited. No amphibian may be kept with them, for they will not tolerate the arid conditions. As most snakes would enjoy a green lizard for a snack, the choice is restricted to other lizard species. If the lizards are being hibernated then the choice is very small. Schrieber's lizard (*L. schrieberi*) is one possibility, as are young specimens of the eyed lizard (*L. ocellata*), and fully adult slow-worms (*A. fragilis*).

If the lizards are being over-wintered then a number of tropical and sub-tropical species may be considered as companions. Several of the medium-sized geckos such as adult *T. mauretanica* will bring variety to the vivarium. Various zonures and the crag lizard (*pseudocordylus sp.*) will tolerate much the same conditions, as will many medium-sized skinks, such as the Mabuyas and various Chalcides species. Desert Agamas are feasible companions, but are not a species that is strongly recommended to the amateur. Desert, or semi-desert species should be chosen, and they must be comparable in size to the green lizards—for *L. viridis* has a reputation for cannibalism.

Bad regulation of feeding is another cause of mischief. The green lizard will eat a wide variety of food, and is not specialised in its tastes; thus monotony of diet is the main danger. All manner of insects, spiders, woodlice, slugs, stick-insects, centipedes, millipedes, earthworms and many other small invertebrates will be taken. Mealworms are a favourite item in the diet, but should be given with discretion, for they are a rich food with indigestible chaetae, and overfeeding can lead to various intestinal complaints. The lizards like to lick demerara sugar, or honey

perhaps, and also appreciate all manner of seedless fresh fruits, like the flesh of apple, orange, grape, plum and banana. The choice is wide, and finding food should present fewer problems than with most reptiles, but it must always be remembered that variety is the key to good health. The lizards are individualists, and will soon sort out their own preferences, and each reject a certain proportion of the offering. Seasonal food such as Crane flies and flying ants should be used to vary the diet, and if you have a greenhouse or reptiliary it is a good idea to establish an ants' nest in it. The lizards will dig up some of the grubs, the toads will enjoy the adult workers, and the flight of the Queens will be greatly appreciated by all the inhabitants, even such staid individuals as the newts.

It is hoped that this will give some guide to those considering keeping this lizard. It is a beautiful lizard, perhaps the most beautiful of all European lizards, and has a temperament to match. It will become so tame that it likes nothing better than to snooze for an hour on your shoulder, or make exploratory tugs at your ears or eyelids to test for edibility. Draped along a branch, basking in natural sunlight, it is a superb sight, a natural focus in any vivarium or reptiliary, however varied its companions may be.

But remember that it should be given only the most spacious and natural quarters, for a green lizard sulking in a small vivarium in a dark corner is a travesty; for its colours will soon become drab, and it will lose all the vicacity and liveliness that make it such an excellent inhabitant of the vivarium, reptiliary or greenhouse.

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THE CHAMELEON

Junior Aquarist

(If you have tears, prepare to shed them now)

By Jennifer Aistrop
(age 14 yrs.)

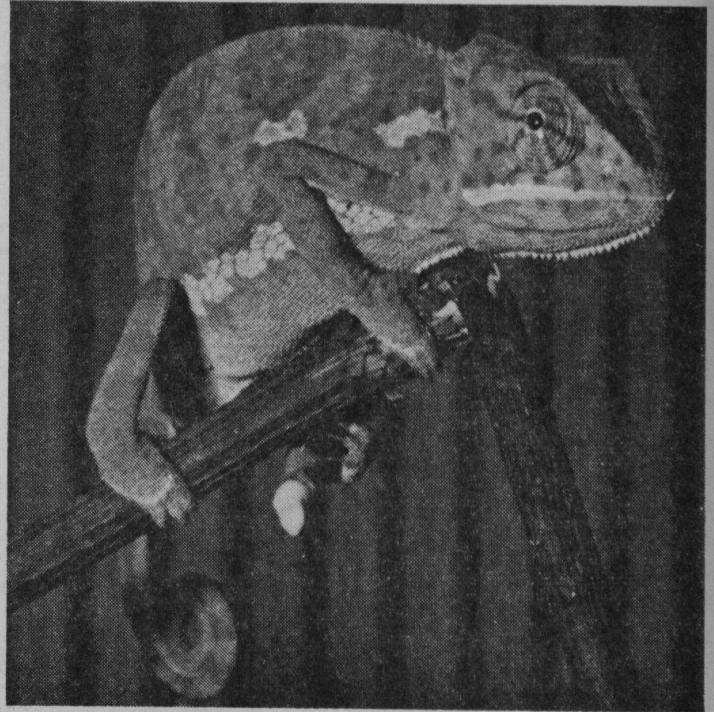
HE'S SITTING on a small piece of geranium stalk at the moment, with his tail wound lovingly around a lower piece of it. Occasionally he heaves a deep sigh, showing very frail ribs. A friend of Daddy's brought the tiny creature to me, and said he had a ten-to-one chance of survival. I try to make myself believe that I'll be lucky.

He really is the most adorable thing, though. His little face is permanently crumpled up into a heart-rending sad expression. The bulbous eyes that viewed the world for the first time yesterday are closed most of the time. When they open, glittering black balls dart in every direction. He (or is it "she"?) really does look comical with one eye gazing at the scenery ahead, while the other looks at objects behind.

Although only an inch and a quarter from nose to tail, he is a miniature replica of a fully-grown chameleon. If I put my finger near him, he climbs trustingly aboard, and, after a few piercing glances round, settles down and goes to sleep. I am supposed to be doing my homework and washing my hair—but I can only sit and stare at the enchanting reptile before me. He won't eat, and sometimes his stomach stops moving up and down: I have to reassure myself that he is still with us. It's funny how a diminutive day-old animal can change the day's events so drastically. I try not to think of what surely must happen. Reluctantly I bring out my geography book.

A goldfish bowl with a woolly vest wrapped round it for warmth served as his night quarters. I put a small begonia in the bowl, and he climbed gratefully up its hairy leaves.

* * * *



I can't fool myself any longer—he's getting steadily worse, and there's nothing I can do about it.

* * * *

Now that he's dead I don't seem to care anymore. He opened his mouth and didn't close it again. On Sunday, December 14th, 1969, a tiny creature died as lots of living things do—of age: the only difference being that he was too young.

BRITISH MARINE *Algae*

By Huw Collingbourne

SEAWEEDS are highly developed marine algae. These plants do not have roots but holdfasts, with which they are secured to rocks or other firm objects. No nourishment is taken through these clasping structures, their sole function being to hold the plant on to a solid base.

In rock pools which are constantly submersed in seawater and are exposed to strong sunlight we find green algae. In ideal conditions good growths of *Ulva*, the Sea Lettuce and *Enteromorpha*, one of two common weeds called Sea Grass, will be abundant.

Emerald groves of Sea Lettuce move and curve with the flow of the cool salt water. Among their translucent leaves hide darting prawns, well hidden by the bright green fronds.

The Sea Grass drapes the rocks with colour. Longer and less broad than Sea Lettuce and yet holding a quality of movement and of life not found in other plants.

Red algae are delicate like the green species, but because they need less light than the green plants,

Blanus cinereus

by H. G. B. Gilpin

AMONGST A SMALL collection of mixed reptiles I received from Benidorm, on the south east coast of Spain, were six examples of *Blanus cinereus*, the only known member of its genus to be found in Europe. Commonly known as worm-lizards, or ringed lizards, they were found on the damp earth underneath stones and although completely without legs were by no means easy to capture. As soon as the stones were raised, they began burying themselves in the earth and, unless picked up without delay, soon disappeared from sight.

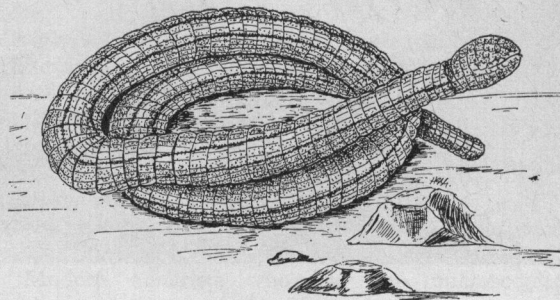
Worm-lizards are said to show a considerable variation in colour, ranging from yellow to pink through shades of violet and reddish grey, grey or brown on the upper sides, with yellow or pink undersides. All six of mine however are uniform in hue, doubtless because they were all found living under similar conditions, with a limited area of ground. Although their underparts are slightly paler than the dorsal surface, they are pinkish-brown all over. The smallest is about four inches long and the longest eight and a half inches. The tails are extremely short in relation to the length of the bodies, that of my biggest lizard being no more than one inch. It extends smoothly from the body, the end being rounded and showing little diminution in diameter.

The muzzle too is blunt and rounded, the small head being roughly triangular, and separated from the body by a narrow groove. Worm-lizards are quite blind, the position of the vestigial eyes being marked by minute dark spots, visible through the surface of the skin. The forked tongue continually darts in and out of the mouth seeking sensations denied to the animal by its lack of eyes.

The rounded body is ringed throughout with furrows. Its surface is smooth and shiny and a long lateral groove extends along each side, reaching from just behind the head to the beginning of the tail. Fainter longitudinal furrows divide the surface into small, neat rectangular plates.

Cinereus differs from its near relative, *Blanus strauschi*, in possessing jaws of equal length, the upper jaw of the latter species extending beyond the lower. Its nostrils too are placed above the lip shield, whilst those of *B. strauschi* lie within it.

On arrival my specimens were placed in a small vivarium, heated to 70°-75°F by an electric light bulb, together with a four inch long skink—confined with them temporarily until more suitable accommodation could be found for it. The floor was covered with



several inches of sandy soil and furnished with a number of large, flat bottomed stones, a small log and a clump of coarse grass. The worm-lizards were somewhat lethargic as a result of their long journey but within less than a minute all six of them had disappeared below the surface. It was interesting to find subsequently that they always buried under a stone. When searching for them on several occasions, weeks after their introduction, not once has one been found beneath the soil in the open part of the vivarium. They always curl up, usually under a stone but sometimes under the log, either on the surface of the soil or an inch or so beneath it.

According to the references, these creatures, under natural conditions, feed upon insects and earthworms. I was anxious to give mine every opportunity to feed as soon as possible, as two of them were distinctly flattened in appearance, suggesting that a meal was overdue. Consequently I provided them with as wide a range of food as I could, including blow flies, newly hatched locusts, woodlice, gentles, mealworms and earthworms. That they started feeding almost immediately became apparent after a couple of days, by which time they had filled out and their bodies became rounded and firm to the touch. They seemed to have made little or no inroads on the insects but the earthworms disappeared at a great rate.

Since a heated tank is rapidly fatal to earthworms, these are not simply tossed into the vivarium but placed in a shallow dish of damp earth, sunk almost to the rim in the floor covering. Fresh supplies of worms, each two inches or less in length, are supplied every other day and the soil in their dish is kept permanently moist.

Continued on page 23

Blanus cinereus

continued from page 9

A vessel of water, also shallow, stands in the vivarium. So far, in spite of fairly close observation, I have not seen the worm lizards drink but since they may well do so at night, keep water continually available.

According to the records, these reptiles are long lived in captivity and make good vivarium inmates. They are certainly easy to maintain, make few demands on one's time and are completely non-aggressive towards other lizards. They do tend to spend the major part of the daylight hours hidden and out of sight but they do appear from time to time and are sufficiently unusual to be of considerable interest to herpetologists. They are unenthusiastic about being picked up and coil themselves with surprising strength around the fingers, making tremendous efforts to bury their heads in the darkest region of the partially closed hands. It does not seem to occur to them to institute reprisals and none of mine have ever made the slightest attempt to

bite. They do however constantly extrude their pink tongues, making up for their lack of vision by a continual testing of the atmosphere.

Normally they move by extending their bodies like earthworms but if placed on a smooth surface they lash themselves into coils in a frantic effort to escape to more congenial surroundings. When returned to the vivarium they immediately set about burying themselves in the familiar soil.

Very little seems to be known about the breeding habits of worm-lizards. Carr states he discovered two eggs of the Florida worm-lizard on one occasion when digging in his garden. Other reports suggest that some species appear to be viviparous. Their way of life does not make observation of their habits, under natural conditions, easy and it is hoped that mine will prove cooperative and at least yield some information about their reproduction.

The Pygmy Angelfish

continued from page 3

My *Centropyge fisheri* was 1 in. in length when I bought him, and he has since grown slowly to just over 2 ins. The blue rings around the eyes give one the impression that he is either wearing glasses or else is suffering from a succession of sleepless nights. He leads a very active life: he is never still, but is continually flitting in and out of the coral in a not dissimilar manner to the Demoiselle fishes. He settled in quickly and took over a beautiful piece of Lettuce coral that is in one corner of the aquarium. This he regards as home: during the day he keeps himself strictly to himself, but when he has decided to retire for the night, the other inhabitants are chased away if they approach too close; even the *Thalassoma lunare* which is over twice his length.

After the first few days feeding has never been a problem. All the usual flake foods, such as Tetramin, are eaten, together with freeze-dried brine shrimp, roe and *tubifex*. Little pieces of shredded fish, shrimp, prawn and ox-heart are greedily accepted. No, greedily is not the right word, because *C. fisheri* is a careful, one might almost say fastidious, feeder

who clearly likes to savour each morsal, unlike the gluttonous *T. lunare* who treats each meal as though it were likely to be his last. In between meals *C. fisheri* browses quietly on the algae covered coral, which is surprising since basically the Angelfish as a group are carnivorous. The prominent lips are, however, ideally suited for this purpose.

My *C. fisheri* has proved to be very hardy. About six months ago, for no apparent reason, I had an outbreak of the dreaded Oodinium in the tank. I was able to cure the fishes with no loss of life, but the *Centropyge* remained unaffected throughout.

My *C. bispinosus* is a comparative newcomer to my collection, and is housed in a separate aquarium. I do not feel qualified to make any detailed comments on this species as yet, but nothing in his behaviour to date contradicts my observations on my *C. fisheri*.

I have grown very fond of my Pygmy Angelfish, and would say in conclusion, that, based on my experience, these are fish which I can wholeheartedly recommend, even to a beginner, in this fascinating and rapidly expanding branch of the aquarium hobby.

Correction

The author of "De-Ionised water in the Aquarium" (March issue) has drawn our attention to the following.

In the article it was stated that a cartridge gave

approximately 15 gals of pure water in the London area and 60 gals in the Liverpool area. This should have read 7½ gals and 30 gals respectively.

THE MARINE TOAD

by Jack Hems

Bufo marinus, or if one prefers it, the marine or giant toad, has an interesting history. Originally confined to Mexico and, almost certainly, not a few of the islands of the Lesser and Greater Antilles southwards to Patagonia, it has been intentionally introduced (chiefly between the two World Wars) into many parts of the tropical and sub-tropical world as a natural enemy of the hordes of insect and other pests that mutilate and destroy fruit, tree and plant crops.

There can be no question of the good it has done. Doris M. Cochran, in her *Living Amphibians of the World* (Hamish Hamilton, 1961), records that “. . . it can be found policing the rows of cane and protecting a crop worth perhaps a billion pounds.”

But there is another side to the story. The marine toad multiplies enormously where conditions are favourable, and in some of the farming communities where it has become established as, for example, those of north-west Australia, Hawaii, and the south-eastern U.S.A., its rapid increase has been, and still is, viewed with mixed feelings (even though it keeps the indigenous snake population down by preying on their young and poisoning their parents); for it is not every man who can hearten to the sight of a nightly gathering of big and bloated toads on his own doorstep.

B. marinus, when full grown, averages 7 to 8 in. in length (from snout to vent) and 4 in. and more across. The warty back and upper surfaces of the limbs are coloured in broken shades of light to dark olive brown. The underparts are creamy grey to ivory with light brown spots. The eyes are prominent but beautiful: the iris brown flecked with green; the pupil black with a gold margin.

The elongated swelling behind each eye, on the neck—the extraordinarily large parotid gland—contains a milk-like (in appearance) poison which seeps out when the toad is subjected to rough treatment. It is virulent enough to kill a small dog within a few hours; larger animals suffer temporary paralysis at best. (Hans Hvas tells us that South American Indians smear the points of their arrows with this poison.) Its effect on sensitive areas of human skin is to irritate

and inflame. It is hardly necessary to say that after touching these toads, the herpetologist is advised to keep unwashed hands away from his mouth or eyes.

The toad has yet another passive, albeit harmless, weapon of defence: it can discharge a copious stream of clear, non-smelly water from the vent (the toad does not drink but it absorbs water like a sponge through the skin). This nervous reaction is sometimes accompanied by trembling of the body and a trilling sound produced from the vocal sac. Shedding of the skin takes place at irregular intervals. Prior to the old skin peeling off, the toad loses interest in food and becomes bathed in what looks like a heavy sweat.

A vivarium for *B. marinus* should be 20 in. or more in length and at least 15 in. in width and depth. It can be made of any suitable material such as wood or metal or glass or a combination of all three. The floor should be covered with peat or well-weathered sawdust to a depth of about 4 in. There must be water for bathing. A glass casserole will make a suitable bathing trough. The water will need changing every second or third day. There must be air-holes half-way up the sides of the case or at or near the top to provide ventilation.

During the summer months, *B. marinus* is hardy enough to stand ordinary room temperature, but for the rest of the year it needs extra heat. A temperature in the sixties to middle seventies (°F) is suitable. A 40- or 60-watt electric lamp (hung out of reach of the toad) is one way of providing heat, though common sense demands that the lamp should be blacked out (not switched off) last thing at night. Alternatively, a soil heating cable or an aquarium heater placed in a tall jar of water will do. To guard against overheating (and wastage of current) a reliable thermostat (and a thermometer) should be included in the set-up.

My own marine toads are kept warm by bottom heat supplied by a chimney-less greenhouse oil-heater. Their metal-bottomed case rests in a raised metal tray filled with sand. The sand takes up the heat from the heater housed underneath and distributes it satisfactorily enough over the bottom of the case.

The marine toad is no problem to feed because live food of some sort or another (mealworms, say, or flies or maggots) is available at all seasons of the year. It will also flourish well on a diet of chunky pieces of lean red meat or raw white fish (cod or haddock). But almost always one has to trick the amphibian into thinking the pieces of flesh are alive. This deception may be accomplished by joggling the offered food about with the aid of a thin stick.

The reaction of a hungry toad to this performance is, first, a raising of the body to an upright sitting position. (Sometimes the excitement engendered by the sight of the moving food will cause an involuntary twitching of the toes.) Then, suddenly, there is a downward lunge and, lightning fast, the food is caught in the mouth. Immediately the body is raised, and as the food enters the throat the eyes sink for a moment into the head. Should the food be of an awkward shape or size, the front toes are used to push it inside. The toes, and also the pink tongue, are used to cleanse the food of clinging dirt.

If a toad does not feed every time food is offered to it there is no cause for alarm. As I have mentioned above, a toad about to shed its skin loses its appetite, and always after a big meal a day or two may elapse before another is eaten. Again, food is more readily taken at a temperature of 75°F (24°C) than at 63°F (17°C).

Both in nature and in captivity, this toad lives to a good age. Its long life in the vivarium was commented on by a Dr. Stradling, writing in the *Boy's Own Paper*, as long ago as 1892. My own specimens were installed in their case in 1965. They are still in excellent health.

Age for age (in well-developed specimens) the female

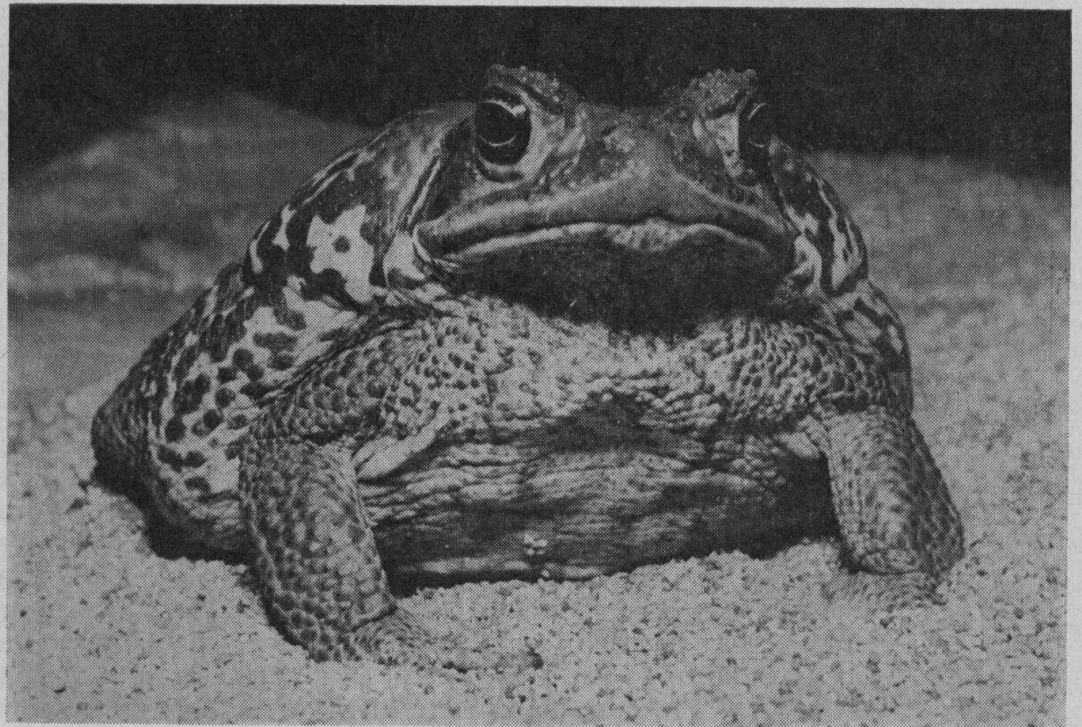
is the larger of the two sexes. There are other distinguishing features too. For instance, it is said that the two rows of warts that extend down the middle of the back are more pronounced in the male than in the female. Further, a male in breeding condition develops a number of excrescences or hard (horny) rugosities on the feet.

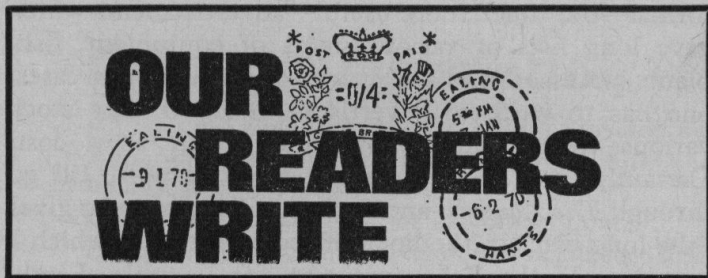
So far as I know, *B. marinus* has not bred in the vivarium. In the natural state, the female lays long strings of eggs in the water. According to a reliable source of information, the eggs hatch out in three to five days. A. G. Ruthven, an American zoologist writing in the early 1900s, is quoted in Wright and Wright's *Handbook of Frogs and Toads of the United States and Canada* (Comstock Publishing Company, Inc., 1949) as saying that forty-five days elapse before metamorphosis is complete.

As the marine toad has a fairly wide temperature tolerance, the question arises: does it hibernate in the winter in the most southerly and northerly parts of its range? There appears to be no information on this point. But it is well known that the toad burrows under rocks and logs for perhaps weeks on end to escape the rigours of excessive drying heat.

Until quite recently *B. marinus* (so-named, I have read, because early naturalists found the toad in ponds near to the sea) was thought to be the largest of all the true toads. Now, however, serious herpetologists know different. There is an even larger one: *B. blombergi* from Colombia, that attains a length of about a foot. The half-grown Blomberg's toad that I inspected a couple of years ago had a narrower snout than *B. marinus* and was greenish rather than dark brown in colour.

Bufo marinus





Terrapins

I have read W. J. Wright's article on keeping terrapins in the December issue of *The Aquarist*. I hate to appear unduly critical, but at the same time I must conclude that his advice must depend to a great extent on guesswork rather than practical experience.

I cannot remember just when my article "Success with Sub-tropical Terrapins" appeared in *The Aquarist*, it must have been around 10 years ago. At that time I had raised healthy terrapins, five inches over the carapace, in four years from pet store hatchlings. I still have most of the individuals that figure in my article, and have kept both painted (*Chrysemys sp.*) and red ears (*Pseudemys sp.*) continuously since. I cannot claim to have had no losses, but since deaths have been mainly among the native Canadian painted terrapins, it is certainly not my practice of letting them winter outdoors that has killed them. I consider that the painted terrapin is somewhat more delicate than the red ear; when both are kept together the former may die from viruses of which the red ears are carriers without showing any symptoms.

My first difference of opinion with Mr. Wright is over his claim that terrapins may be fed meat. I have had many small terrapins brought to me, dying, with shells like putty, and in many cases I have traced the trouble directly to a diet of minced raw beef. Now Mr. Wright will at once object that he does not advocate a straight diet of meat only. But in the face of this inescapable evidence that meat does terrapins no good, why feed it to them? The natural diet of terrapins consists of invertebrates, fish, tadpoles, and succulent green-stuff. Surely most people can supply this natural diet in some form or other. If a large proportion of Arthropods can be supplied, this will take care of the calcium needs of the terrapins. The best of all are woodlice, they are usually easy to obtain, and are always relished by terrapins. Cod liver oil or any other vitamin supplements are quite unnecessary if the animals get direct sunlight and a good varied diet.

The red ear, which, in this country at least, is most commonly seen in pet shops, is much hardier than Mr. Wright admits. I kept my red ears away from frost for a number of years, but eventually one of these in a large pond got out of sight in the mud and I had to let it stay. This pond is about two feet deep. That winter the temperature dropped to 5°F, the ice on the pond would bear my weight. The terrapin showed up in

the spring, hale and hearty. Since then I have left my red ears outdoors all the year round with no losses. But ponds for wintering terrapins (and to my mind for anything else, including goldfish), should have a great deal of soft mud at the bottom including some decaying organic matter.

My ponds all have clay bottoms. Mr. Wright's objections to clay appear to stem from his idea of wintering terrapins without water. I think that this is a serious mistake. Before I learned to leave my terrapins outdoors, I used to winter them in a shed that could be protected from frost. I kept them in various containers from plastic lined boxes to old bathtubs, anything that would give them a bit of space to crawl around. I used no compost under these circumstances, only some "houses" built of bricks and flat stones, providing sufficient space for the animals to hide. When wintered under shelter terrapins are active to some extent most of the time, in fact at temperatures over 40°F they must come to the surface to breathe quite frequently. Hence coming out of hibernation is not a sudden process, and there is no stage at which the eye-bathing process suggested by Mr. Wright would be indicated.

I agree that sickly and very young terrapins should not be hibernated. But red ears in their second winter will not be harmed by three months at 40° to 45°F, without food. So far as sickly terrapins are concerned, I recommend that they should be painlessly destroyed, and another start made. My experience has been that a terrapin must be brought right along under optimum conditions from a few weeks after hatching. They should grow rapidly reaching four inches or more over the carapace in four years. After that growth slows down a great deal. The prospective terrapin owner should remember that a four inch terrapin requires quite a tank. Unless one is prepared to provide such accommodation it is hardly advisable to acquire a terrapin.

RICHARD GUPPY,
Thetis Island,
British Columbia,
Canada.

Notice to Secretaries of Local Clubs and Societies

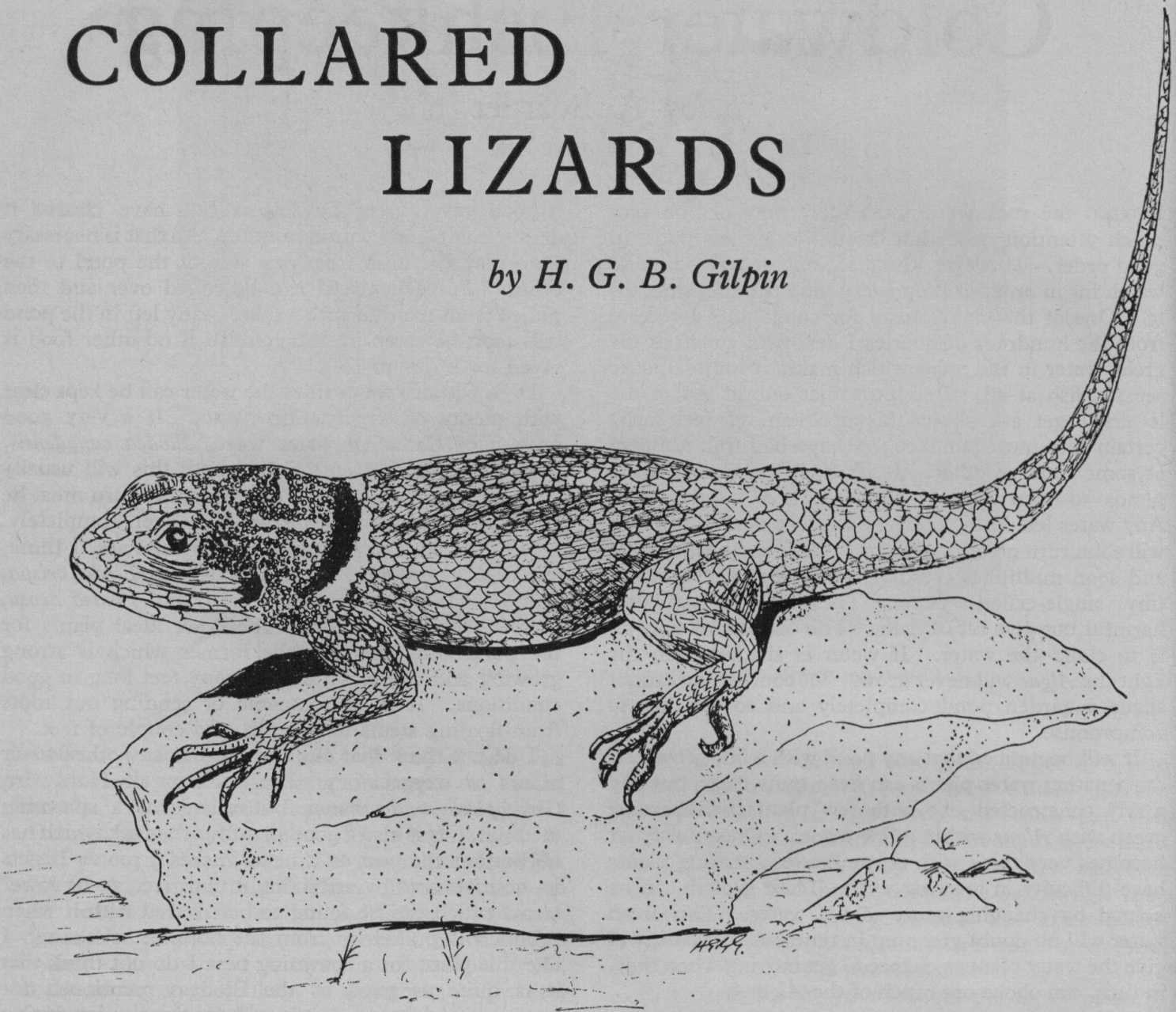
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COLLARED LIZARDS

by H. G. B. Gilpin



THE COLLARED LIZARD (*Crotophytus collaris*) is widely distributed over the south-west quarter of the United States of America. It is terrestrial in habit and found on open, barren country, particularly favouring flat, rocky areas.

These lizards are stoutly built, bulky animals, reaching about fourteen inches in total length and the colorations of the adult males during the breeding season are most striking. Their basic colour is a bright green, liberally embellished with yellow spots. The hind legs are dotted with red and the black double collar around the neck is characteristic. An orange patch extends across the throat and between the front legs. Young males and females are much duller in colour.

Collared Lizards are very active and have been

reported achieving speeds of up to seventeen miles per hour, sometimes starting their dash in an upright position on their powerful hind legs, unlike most lizards capable of bipedal motion whose tendency is to work up speed before becoming erect. These same hind legs enable them to make frog-like jumps.

My present specimen of *collaris*, almost certainly an immature male, was imported in May 1970 but did not reach my possession until November of that year. It is a heavily made lizard with a broad head attached to the body by a narrow neck. Its nose to vent length is three and threequarter inches and its six-inch tail, lighter in colour than the body and broad at the base, tapers to a fine point. Dorsally it is olive brown, covered with small, lighter brown patches. The upper surface of the neck carries a

very dark brown, almost black, band edged posteriorly with light fawn. The legs are crossed with bands, slightly darker than the body colour, and the abdomen is light brown. Deeper shaded streaks pass down the middle of the undersides of the thighs and over the vent. The eyes are prominent and the mouth wide and menacing. The orange patch beneath the throat disappears after a while but reappears when the skin is sloughed.

The hind legs give the impression of considerable strength and are twice the length of the fore limbs. The scales on the abdomen are small and hexagonal whilst those on the tail are slightly raised and have a tiny projection on one corner making it very rough to the touch. Five small, pointed scales overlap the front of the rather large ear aperture.

When at rest the skin under the mouth lies completely flat, with a deep furrow where the neck joins the body, but when the animal is disturbed by the intrusion of a hand into its vivarium or excited by its reflection in a mirror, this throat flap swells considerably.

Collaris makes an interesting and worthwhile vivarium inmate but it is a naturally pugnacious and aggressive animal and extreme caution is necessary before enclosing it with other lizards. Lizards smaller than itself will be eaten with very little delay and with those of comparable, or even larger, size there is no guarantee that trouble will not result.

My specimen lived quite amicably with adult Agamas but attacked a *Calotes*, somewhat larger than itself, so savagely that its immediate removal was imperative. During the three months it was kept with a large *Cnemidophorus*, however, there was never the slightest sign of disagreement.

Collared Lizards are said to bite readily when first captured but rarely after they have been kept in a vivarium for some time. I found mine perfectly safe to handle from the beginning. The first time I attempted to pick it up, in order to examine it in detail, I confess I did so with some trepidation, in view of the wide gape of its powerful-looking jaws and its particularly antagonistic behaviour. At the approach of my hand it reacted violently, facing the apparent adversary threateningly and making jerky jumps from side to side, accompanied by vigorous lateral sweeps with its tail. As soon as my hand came within touching distance the animal's opposition collapsed and it backed away, prior to dashing to the other end of the vivarium. When caught it made one strong muscular effort to escape and this proving unavailing it relaxed completely and shammed death. At this stage it could be turned over on to its back where it remained utterly still even when the hand was opened and there was nothing to prevent it from decamping. Its eyes, firmly closed to begin with, opened from time to time as if to seek out the pos-

sibility of escape. The moment it was gently rolled off the hand on to the floor of its vivarium it returned instantly to "life" and rushed away at considerable speed.

Left to themselves in the vivarium the behaviour of these lizards is most satisfactory. Although they may retire behind a rock occasionally, they do not burrow in the floor covering and are almost constantly on view. With the glass between them and their owners they show no signs of nervousness and go about their business regardless of outside activities.

Collared Lizards are voracious feeders and will eat most forms of insect life. In confinement they do well on a diet of locusts, maggots, blowflies and mealworms. Personally, in view of their rather indigestible nature, I limit the number of the latter *larvae* and tend to confine their use to such times as the supply of winged insects falls below normal.

Because of their activity and not inconsiderable size, these lizards require a fairly large container. One about three feet in length is satisfactory and the floor is best covered with a layer of dry sand with a few large stones scattered about to provide basking sites. They need heat and are best maintained at a temperature of 75°F.

Collared Lizards are oviporous, from four to twenty-four eggs being produced at a time. The laying season extends from July to August and the eggs undergo an incubation period of several weeks before hatching.

COLDWATER FISHKEEPING

Continued from page 157.

fine food is offered this can be eaten by the older fish but if a screen can be introduced to keep the larger fish from one part of the pond, some fine food can be given there each day.

Some pondkeepers take the small fish from the pond and try to raise them in tanks. This is all right as long as the fry are not overcrowded nor over-feeding takes place. Of course, the safest way to breed goldfish is to take the eggs from the pond to hatch and rear in a safe place, away from the parent fish. When any of the fancy goldfish are bred it is essential to raise the fry under separate conditions or very few good fish are likely to be reared.

During the warm weather the fish in the pond can eat more food than when the water was cold. This does not mean that too much food should be given at any time. More fish are lost by over-feeding than from any other cause. There is usually plenty of food available in a good garden pond and if too much artificial feeding takes place then the fish are not encouraged to search for food and help to act as scavengers. They can do this just as good as any Catfish or Tench. A little common sense on the part of the pondkeeper will ensure that all goes well in the pond.

HERPETOLOGICAL NOTES

by S. J. Peaker, B.Sc.

Far-Eastern Newts

INHABITING parts of China and Japan are two newts of very distinctive appearance. One of these, the Japanese Fire-bellied newt (*Cynops pyrrhogaster*) is found in Japan and adjacent areas of north-east Asia. It lives in ditches, ponds and paddy-fields and is apparently almost entirely aquatic. Dealers in Britain often import this species and it is an ideal amphibian to keep, especially by aquarists who sometimes have a tank to spare. The best way to house these newts is in an aquarium tank of as large a size as possible and this should be planted with hardy specimens well-anchored into the gravel. Rocks can be added as well and it must be remembered to keep the tank covered to prevent escapes. Japanese newts are hardy but they must be protected from over-heating and the tank should not stand in direct sunlight. Room temperature is suitable all the year round.

Hibernation seems to be necessary to induce breeding activity and in research laboratories it is induced by housing them in damp moss contained in a plastic sandwich container (with a few holes drilled to admit air) at 37°F. The bottom shelf of a refrigerator is usually suitable but the temperature should be checked before the newts are placed there. Food should not be given for a few days before hibernation but they must have been well fed previously. The newts can be held in the hibernating state for several weeks before raising the temperature and allowing the animals to become aquatic once more. Breeding is similar to that of many other newts. Following a courtship display the male deposits a spermatophore which is later picked up by the female's cloaca. Fertilised eggs are then carefully laid and wrapped around the leaves of aquatic plants. The eggs can then be removed from the tank and hatched in fairly shallow aerated water.

Until metamorphosis the young may be given *daphnia*, *infusoria* and small worms. When metamorphosed *tubifex* and small earthworms can be given and the adults will also accept these as well as soft insects and pieces of meat and liver. All our newts receive meat and liver as a basic diet to which are added vitamins and mineral supplements. The newts quickly learn to take it from the surface of the water, especially if it is wriggled.

A closely related species I have never seen in Britain is the Hong Kong newt (*Cynops chinensis*) but when in Hong Kong we kept several. The back of

this species is uniform dark olive-brown but in an aquarium the underside can be seen and this is extremely attractive. The colour here is deep black interspersed with large red or reddish-orange spots or blotches. This species grows to a length of about four and a half inches and some specimens have the dorsal ridge tinged red. The female is slightly larger than the male and in common with many newts, the cloacal lips of the male are more swollen than those of the female.

The Hong Kong newt is so called because it occurs only in the colony and a small adjacent part of south-eastern China. In Hong Kong it is usually found at relatively high altitudes above one thousand feet and lives in slow-moving streams, ponds and small reservoirs. It is more abundant in the autumn and is caught then to be sold at road-side goldfish stalls.

Varanus

Most zoos have monitor lizards on display and many herpetologists keep a small specimen. However, they tend to be lethargic even in a large vivarium and it is something of a surprise to see their speed in the wild. A fairly large specimen popped its head up to examine us outside a rest house between Nuwara Eliya and Colombo in Ceylon. Before we could change the lens on the camera to take a photograph we moved a little closer and the lizard was soon off along the drive at a tremendous speed and easily avoided us by disappearing into a hedge.

Giant Salamanders

Giant salamanders from Japan and China have rarely reached European herpetologists and it was with some interest that I learned on my arrival in Hong Kong that one of these species is regularly imported into the colony from the People's Republic of China for sale as food. Although the largest amphibian alive today is the Japanese Giant Salamander (*Megalobatrachus japonicus*) which grows to a length of just over five feet, the Chinese species, *Megalobatrachus davidianus* also reaches a considerable size and individuals three-and-a-half feet long have been recorded. The specimens that reach the markets are usually much smaller than this, being about fifteen inches in length.

The family to which these animals belong, together with the Hellbender (*Cryptobranchus alleganiensis*), the Cryptobranchidae is regarded as being a primitive one

since, unlike in most tailed-amphibians, fertilisation is external.

The Chinese species, like so many oriental animals, was first made known to the occidental world by the now-famous Jesuit, Pere David. It apparently inhabits mountain streams like its more northerly Japanese relative. It is almost entirely aquatic feeding on water insects, worms, other amphibians, fish, etc., which it seizes in its large mouth. Incidentally, even small specimens of the Chinese form

can give quite a bite.

Housing in captivity was a simple matter—a large tank of water being all that is required. Before trying to obtain one of these animals, remember that they are now on the IUCN list of rare animals whose position is uncertain in the wild and that they have rarely been imported into England. However, there is no reason why the aquarium of a large zoo should not obtain some small specimens of the Chinese species, rear them and eventually try to breed them.

Whiteworms

by Jack Hems

IF YOU'RE LA-DE-DAH you refer to them as oligochaetes or enchytraeids. Ordinary folk call them whiteworms. Whiteworms (there are some fourteen different species in Britain) range far and wide. They choose the undersides of refuse bins (standing on soil), well-rotted farmyard manure, decaying piles of vegetation, the crooked bottoms of aspidistra pots, and the like, to make a home.

The species most commonly bred by the aquarist, because it provides an excellent food for fish, is known to science as *Enchytraeus albidus*. It is creamy white to pale yellow, microscopically bristled, as thick through as a stout sewing thread and almost, if not quite, an inch in length.

It is probable that we'll never know when *E. albidus* was first cultivated as food for fish. Neither Shirley Hibberd nor the Rev. Gregory C. Bateman, perhaps the most informed and readable of the several Victorian writers on fishes in the home, mention it in their works. And coming to more recent times, A. E. Hodge and Arthur Derham, joint authors of *Goldfish Culture for Amateurs* (Witherby, 1926), mention it not at all. Wilhelm Schreitmüller gives it a passing mention in his *Zierfische Ihre Pflege und Zucht* (Müller, 1931). But thenceforward almost every aquarium book off the presses, here and abroad, were not backward in pushing it forward as an easily bred livefood.

To obtain a worthwhile supply of whiteworms it is necessary to cultivate them in a receptacle not smaller than about 15 in. by 5 in. by 12 in. And after the worms have been installed it is important not to feed any of them to your fish for the first couple of months. This will give them time to settle in and begin to multiply.

A plastic container makes the best worm farm. Unlike wood, it does not rot away or create a mould-stained area where it is put. Furthermore, a plastic container is lighter in weight. As whiteworms do not

stray away from the culture-medium they can be kept indoors. A range of temperature from about the lower fifties to the middle sixties (°F) suits them best.

The soil for whiteworms should be of a crumblike texture and kept habitually moist. Moist not *wet*. Baked soil from a well-worked garden border (after sifting it for worms, and the like) is suitable, but it is easier to buy about 14 lb. of sterilised potting soil or good yellow loam from a garden shop to fill your container.

After the soil has been introduced into the container, level it off with a piece of board and firm it down. Then procure a piece of glass narrower all round than the surface area of the soil to go on top. As the worms are light-shy cut a piece of hessian, thick card, or black plastic to cover the glass.

You can buy a portion of whiteworms at your local aquarium shop or from certain advertisers in this magazine. The worms should be distributed in shallow depressions made in the culture medium. Then fill in each depression with about a teaspoonful of stodgy milky porage, milky mashed potato, or bread (preferably brown wholemeal or black) soaked in milk. Place the glass over the lot and exclude the light. Do not disturb for a week or two, then remove the coverings to see how things are going on. You should find plenty of whiteworms snaking about and most of the food eaten. If the uneaten food has turned green or developed a mould, throw it away. In any case, introduce more food into the depressions. Return the glass and light-excluding material to the receptacle. Within the space of six weeks you will find it possible to remove many hundreds of worms a week without drawing too heavily on the stock. It is advisable, though, to have two or three receptacles on the go. This will guarantee a supply of the worms for about fifty small fishes all through the year.

The Viperine Snake

by Peter Burns

THE Viperine Snake (*Natrix maura*) is closely related to our own Grass Snake (*Natrix n. helnetica*) and is found in many European countries (including France, Italy and Spain) and in N.W. Africa. It is quite a small species—large females barely reaching three feet and males are considerably smaller. It is, however a very attractive snake with the ground colour of the the upperparts sometimes a very pleasing reddish-brown (or sometimes grey-brown). Along the back is a more or less clearly defined, black zig-zag line which breaks up towards the end of the tail. It consequently bears a certain resemblance to the Adder (hence its name) but the two can readily be distinguished by the slimmer body, different shape of head and the eye's circular iris in the case of the Viperine Snake.

Like most of the other members of the genus *Natrix*, this animal is very fond of water and in the wild is found in marshes and by rivers and lakes, etc. Despite this it will thrive in a completely dry environment respecting certain provisos. A suitable cage is provided by a vivarium (or even an old aquarium) with a very thin flooring of dry, aquarium gravel. This should be no deeper than half an inch. If it is any deeper the snake will tend to keep itself buried for most of the time. Gravel is preferable to peat (for example) since the finer particles of the latter tend to adhere to the scales making the snake appear dull and dirty. A hide-out should be provided by an arrangement of rocks in one corner. The top or cover-glass should be close-fitting with provision for adequate ventilation (using perforated zinc). An electric light should be installed and left on for most of the day to give warmth and "sun-bathing."

After purchase most Viperine Snakes settle down quickly so long as they are handled frequently and gently and picked up slowly without too much disruption of the cage contents.

Since there is no water in the cage (the relative humidity must be low to allow easy sloughing and to prevent skin diseases) a snake is best given its water by holding it a few inches above a basin of tepid water—it will then generally lower its head into the water to drink. After this, the snake should be immediately returned to its cage with care for if it is even slightly alarmed, most of the water taken in is generally regurgitated.

Give the snake up to a week to settle down before trying to feed it. If possible, for its first few feeding sessions, fit up a small (say 16 inch or 18 inch) tropical tank with about four or five inches of water, a landing-stage (a half-brick is suitable) and planted out with about a dozen plants such as *Vallisneria*. Because of its aforementioned love of water, the Viperine Snake will immediately enter the water and move easily along the bottom exploring its surroundings by means of its eyes and tongue. Runt Guppies, Tadpoles, Sticklebacks or Minnows should be present and the snake rapidly takes to stalking these with great perseverance. Its methods rather resemble those of a cat—using cover to effect. The prey is eaten live underwater and is swallowed head-first. An eighteen inch long Viperine Snake is quite capable of managing a stocky two inch Minnow. At first, seafish (such as Haddock) is not accepted unless the scent is masked by a more familiar one. Although some books state that earthworms are eaten, I have not yet witnessed this—the worms generally being ignored.

Once the snake is readily feeding underwater on live food; it must be "weaned" onto dead food taken in its usual cage. This is done by offering fresh "de-spined," Sticklebacks (which can be caught in most streams and park lakes) on the end of a thread. This is moved along in front of the snake in the water tank. The fish is seized; the thread is removed by a quick flick of the wrist and the snake is left to swallow its meal. The next fish is held *above* the water and the snake follows to get its food. Dead fish can then be offered in its dry cage simply by dangling it just above the gravel.

Eventually, the thread can be dispensed with and fish will readily be accepted from the fingers.

Sloughing occurs every one or two months and is preceded first by the eyes clouding over with a greyish opaqueness which then clears after a few days. It then sloughs and the dead skin should come off in one piece and if this is so it is a sign of the animal's good health. Sloughing will be more frequent if it has been eating with a good appetite.

Thus it may be concluded that if fed well, has plenty of light for sun-bathing and warmth and is generally treated with care, the Viperine Snake makes a very peaceful, interesting and odourless animal to keep.

HERPETOLOGICAL NOTES

by Stephanie Peaker

Chamaeleons outdoors

Chamaeleons require a rich and varied diet if they are to survive. In addition a number of the small species can be kept in outdoor enclosures during the summer and even into autumn. A useful method to vary the diet of hard chamaeleons is to release them in a small bush and attract insects to the site with meat, fruit and other foods. Since chamaeleons may fall to the ground and wander off, a large hoop of hardboard or similar material should be placed around the tree to the limit of the farthest branch. Various baits to attract insects can then be hung amongst the branches and the lizards can enjoy a wide variety of food.

Provided that the foliage is fairly thick there is little danger from predators, but if protection is required then a large cage such as is used to cover fruit trees completely clear of the branches will suffice. If montane species like *Chamaeleo hoehnelli* are kept under such conditions interesting behaviour will be seen throughout the day. For example, in the early morning the lizards will move onto an exposed branch, flatten themselves towards the sun and darken to absorb radiant heat. As they become warmer they lighten to camouflage coloration, become more elongated and start to move about in search of food. The bush on which they live should be sprayed with water every day to allow them to drink but especially if the foliage is rather sparse, a shelter against heavy, prolonged rain is advisable. Incidentally there is no reason why chamaeleons kept under such conditions should not breed freely.

Kinixys

An interesting group of land tortoises is found only in Africa. There are apparently eight species in the genus *Kinixys* distributed throughout tropical and southern Africa but of these only one is commonly imported, Bell's Kinixys, *K. belliana*. The group is interesting in that the carapace is hinged between the 7th and 8th marginals and can be moved down to protect the hind limbs. The hinge is hardly present in the young, developing as the animals grow. The degree of protection afforded by the hinged carapace is not nearly as complete as that in the box tortoises (*Terrapene*) and I personally wonder whether this was developed as protection or as an aid to locomotion. After all the young, which do not have the hinge are in most need of protection against predators and I feel that its purpose is perhaps to allow more

freedom of movement by the hind-limbs. Indeed in some specimens the hinged rear portion hardly moves at all while in others it will move only a centimetre or so.

Like most tropical species, the members of *Kinixys* are not cheap to feed. Always preferring, it seems, the most expensive food when other items are plentiful. Fruit is preferred but they should be encouraged to eat herbage as well. Roughage should also be given to these herbivorous reptiles and chopped, good-quality hay should also be mixed with the fruit or offered separately especially in winter when greens are scarce.

Being tropical these tortoises require heated accommodation in winter, and, indeed for most of the year except in the south-west. The usual vivarium is not suitable for any large tortoise and a larger area is required. I shall be dealing with the care of tropical tortoises in a later article and shall make more detailed suggestions there.

As I have mentioned, the commonly imported species is *Kinixys belliana* which is found in savanna country over much of Africa. Many different colour varieties can be seen. Some individuals are rather dull but others have black and/or yellow-orange markings. Another species sometimes imported is the Eroded Kinixys or Eroded Hinge-backed tortoise as it is sometimes known and this form known as *K. erosa* is found in the rain forests of West Africa. Like the Gopher tortoises of north America this species has a forked extension to the plastron which it uses to turn rivals over on to their backs. The rear marginals are serrated and flared and the carapace is usually dully brown in colour. For a tortoise this species has long legs on which it scuttles around. This forest dweller prefers shade and this should be remembered when designing an enclosure for them.

I have not seen *K. erosa* on the market this year, but a number of *K. belliana* have been imported priced from £2.75 for a 3 in. specimen to £3-5 for one at 4 in. As with most reptiles I advise that at least two or even more should be purchased, since most tortoises prefer company and they are far more interesting when kept in groups.

Eyed Lizards

The Eyed Lizard (*Lacerta lepida*) from Spain now only rarely appears on dealers' price-lists. I have heard that this is due to difficulties with transporting them in Spain. If one or two can be obtained they

are an excellent addition to a collection of European reptiles. Growing to a length of two feet or even more, it is a very heavy, thick-set lizard and qualifies for the title of largest European lizard. The adults are normally deep green above with blue and black ocellations along the flank, together with spots of black and yellow. The young when imported are similar in size to Green lizards and are more sombre in colour than the adults. The ones we had were blue-grey with blue and yellow blotches along the flank. The young ones can be recommended since they can be housed in an outdoor reptiliary with other European lizards and can also share the same heated accommodation in winter. Keeping the adults is however a different kettle of fish. Few outdoor reptiliaries have sufficiently high walls to prevent them from climbing over and very often the weather is not sufficiently warm to let these large lizards warm up to normal activity temperatures. If they are housed indoors they must have sunlight or some ultra-

violet light to keep them healthy. The only other European lizard that can be housed with them are adult Dalmatian Green Lizards of a similar size.

The usual insect and worm diet is ideal for the young but the adults prefer something larger—locusts, pink mice, etc.; some will also eat meat and soft, sweet fruit, like peaches and apricots, but our young ones would not accept any fruit. Like all typical lacertids, the Eyed Lizard likes to bask and clamber on rocks and low branches. The high temperatures of its natural habitat—southern France, Spain and Portugal must be remembered when planning the heating.

A smaller, attractive species is found in south and west Spain, Schreiber's Lizard (*Lacerta schreiberi*). Basically green, there are patches of black along the back and sides. The young have a brown back with ocellations of yellow or blue bordered with black along the flank. Again, a species that can be recommended.

FISH FOOD REVIEW

HYKRO MULTI FLAKES are made by Hykro of Denmark, and distributed in Britain by Peterama Ltd., Church Road, Harold Wood, Romford, Essex. Recommended prices are: 14p for the standard size, 23p for the large size, and 49p for the breeder size.

This new food bears the well-known Hykro name and the prices compare favourably with competitive brands. The food consists of flakes in a variety of colours and sizes. Some of the flakes are quite large; others are of medium size. The food is thus suitable for a wide range of fishes. The makers claim that it cannot cloud water. As the food is easily crushed between finger and thumb the size of particles can easily be reduced for even the smallest fishes.

Hykro Multi Flakes contain fish meal, fish roe meal, fish-liver and glandular meal, tropical crayfish meal, insect larvae meal, dehydrated kelp meal, mussel meal, brine shrimp meal, wheat germ meal and cod liver oil—a combination which my fishes obviously liked as they ate the food with relish.

The analysis is given as: minimum crude protein 45%, minimum crude fat 3%, minimum crude fibre 10%, and maximum moisture 9%. The instructions on the handy, plastic container state that fish should be fed lightly several times a day.

I have only one very minor complaint about the food and that is that some of the flakes seemed to begin to sink in the water quite quickly after food was placed on the water surface—however, they were soon eaten by middle swimming fishes.

This food would make a good, standard diet for a wide variety of fishes.

B.W.



KOI ON THE BOTTLE

Mrs. Hilda Allen of Peterborough, a member of the British Koi-Keepers' Society, sent the colour transparency from which the above black and white reproduction was made. It shows "Fred," a Koi, sucking a baby's feeding-bottle which contains a proprietary brand of baby's "Creamed Fish Dinner." Fred is being jostled by another Koi, Sylvia, who impatiently awaits her turn at the bottle. Fred and Sylvia, both 6 years old, are about 14 inches long and among the luckier members of Mrs. Allen's 16 strong Koi community because their mouths are large enough to cope with the bottle-teat. Along with her Koi, Mrs. Allen runs three Hi-go, two Crucian Carp, two Golden Orfe and two Tench, all in a thousand gallon pond.

(Details of the British Koi-Keepers' Society may be obtained by writing to 13, Nutley Lane, Reigate, Surrey).

BREEDING

Hemidactylus turcicus

by H. G. B. Gilpin

I HAVE MAINTAINED a collection of these charming little animals for a considerable number of years. Apart from one characteristic, the facility with which they abscond from even carefully designed, escape-proof quarters, they make excellent vivarium inmates.

Most years mating has been observed taking place in the colony and subsequently eggs have been seen in the pinkish, partially transparent abdomens of females, clinging to the front of the vivarium with their undersides tightly pressed against the glass. Sometimes too, eggs have been deposited in the vivarium, either on the rounded gravel covering the floor or attached to one of the vertical glass sides, but until this year none of the eggs actually hatched.

This year, however, largely as a result of an accident, a successful breeding took place. The accident consisted of the undetected escape of a female *turcicus* from the main gecko vivarium. This had been established for some years and was inhabited by a dozen specimens, both *Tarentula mauritanica* and *Hemidactylus turcicus* obtained in the first place from Spain and Malta.

The female's defection was not discovered until she was seen scuttling along a bench with the characteristic laterally weaving motion of her species when moving over a slightly slippery surface. Catching an escaped gecko is never a particularly easy business, especially if it has been at liberty long enough to become familiar with its surroundings and discover some narrow gap where it can take refuge. My specimen was obviously well acquainted with the terrain and disappeared with celerity as soon as it was pursued. Fortunately it was observed insinuating itself through a small ventilation hole in the wooden frame supporting a tank devoted to red-eared terrapins.

The frame contained an electrical heating unit which maintained the temperature of the tank at 70°F. and consequently the enclosed area beneath the tank was permanently warm. The front of the frame was gently dismantled and the gecko recaptured, happily without the loss of its tail. Further examination of the space under the tank revealed the presence of two white delicately shelled eggs.

These were gently removed and placed in a small jar of slightly dampened sand, the eggs themselves being about a quarter of an inch below the surface of

the sand. A piece of polythene was fastened over the mouth of the jar, in the form of a dome, so that at its highest point it reached an inch and a half above the level of its contents. This was designed to conserve the moisture and at the same time to allow a reasonable air space above the sand.

The jar was then placed in a twenty-four inch by eight inch by eight inch vivarium, to one side and three inches away from the 25 watt bulb which heated it.

The eggs were first discovered on 27 July and on 20 August one of them hatched. A slit was made in the polythene and the baby gecko emerged into the vivarium. At this stage it was one and a half inches long, basically an almost translucent greyish cream colour spotted, rather more heavily than the adult, with dark brown. The tail of the adult is much swollen where it joins the body and narrows sharply to a fine point. It is pinkish cream, sparsely marked with fine brown spots. That of the baby, on the other hand, is slender, gently tapering throughout and fairly heavily barred with dark brown rings. It is longer in proportion than that of the adult and accounts for half of the entire length of the little lizard, whereas the adult's tail measures about half combined head and body length.

One of the main problems encountered when rearing newly born lizards is the provision of a regular supply, in sufficient quantity, of insects small enough for the tiny animals to swallow. In this case no difficulty was experienced as the relatively large mouth of the baby gecko enabled it to feed on freshly hatched stick insects. My colony of these has been in existence for many years and at any given time can be relied upon to provide all sizes from the egg to maturity and with only one baby to cater for the supply of new born specimens was adequate.

Usually I have found that it takes lizards some little while before they recognise stick insects as food—probably because these insects remain motionless for long periods. This did not apply to the baby gecko. It ate them immediately and continues to do so.

The tank to which the gecko had been transferred previously contained lizards but for some considerable time had stood vacant. During this period mealworm

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some females, defend their domain by attacking all intruders. Smaller fish are chased away by bites, but if the opponent is too big and strong the owner will exhibit these lateral bars. When the darkest bars are seen and a chase follows the attack is much greater the stronger the coloration and very much more vigorous than if the parent only showed pale bars—coloration is therefore also a measure of intent. Other specimens, when presented with the same situation, may hesitate to bite and take up a lateral position towards the opponent spreading its median fins. These fins will then increase in coloration until they are black, thus effectively increasing the apparent size of the individual and may succeed in scaring off the intruder.

The above patterns are only types and the fish cannot be expected to exhibit one or the other just so as to conform to the text book. There is a large number of intermediary combinations of these patterns which undoubtedly have their own subtle variations in meaning, but the interpretation of these will require much further study. In *P. kribensis* the males, and some females, have a large number of black eye spots in their tailfin which are surrounded by an iridescent orange or green iris when the male performs his lateral "warning" display. If these spots serve the same function as in butterflies (not the fishy type) then they may have a frightening effect. There are too many spots for them to act as false eyes, as in marine butterfly fish, and under aquarium mating conditions

females do not seem to show preference for multi-spotted males. The spots are also seen in *P. taeniatus*, but they do not seem to be used for advertisement here either.

"Advertisement" is seen during courting and leads to a general enhancing of the colours—this breeding coloration is particularly striking in *P. kribensis* and *P. taeniatus*, and has led to their success as aquarium fish. Unfortunately, the areas of enhanced coloration fade as the parental period proceeds.

As a type of footnote or addendum, it would be interesting to know how many doting fans and breeders of "Kribs" had observed the two colour forms of the courting male. The one has the red pigment extending from the anus to the snout; in the other the area from the anus to the snout is divided almost equally, with the forward area being yellow, and the latter red. These colours are passed on from parent to young and one type does not change into the other. I would like to thank Lottie Hardman for drawing the illustrations (a)–(f) and Ballière, Tindall & Cassell Ltd. for permission to reproduce them from the journal *Animal Behaviour* (XIII P. 322).

References:

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PERMANENT PLANTS FOR SIMPLER AQUARIUM MAINTENANCE

LATEST development in the drive to make the maintenance of a tropical fish aquarium even simpler is the introduction of permanent plants.

An extended range of 27 different species is now being marketed by Inter-Pet of Dorking. Each plant is moulded in a non-toxic plastic and once immersed in the aquarium water is virtually indistinguishable from similar live plants.

Permanent plants also offer the aquarist advantages in eliminating pruning, they can be used in brackish water where the salt element would cause normal plants to die, and they cannot be eaten by fish.

Priced at around 18p, normally less than an aquarist would have to pay for the equivalent healthy plant from a dealer, they are fitted with a triangular tray to allow firm rooting in the aquarium gravel.

Inter-Pet's permanent plants are moulded to closely resemble the natural species and the varieties available include many popular, but far from hardy, exotics as well as a selection of more common plants, including Amazon Sword, Madagascar Lace, Foxtail, Honey-suckle and Squirrel Grass.

A leaflet is available direct from Inter-Pet, Church St., Dorking, Surrey illustrating the varieties available.

Hemidactylus turcicus

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beetles, survivors from former residents, had multiplied into a colony containing *larvae* from the newly hatched stage upwards. Once it was realised that the beetles were breeding, they were encouraged to continue doing so by regular feeding. The tiny grubs from this colony provide an excellent reserve of food for the young gecko. Day old locust hoppers are also offered from time to time but, as is not unusual at this season, reduced fertility has resulted in supplies of these insects falling below their normal level and specimens small enough for the gecko to swallow are not always available.

A pot of water is kept in the vivarium but so far the gecko has not been seen drinking, although presumably it does so. Unless disturbed it is inactive during the day and follows the adults' example of remaining static on the underside of some overhanging rock until hunger, or the decreasing evening light, stimulates it into motion. Unlike the adults, which are commonly seen clinging to the glass sides of the vivarium, however, the young one has not yet been observed holding on to, or moving over, a vertical surface.

HERPETOLOGICAL NOTES

by Stephanie Peaker, B.Sc.

Geckos

MORE than four hundred species of gecko *Gekkonidae* are known to occur in tropical and sub-tropical parts of the world. Many types are popular with herpetologists because they are active and live very well in the vivarium. Most of the species kept are from four to six inches in length but the largest gecko, the Tokay *Gekko gecko* from Asia is usually available from dealers. On the other hand, the smallest geckos which belong to the genus *Sphaerodactylus* from the West Indies, are only just over an inch in length.

The typical gecko is a small lizard that runs around houses in the tropics catching flies and moths in the evening. Their feet have the remarkable ability to carry the body almost anywhere but there are geckos which do not fit this typical description and some need different conditions in the vivarium. In this article I shall therefore confine myself to the typical geckos, for example, Brook's Gecko *Hemidactylus brookii*, the Moorish Gecko *Tarentola mauritanica* and the many house geckos offered for sale.

A fairly large vivarium displays geckos to their best advantage. I use a thick layer of fine sand for the floor-covering and on top of this sprinkle dry woodland litter—leaves, sticks, moss, etc. For the back of the cage several pieces of a large tree stump I have found to be ideal. The bark should be left intact and the set-up is safer if these heavy pieces of wood are nailed into place. A small wall could also be provided for house geckos. I never give geckos twiggy branches because they really prefer thick branches arranged around the cage. Pieces of bark are ideal to give shelter to these lizards.

An important point to bear in mind when housing geckos is to make the vivarium really escape-proof. Two doors in such a vivarium are ideal—one large for cage furnishings, water bowl, etc. which is only rarely opened and a small one towards the bottom for routine feeding. It is possible to include a living plant in most vivaria for geckos but in this case plenty of ventilation should be provided to keep the humidity down.

Geckos need heat all the year round. I prefer to have the room heated to around 60°F and then provide individual heat to the cages. A natural dark and light cycle should also be provided and so that the light of the day coincides with the highest temperatures, an incandescent lamp is perhaps the best form of heating and a day temperature of 75-80°F is ideal.

Most geckos are most active about dusk. By having the artificial sunset at a regular time each day the time

of greatest activity can be controlled. A useful addition to the cage is a blue lamp which enables the antics of the lizards to be seen after the main light goes out. Geckos will drink from a dish but I and others have found that, like chameleons, they prefer to drink from droplets on branches, foliage, etc. For this reason I spray the cage fittings every day or so. Care should be taken, however, not to make the cage too damp.

These lizards are best kept in colonies of one species. Many, if given the correct treatment, will mate and lay eggs and the behaviour of such a colony is of far greater interest than of one or two kept with other species. A little trouble may be caused by aggressive males but with plenty of hiding places, or even a cage semi-divided by a wall, it is usually not necessary to remove the offender. Two colonies of geckos we had amply repaid the initial purchase of a dozen specimens of each.

Another problem is how to move geckos from cage to cage without either losing them or their tails in the process. I have not yet found a way.

Geckos eat the usual lizard diet of insects, spiders, mealworms, moths, etc. and as wide a variety as possible should be given, especially during the summer when hedgerow sweepings are of the greatest value.

Most geckos are classified according to the arrangement of their toes, hence the ending *dactylus* on many of the generic names. Many species of gecko can be housed in the manner I have described including such species as I shall describe in a future article on small geckos suitable for the vivarium. A number of less common species are often available from dealers and there is plenty of scope for the adventurous herpetologist.

Algyroides

There is little chance of obtaining any of the three species of keeled lizard (genus *Algyroides*) which occur in Europe from dealers. There is, however, a good chance that those who travel to northern Yugoslavia may be able to obtain some, as we did, from the Istrian Peninsula. This species is *Algyroides nigropunctatus* which is found on large boulders in rather open country. It is very shy in the wild and almost impossible to catch without a fishing-line noose on the end of a long pole. This lizard has a distinctive appearance being very dark brown or almost black above and the scales are keeled. The females and young are olive-white below but the males are bright

brick-red with a blue throat. About the same size as a wall-lizard it requires similar conditions and thrives in the outdoor reptiliary.

In the early 1960's I saw *A. fitzingeri* advertised by a Continental dealer. This keeled lizard is found in Corsica and Sardinia and has a dark olive-brown back. I have never seen a live specimen but the snout is said to be blue and the legs and underparts deep yellow. A third species, *A. moreoticus*, is found in Morea in southern Greece and the Ionian islands. The genus is closely related to *Lacerta*.

Control of Snake Mite

A useful paper taking into account a modern method of insect pest control has recently been published in International Zoo Yearbook, volume 11, 1971. E. Wagner of the Woodland Park Zoological Gardens, Seattle, U.S.A. has successfully used pieces of Shell's Vapona strip to eradicate snake mite. Three to four days' exposure appeared to completely eradicate the pests but some snakes were exposed to the vapour for three weeks. During this time snakes of many different species were given food and water in the normal way and none was observed to have suffered any ill effect.

BIOLOGICAL FILTRATION (cont. from page 373)

minerals from the heterotrophic bacteria encourages the fast development of the autotrophic bacteria colony and a subsequent reduction in the numbers of the heterotrophic bacteria to a balanced condition.

If neither of these methods is available, or if it is desirable to set up the aquarium initially with ammonia-sensitive creatures, i.e., most tropical freshwater and marine fishes and invertebrates, then the aquarium should not be fully stocked immediately, but only on a gradual basis so that there is never an excess of ammonia present during the time before a reliable autotrophic bacteria colony is established. Under these conditions, using new gravel, this can be about three months.

Maintenance

Once set up, the filter bed should be considered permanent. It will become gradually filled with detritus which filters down, but this will only increase its efficiency by providing more surface areas and inorganic material for colonisation by the bacteria. A working filter bed should never be washed as this dislodges and removes most of the bacteria. Any layers of detritus on the surface of the bed should be siphoned off, but otherwise no maintenance should be necessary if the system is properly set up. Should washing be undertaken at any time, then aged fresh or salt water should be used, as appropriate, as this will dislodge less bacteria.

Changes in the characteristics of the water will temporarily upset the working of the bed while the

Mindful of the warnings given in several publications concerning the use of this pesticide near fishes and birds, Mr. Wagner carried out experiments on Garter Snakes (*Thamnophis sirtalis*). He kept twelve in each of two identical vivaria but over one placed a fresh full-sized Vapona strip. Thirty days later blood was taken from all the snakes and analyzed for cholinesterase (the enzyme the organo-phosphorus compound in Vapona inhibits). There was no difference between the cholinesterase levels in the two groups, indicating that no damage had been suffered by the snakes over this period.

Mr. Wagner has found that a $\frac{1}{4}$ -inch strip cut from the standard Vapona across the width per 10 cubic feet of cage is suitable and that four days exposure is sufficient. He suggests that the strip should either be placed on the ventilator or enclosed in a wire cage.

It is very welcome that a really effective method of ridding snakes of snake mite (*Ophionyssus*) has become available and has been tested in this manner. This mite has long been a pest in many collections, seriously affecting the health of many snakes. Incidentally, Mr. Wagner has also used this method to kill mites on lizards.

bacteria adapt to the new conditions. A difference in the number of fishes kept, or their feeding programme, changes of pH, temperature, and salinity in marine aquaria, will all do this. This last point is important in marine aquatics as salinity is generally increasing constantly due to losses by evaporation. Make-up water should always be aged and supplied before the density change is greater than 0.002. Changes such as those mentioned above generally cause inefficiencies in the bed for about three days afterwards, depending on their severity.

It can be seen from the above text that the whole purpose of this exercise is the establishment of the colony of autotrophic bacteria in the filter-bed, and the consequent conversion of ammonia to nitrates and nitrites. It follows, then, that a measure of the nitrite content of the water will give information as to the efficiency of the system. Kits are available for this purpose and their use is recommended, particularly with marine aquaria.

It was previously stated that mechanical and chemical filters should be considered as secondary systems when an efficient biological system is used. In fact it can be seen that the filter-bed is a good mechanical filter and unless conditions in the aquarium are likely to be very bad, possibly due to the particular kind of animal kept or the method of feeding, then a separate mechanical filter should not be needed. If an activated charcoal filter is required this can be fitted as an outside unit and will not affect the functioning of the filter-bed.