

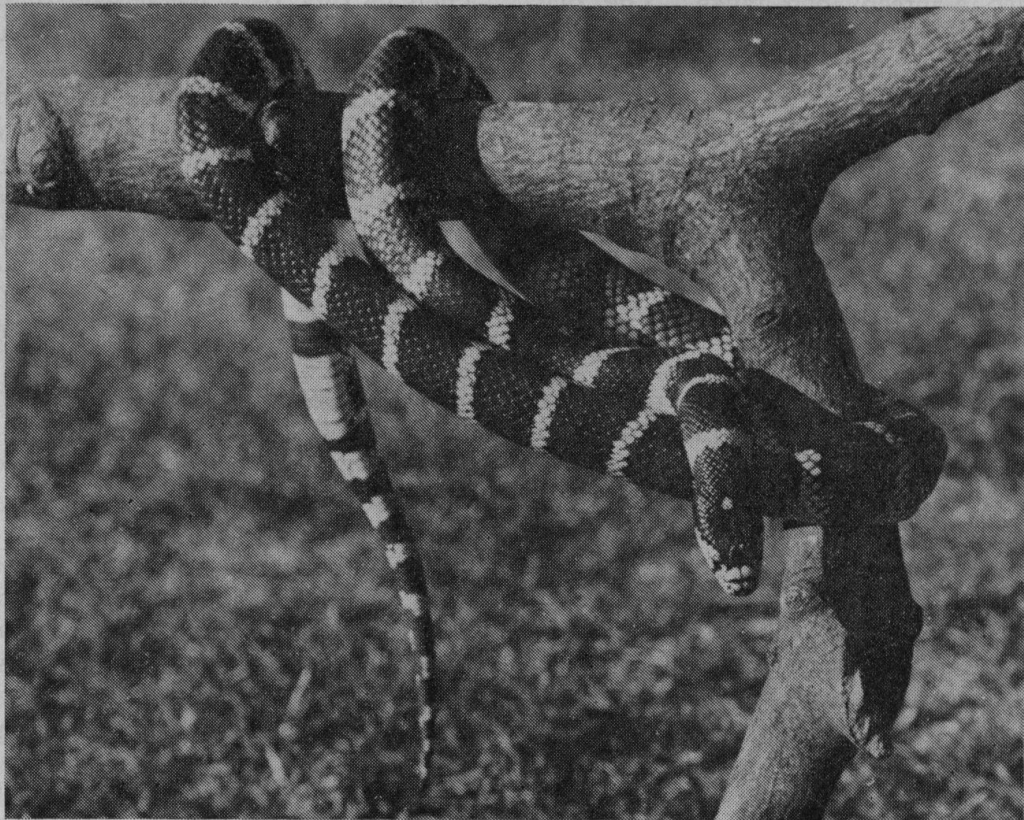
HERPETOLOGICAL NOTES

by *Stephanie Peaker*

NORTH AMERICA provides the collector with a rich source of attractive and desirable specimens. Of these the king snakes (genus *Lampropeltis*) are extremely popular and the less commonly imported forms are greatly sought after. In many respects king snakes are ideal because they are easy to keep and feed as well as being attractive and active.

King snakes are well known because of their habit of killing (by constriction) other snakes and eating them. This includes the venomous rattlesnakes to

whose poison they are relatively immune. The fact that they do prey on other snakes means that king snakes should not be kept with other snakes. Indeed, a king snake attacked a larger Royal Python with which it was housed for a few minutes while a vivarium was cleaned. However, similar sized king snakes can be housed together provided that they are well fed and that plenty of food is offered. Apart from snakes of course they eat rodents, lizards, birds as well as eggs of both birds and reptiles.



Californian King Snake showing typical patterning.

Most specimens imported belong to the species *Lampropeltis getulus* which is also known as the Chain King Snake. There is, however, such a wide variety of sub-species extending across the continent and which display entirely different colour patterns, that it is necessary to know the sub-species in order to be certain of what will arrive from the dealer. Those imported are likely to belong to one of four sub-species, although it must be remembered that many other sub-species are recognised and that, in common with other North American reptiles, intergradation is the rule. The first, the Eastern King Snake (*Lampropeltis getulus getulus*), is black or dark-brown with the relatively narrow "links" of the chain white or cream. This sub-species intergrades with another sub-species—the Florida King Snake (*Lampropeltis getulus floridana*); this form is extremely variable in the arrangement of the pattern. The Speckled King Snake or "salt-and-pepper snake" (*Lampropeltis getulus holbrooki*) from the Mississippi Valley is extremely attractive with a profusion of white, cream or yellowish spots speckled over the entire black or brown dorsal surface. All these forms, together with others from the eastern parts of North America, are described in Conant's 'Field Guide to Reptiles and Amphibians of Eastern North America'. One sub-species commonly imported but which is not in this guide is the Californian King Snake from the western parts of the U.S.A. (*Lampropeltis getulus californiae*). Even this occurs in two pattern phases. The typical type is a rich brown with whitish cross bands—this is the one shown in the photograph. The other—the striped phase—is of a similar colour but instead has longitudinal whitish-yellow stripes, usually mid-dorsal, along the length of the body.

Most king snakes grow to a length of three to four feet so a large vivarium is not required. In the wild they occupy a large number of habitats—stream valleys, open plains, woods and even swamps, but they are not great climbers. A vivarium about three feet in length and eighteen inches to two feet in width is ideal for several specimens. Shelter should be provided but the cage furnishing can be very simple. For snakes such as these we prefer a fairly soft floor covering and if something more attractive than the functional newspaper or absorbent white paper is desired, then a mixture of one of the peat-based composts mixed with a good quality dry loam and sand can be used. Water is, of course, essential and these snakes, in our experience, drink a great deal; the water should be changed regularly.

The vivarium should be heated and a temperature of about 75°F seems suitable. In our opinion most snakes are underfed and under conditions of frequent feeding it is surprising how much will be eaten and how then rapid the rate of growth. Food can be offered at least twice per week and a king snake may

often eat three or more mice or young rats one after the other. For example, the Californian King Snake shown in the photograph ate fifteen young rats in its first month. As with most snakes they do not feed immediately before and during sloughing.

These snakes are oviparous and lay about ten eggs. They have been bred several times in zoos and private collectors often achieve success if the eggs are artificially incubated, so it is worth choosing a pair of these snakes.

Only *Lampropeltis getulus* has been dealt with in these notes. Other species occur as far south as Ecuador but these must wait for another article.

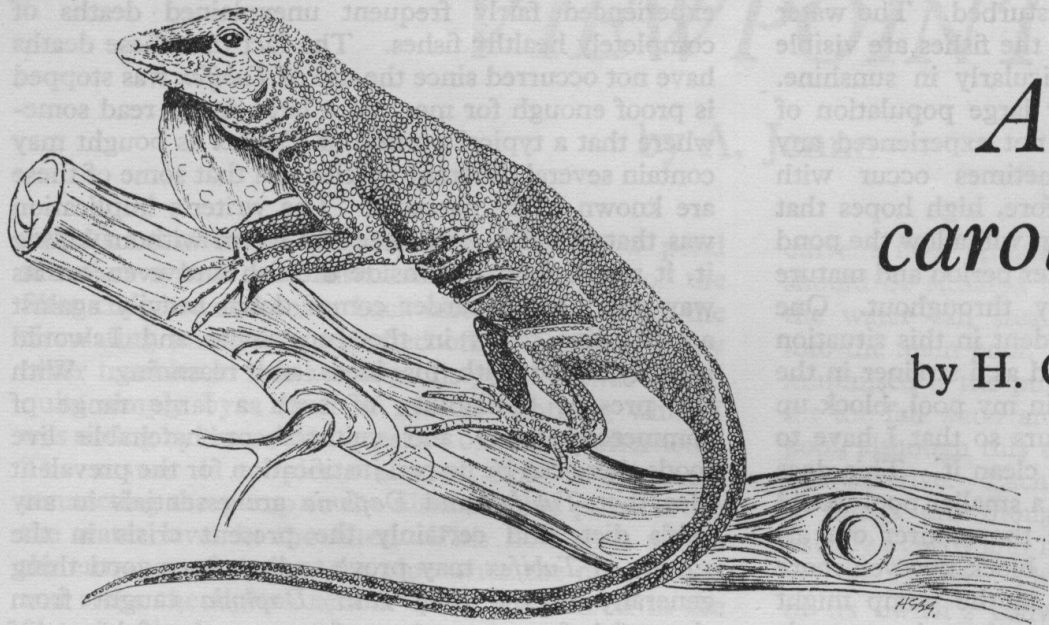
King snakes usually settle and become very tame. They rattle their tails when disturbed and when they do this on stones they sound rather like a rattlesnake—are they mimicking? These snakes which are highly recommended are now fairly expensive. A specimen three feet in length may cost from £9 to £15, the Californian sub-species tending to be more expensive than the others mentioned.

Takydromus

The lizards with which we are most familiar in Europe, the members of the family *Lacertidae*, are very poorly represented in the Far East. One genus, *Takydromus*, has two species and we kept a group of *Takydromus sexlineatus ocellatus* while in Hong Kong. This really has no generally used common name but Long-tailed Grass Lizard and Six-lined Grass Lizard have both been used. These small lizards do in fact live amongst long grass and the very long tail assists them to move at very high speed between the stems. This species from south-east Asia and the East Indies is occasionally seen advertised and a typical vivarium with a day temperature of 80-85°F (falling to about 70°F at night) is required. They should have a place to bask and if long grass is included in the set-up the vivarium should be well ventilated. Their care, therefore, is similar to that required by the European members of the family. They are sold for about £1.50; this contrasts with the half-penny paid for our specimens in Hong Kong. They are caught there in large numbers as food for cage birds.

Hay

Tropical tortoises are often finicky feeders, especially in winter, but if they are kept sufficiently warm and out of draughts then most specimens will eat fruit, lettuce, etc. However, it is important that roughage should also be given in order to keep the digestive system in good condition. An ideal way of doing this is to chop good quality hay into short lengths and mix it with the fruit. Cabbage stems are also a good source of roughage—if the tortoises will eat them.



Anolis carolinensis

by H. G. B. Gilpin

COMMONLY KEPT in America and normally readily obtainable in this country, the Green Anole is an excellent choice for the amateur herpetologist. It is a comparatively small lizard, the male measuring some two and three-eighths inches from nose to anus and the female an inch less. The slender body ends in a long whip-like tail and the head is markedly triangular in shape, with elongated jaws. Its colour varies from brown to bright green, according to its emotional state and to some extent with the hour of the day. Often after remaining brown all day, it changes to green at night.

The colour change is fairly rapid and is governed by expansion and contraction of the pigment cells, stimulated by a hormone produced by the pituitary gland, the animal being green when the cells are contracted and changing to brown when they expand. Beneath the throat is a flat gular sac which under the influence of excitement is distended, displaying a vivid pink coloration, veined with delicate lines, caused by contraction of the pigment cells exposing the colour of the blood in the capillaries. The throat fan is larger in the males than in the females and is more frequently in evidence.

When first obtained in September, my pair of Green Anoles was placed in a vivarium 30 in. by 10 in. by 10 in., floored with gravel, and already occupied by a Moorish Gecko, a pair of Ruin Lizards and a *Platy saurus minor*. Furnishings consisted of several rocks, placed there for the benefit of the original inhabitants, some branching twigs and a few small fuchsia plants in pots. Anoles are active little creatures and these, although they spent some time each day sprawled along a branch, were frequently to be seen dashing amongst the twigs, often jumping from one branch to another. Their ability as climbers made it essential

that the top of the aquarium should be safely covered with a lid.

The feet of Anoles are admirably adapted for this purpose. The sharp clawed toes are equipped with adhesive pads on their under surfaces which enable the lizards to scamper up a vertical wall with admirable and sometimes annoying celerity.

Although they do not seem to like excessive heat, they require some warmth in this country and mine remained lively and apparently content at a temperature of 70°F.

The pair had not been in the vivarium more than a few hours when they engaged in a courtship display. The colours of the male became intensified, his body a vivid green above and white below and his gular sac fully extended. The female remained brown but her throat sac, smaller than that of the male, spread to its fullest extent. This was the only occasion when it was seen in the raised position. Very soon the male seized the skin around the neck of his mate in his jaws and grasped her behind the front legs with his fore legs. One of his hind legs slid over and the other under her body near the tail. His tail slipped beneath hers and mating took place. Copulation lasted for twenty minutes.

The female Anole matures sexually in twelve months, the male a year later. Under natural conditions mating takes place from mid-spring to the end of the summer. The female descends from the trees and digs a hole in the ground with her nose. She deposits an egg and the hole is filled in. The process is repeated at fortnightly intervals. The eggs are white, oval and membranous shelled. Each is one quarter of an inch in length. Six to ten weeks after they are laid the eggs hatch.

Although my specimens showed no signs of pug-

nacity towards other lizards of approximately the same size, in a community vivarium, where a number of their own species is confined together, attempts to establish a social hierarchy are inevitable. Impelled by a strong territorial sense, males warn off other males by an intimidation display. The gular sac is fully spread as they circle the "enemy" constantly raising and lowering the body and wagging the tail up and down. This performance, whilst impressive, does not necessarily end in a fight. Where Anoles are kept together, it is essential that they should be equal in size. Small ones will almost certainly be eaten by any of their companions large enough to swallow them.

I have seen it stated that Anoles will feed upon fruit

but those I have kept steadfastly refused to eat anything other than live food. They readily accepted bluebottles, spiders, mealworms and small locusts. Water is necessary but only seems to be taken in small quantities. One is advised to supply this by lightly spraying the foliage in their enclosure as is the practice with chameleons. I have, however, on two occasions seen an Anole drinking water from a pot and consider it wise to provide them with a water vessel.

Anolis carolinensis hails from south eastern areas of the U.S.A., Cuba and the Bahamas. It is easily maintained in a vivarium and may be expected to live a long time—four to six years is not unusual—in confinement.

VIEWPOINT (continued from page 227)

justify its price on this point alone.

Fungus attacks and their consequent effects are one of the big dangers which always seem to be waiting just around the corner to strike the unwary, and many of us have lost good fishes through this problem, even though the primary cause, the wound or whatever, would probably not have killed the fish on its own. The mouth and gills are the sensitive areas and it seems that once these are infected everything is lost, despite medication or other treatment. Thus it was with some interest that I noticed the following events. Two Ember Barbs (*Melanamphix*?) had to be removed from a shoal in a large tank because they had been set upon by the others and damaged. One had its whole bottom lip torn away and the other the underneath of its jaw behind the mouth and between the gills. With no spare tank space at the time they were put into a stock tank containing only male Guppies and Platies and, because of the other fishes, were not treated in any way. The aquarium in question contains a thoroughly mature biological filtration system and no plants.

After about a fortnight when no signs of fungus had appeared I became more interested. The wounds were quite extensive and in very sensitive areas. The fishes eventually died after a month through starvation due to their condition not, apparently, allowing them to feed, and the bodies were left in the tank for another week before removal. The point is that at no time before or after death did fungus appear on the wounds, nor was there any inside the mouth. Subsequent tests with lumps of meaty food left uneaten and not removed from the bare end of the tank have shown that this does not fungus either. Therefore it would seem that the biological filter, or more properly its effects upon the water, has some property which retards fungial growths. Since then, on thinking about it, I cannot remember having any fungus attacks since using biological systems although, of course, this point would not be a good proof of anything. One question which does arise is whether we can perhaps test our biological systems for maturity by simply leaving in a small piece of boiled liver and observing its condition after several days.

KEEPING WATER FOR KOI (continued from page 225)

winter months it will usually be sufficient to operate the Koshihara filter once a week, but during the summer it is advisable to remove the cap twice daily—in the morning and evening. The small amount of water which one loses from the pond can be replenished once a week.

One major point which I feel may be raised by many pondkeepers is whether or not this type of filtration, or perhaps a modified version, can be installed in plastic pools. As I said in my article in the May 1974 issue of *The Aquarist and Pondkeeper*, in my opinion this could be quite a problem. I feel that it would be

advisable to consult the manufacturers of these types of ponds on this matter. I know that some distributors of plastic liners advise against fitting either a drain or overflow since water draining away under a pool can cause major disasters such as erosion or subsidence.

One very important merit of the Koshihara filter which I would like to mention is that it is operated with no cost to the pondkeeper, and only takes a few seconds to remove harmful sediment from the deepest part of the pond where the fish tend to congregate especially in the winter months.

CONSERVATION, ETHICS AND THE HERPETOLOGIST

by Andrew Allen

CONFRONTED with decreasing populations of Reptiles and Amphibians, the herpetologist should be aware of the effect that his actions can have upon endangered species. It is no longer satisfactory to blindly purchase animals without consideration of the broad issues of conservation that are involved. In this article I present my personal views upon the ethics that should guide every herpetologist, and the ends to which he should work.

Previously I have stressed the pleasures of studying and observing captive Reptiles, and the educational rewards that this can bring. But there is another side to the coin: the present situation dictates that the herpetologist sometimes sacrifices these undoubted satisfactions in favour of the wider welfare of the creatures in which he is interested.

Recent decades have seen sharp decline in numbers of all the British Reptiles and Amphibians. Three species—Natterjack toad (*Bufo calamita*), Sand lizard (*Lacerta agilis*) and Smooth snake (*Coronella austriaca*)—have become very rare indeed. Collecting by unscrupulous dealers has contributed to this unfortunate situation. And such collecting continues, jeopardising some otherwise successful conservation measures. Any herpetologist who takes these three species from their remaining haunts, or buys them from any dealer whatsoever, is acting in a reprehensible fashion and deserves the almost unutterable contempt of his fellows.

The other British species are all threatened to a lesser degree. Collection by individuals and dealers has certainly accelerated this process, though habitat changes are the fundamental cause. The next few years could be crucial in deciding their long-term

status. So the herpetologist with any concern for his native fauna (and ex definitione that should be every one of us) will refrain from collecting any species in the field. And he will refrain from buying any British species from a dealer. Common toad and Grass snake are not yet in the position of Natterjack or Smooth snake; it would be pitiful if thoughtless hobbyists helped them on a downward path.

The situation in Continental Europe is less critical. More space exists for wildlife, accordingly pressures of urbanisation and intensive agriculture are relatively less advanced. But one cannot doubt that the decreases recorded here will be followed by decreases throughout Europe, as the same threats come increasingly to bear. Already declining populations have been noted in such crowded countries as Holland across a wide range of species, and in several susceptible animals from broader, hotter lands of the south.

Particularly endangered are the larger lizards and snakes, whose conspicuous appearance, naturally small populations (they are usually at higher trophic level than other Reptiles) and low fecundity ensure that collection or persecution will rapidly lead to falling numbers. Such decreases have been noted in the beautiful Green lizard (*Lacerta viridis*) and yet more magnificent Eyed lizard (*L. ocellata*). Another classic example is the tortoise, where an uncontrolled pet trade has caused untold damage to wild populations. Hopefully Parliament will eventually pass strict legislation to halt such imports; until then voluntary restrictions must suffice.

Most European Amphibians are collected at times when they congregate in ponds to spawn. Such collection from temporarily concentrated populations

can seriously deplete breeding stocks. In addition breeding pools are being lost to pollution or development, paralleling events in Britain. And the lesson from Britain is that a combination of collection with loss of spawning sites can lead to a population crash such as occurred in the Common frog.

It would be parochial to concern ourselves solely with conservation of the British herpetofauna. More, it would be a particularly odious brand of hypocrisy to piously protect our own animals whilst importing lizards and the like from our neighbours! The European herpetofauna is part of our own, European, heritage. We have a responsibility not to create future conservation problems for our friends.

Ideally the herpetologist should not collect or purchase any European species. At least he should ensure before making any purchase that he has accurate information upon the status of the animal concerned. If he cannot obtain such data, or if expert advice suggests that the species is at risk, then he should not buy. The onus is in him to prove to his conscience (and the satisfaction of others) that his purchase will cause no damage to wild populations.

I would like to extend these ideas to creatures imported from other parts of the world. However, that would be extrapolating far beyond my own sphere of experience. Suffice to say that while Reptiles of tropical lands are far less threatened than those of our own latitudes, it would still be reckless to buy any without due prior thought. In particular I would suggest that some large species with low reproductive rates (e.g., monitors, iguanas, pythons, all tortoises) could be very susceptible to over-exploitation.

It must be stressed that with regard to conservation the herpetologist is in a fundamentally different position to the aquarist. First, Reptiles and Amphibians may readily be observed, studied and enjoyed in the field—whereas no one would expect the keen aquarist to peer hour after hour into the murky depths of ponds and streams in forlorn hope of catching some glimpse of a fish!

Secondly, most species of fish can now readily be bred in captivity, so that aquarists may be supplied with animals without serious depletion of wild stocks (I do not claim that all in the aquarium garden is lovely, or that the ideal situation of negligible exploitation of wild populations occurs; however, the possibility indubitably exists). High fecundity and short generation time ensure that fish breeding for sale (or protein!) can be economically attractive, viability increasing as transport costs soar.

But few Reptile or Amphibian species have yet been bred in large numbers in captivity; nearly all animals offered for sale are imported specimens culled from wild populations. Some frogs and newts could potentially be "farmed"; most Reptiles could not—

they lay small clutches of eggs that will only hatch under carefully controlled conditions, offering little financial inducement to dealers.

Clawed toads (*Xenopus sp.*) constitute a major exception to the above generalisations. They have been bred in captivity in enormous numbers, induced to spawn at any required time by the injection of appropriate hormones. Hopefully the herpetologist who wishes to keep an Amphibian species indoors, but possesses a conscience, will consider this animal in preference to any European batrachian. By purchasing "British" Clawed toads he will not be disrupting wild populations of that species, and simultaneously will be safeguarding the native herpetofauna. *Xenopus* demands only simple treatment and is a beast of rather unusual and tantalising biology (a good summary article by Jack Hems appeared in *The Aquarist* of February, 1974).

In addition, fellow herpetologists will often be willing to offer "home-bred" specimens for exchange or sale. Obtaining such stock obviates the need to purchase from dealers, and ensures that field populations are not depleted.

Faced with all these necessary moral don'ts, what can the herpetologist do?

For a start he can observe all British and European species in the wild, with minimum bother and maximum enjoyment. The nearby pond or local heath will prove fascinating places to any genuine herpetologist prepared to pick up a pair of binoculars and employ eyes and wits. European animals can be studied on any holiday to southern parts, by young or old, leaving compelling memories of colourful lizards sunning on old walls of mellow stone, or of deafening choruses of tree frogs around some Provencal pool.

For those disinclined to use their feet, admirable alternatives to the vivarium do exist. Sink a large pond in your garden, and it should soon become the home of a wide variety of native Amphibia. If none turns up, introduce a small amount of spawn to establish colonies of indigenous species. Such colonies are of proven importance in safeguarding suburban populations of frogs and newts, and speedily become foci of pleasure for the appreciative naturalist. What an excellent way to combine the joys of armchair herpetology with the practical and imperative demands of conservation!

Above all, be responsible. The individual herpetologist should formulate for himself a code of conduct that takes conservation into full account, ahead of his personal pleasures if necessary. Those who thoughtlessly plunder specimens from the field or patronise dealers purely interested in profit contribute substantially to the plight of British and European herpetofaunas; their attitudes are contemptible. I trust that no readers of *The Aquarist* belong to this narrow-minded breed.

AN IGUANA AND HIS VITAMINS

by Peggy Aldis

IT WAS MY intention originally to subject my fellow readers to only one article on my Iguanas, but circumstances have since prompted me to write again on the subject. I feel a recent experience might prove helpful to others.

It all started with my smallest Iguanas' (8 in. long) decision to stop eating. I did everything I could think of to tempt him; first the daytime temperature was raised from 25°C to 35°C which made no difference at all. So a larger home was provided, with branches to climb, plenty of places to hide, water to swim in, and an infra red lamp to bask under.

Still not interested in food. It was suggested that perhaps company might help. My large Iguana was housed separately, and I knew that he would not tolerate intrusion. So another small Iguana joined the family, and instant friendship raised my hopes considerably. But alas, it still did nothing to induce my patient to eat. Becoming thinner and weaker, scarcely able to lift his back legs, he was now looking very frail. As a last resort I turned to force feeding which, needless to say, was disliked.

One day a month or two later, whilst on my lap my little Iguana had a kind of fit, first shaking violently, then the whole body stiffening for several minutes. This was the last straw. I cannot explain to you how I felt at that very moment. Without a shadow of a doubt my lack of knowledge only was responsible for his sad condition.

Professional help was urgently needed. Fortunately in my area we have an extremely clever Veterinary Surgeon who, I am given to understand, is very knowledgeable in the care of small animals including reptiles. So the next evening found me in his surgery with the little Iguana comfortably wrapped up in my shopping bag.

When the Vet lifted him out and said, "Oh! a little green Iguana. What a dear little chap," all the words I had carefully rehearsed now vanished and with tears trickling down my face, all I could say was, "He

will not eat, please don't tell me he must be put to sleep." The Vet smiled, and after giving my Iguana an examination proceeded to explain why the trouble had started. It was due to extreme vitamin deficiency; although vitamins as such had been given they were not sufficient and of the right kind. He concluded that with patience little Iguana had a good chance of recovery. A special bottle of pre-digested liquid food was to be given as often as possible with an eye-dropper. Also concentrated Vitamin tablets, namely (SA-37), a sprinkling of one to be mixed with a portion of minced raw meat, forcibly fed if necessary once a day. Regarding the method of feeding: I was assured that this was in no way cruel providing it was done gently and with care.

I am glad to say that in no time at all my green Iguana was enjoying his hourly drop of liquid food and much to my surprise eventually opened his mouth and let me pour it in.

The solid food on the other hand was a different matter. Everyday was a battle, most of the food ending up on the floor or on my lap. Nevertheless the difference in him after two weeks was remarkable, he looked fatter, more lively, and no longer slept all day.

I decided, nevertheless, to continue force-feeding until one day whilst mixing up the vitamin powder, etc., my Iguana suddenly burried his head in the dish and quite voluntarily ate every bit; even my cry of delight did not deter him. After this I am pleased to say there has been no looking back, everything that is now offered is eaten with zest and he is growing at an alarming rate, can run at lightening speed, and colour has returned to a beautiful emerald green. It is hard to believe now how close to death he came.

I feel somehow that not enough advice is given when one buys these creatures. The pet shop proprietors' knowledge is unfortunately often very limited. It is indeed very sad that many Iguanas must die needlessly.

after rinsing to remove any soil, or put into a worm feeder. On the whole, white worms are about the best food that the aquarist can easily use. Baby fish and eggs provide a good food for all fish and as all aquarists have unwanted baby fish, most aquarists have fairly good supplies. The size of fry obviously

depend on the size of the fish that you intend to feed. If you feed fry to cichlids then it is likely that you will have to raise the cichlid fry artificially, so some thought is necessary before introducing this food as to the consequences.

(To be continued)

FOR THE HERPETOLOGIST'S BOOKSHELF

by Andrew Allen

DURING his early days as a herpetologist, the amateur encounters a major problem: the vagaries of the literature. Public libraries feature only one or two relevant volumes. Bookshops are no more help, their wares chosen for saleability rather than pure merit. Specialized papers will be scattered across dozens of minority learned journals, heart-breaking to locate. And the herpetologist is rather a rare and select beast; so there may be no one handy to ask for advice. The net result can be a costly and irritating baptism of fire.

These articles attempt to furnish just such advice, by evaluating books and discussing in detail the literature upon various topics.

For today I shall just discuss some general characteristics of that herpetological literature, to set later specific articles into a unified context.

Firstly, the literature has been rather small in extent. This stems directly from the economic unimportance of Reptiles and Amphibians, and their relative paucity of species. The volume of print produced bears absolutely no comparison with fields like entomology or the aquarium hobby. Consequently whilst aquarists must ever sift rare literary wheat from mountains of superfluous, ill-written chaff, the herpetologist encounters the opposite problem. He finds rather a limited selection of books, often difficult to trace. And unhappily not all of them merit a search.

But times change. The literature now begins to mushroom, fed by a crop of new articles, papers and books. So now one must not only search diligently for herpetological works; it becomes imperative to discriminate severely when they are found. If not prepared to follow the advice of myself and other reviewers (I hope none would meekly accept our words as gospel), inspect the books in public or university library before putting any cash on the counter. At current prices anyone who buys books blind stakes out priority claim to a padded cell.

With book prices so unstable, any figures that I quote should be treated as guidelines, and nothing more. Changes are quite probable in the interval between my penning these words and your reading them.

Herpetological articles and papers speckle the scientific literature, dispersed across numberless journals from Ecological Monographs through to Ultrastructure Research. Some may be apprehended via bibliographies of the better books. Or, as these are invariably several years out of date, consult the mammoth Biological Abstracts (of which more in later articles); these provide a mind-bending doorway into the darkest recesses of the literature.

Apart from articles in 'The Aquarist', the sole mode of herpetological writing is the British Journal of Herpetology, published twice yearly by the British Herpetological Society. Slim but expensive, it features a hotch-potch of minor papers upon a variety of academic subjects, plus letters and book reviews. Members of the society enjoy use of a library, and receive a newsletter crammed with snippets of vivarium small chat, full of opportunities for contact with others in the field. Membership is a 'must' for serious herpetologists, particularly as revenues go in part towards support of a vigorous conservation programme.

To remain abreast of current advances one must maintain contact with the gargantuan American literature—like the curate's egg in quality, but containing some very important work. I shall discuss this field in due course. Also many vital writings are in French and German; the complete herpetologist should develop a reading knowledge of both languages.

This brief sketch of the scene, in bold but blurred strokes, must needs leave all the vital questions unanswered. But my next article will sharpen its focus and approach the field from a logical beginning. I shall commence by discussing books that give a gentle lay introduction to the biology of Reptiles and Amphibians, and their place in the pattern of life.

job effectively as air-driven types do not agitate the water powerfully enough to move the detritus to the filter inlet.

Cichlid Tanks

Where large cichlids or other robust fish are kept, it is often impossible to grow any plants at all as they are constantly grubbing the bottom and in the case of herbivorous species, the plants will be eaten. In this case, the decoration must be confined to interesting

rockwork, woody material and, if desired, artificial plants. Artificial plants can never take the place of the real thing, but in the last few years some magnificent copies have appeared; in particular, the Metaframe range, and in cases where the real thing cannot be used the artefacts can be very realistic. Unlike natural plants, however, they confer no contribution on the biological cycles in the tank and unlike natural plants have no self-cleaning ability and, therefore, must be removed periodically for scrubbing.

FOR THE HERPETOLOGIST'S BOOKSHELF

by Andrew Allen

IN THIS ARTICLE I intend to compare and evaluate some little books that give a painless introduction to the world of Reptiles and Amphibians. They are for complete amateurs, arriving new to the subject. Those experienced in herpetology should pass on, or wallow in gentle nostalgia as they read of the works on which they cut their intellectual teeth.

Gentlest of all is *A Study of Reptiles and Amphibians* by Alfred Leutscher, Blandford Press, 1973. A slim little volume, price about 60p, it nowhere taxes the powers of very young, busy or old. The photos please, the account skims superficially along, and (unlike most others of similar bulk) the readable prose is in clear English rather than half-breed American. Could serve as a child's first book on the subject, but little more.

Amphibians by J. F. D. Frazer in the Wykeham Science Series (1973) may claim to be somewhat more erudite. It covers classification, evolution, anatomy, physiology, ecology and behaviour of Amphibia from the viewpoint of natural history; throughout, the emphasis is upon adaptive relations between the animal and its environment. Though the general level is introductory, a scattering of unfamiliar and fascinating facts ensure that every biologist will find the book of interest. But at £2 for a paperback of 120 or so pages with only ordinary black and white photos, the value is not good. And not many public libraries may yet possess copies.

Reptiles are covered in very different style in *The Book of Reptiles* by R. A. Lanworn, Hamlyn, £1.95. The author was long in charge of the Reptile House at London Zoo; he has produced a volume distinguished by some large and superbly chosen colour photographs. The text does not demand; chapters flit from Reptile variety to morphology, dinosaurs, conservation and the fate of pets. Distinctly lightweight, but good

value for cash, it might be enjoyed by precocious youngsters or look handsome by the coffee table.

Less profusely illustrated, but more solid value in terms of information per new penny or per page, is *The World of Reptiles* by A. Bellairs and R. Carrington (1966), Elsevier Publishing Company. This compact little book of 153 pages provides a contemporary account of Reptile biology, slanted towards the different groups, and aimed at readers with no prior experience. The photographs do not meet the most exacting modern standards, but the well-written text should occupy several agreeable hours.

All these books come from the pens of accepted figures in the field. Each is directed towards herpetile biology and natural history, rather than just descriptive cataloguing of endless species. And all should be readily available through inter-library loan, if absent from the local shelves. Few will wish to actually buy them—for any progressive biologist they soon become redundant items on the bookshelf, superseded by growing personal knowledge, giving way to more comprehensive tomes.

To close, I shall offer warning against a book. Newcomers to the field might hear of *A Dictionary of Herpetology* by J. A. Peters, 1964, Hafner, and feel that this could help them in understanding more advanced literature. But few scientists would consider a specific dictionary of herpetology to be very valuable—most herpetological terms belonging to biology as a whole. And the book in question struck me as a dubious hotch-potch of 3,000 items, including such as "dot," "notch," "toadlet," and "lizardlet"! Etymologically confused, I can think of few uses for this book. Save your money. If terminology and jargon confuse, prefer *A Dictionary of Biology* by Abercrombie, Hickman and Johnson or Uvarov's *Dictionary of Science*, both in the Penguin reference book series.

modifications to his earlier proposals. For instance, his much-quoted recommendation that biological filter beds do not gain in efficiency when the bed depth is deeper than three inches (using 2 mm.-5 mm. particle size), is now questioned and it seems that performance may now increase with depth after all. Certainly this booklet should be read by serious followers of the practices of closed system water management. Being a scientific booklet, various tests and tables are given which are not always available to the hobbyist elsewhere.

Secondly, for anyone who was interested by my description of the closed-system fish culture unit in use at the University of Aston in Birmingham, in last month's column, I have since obtained a copy of a scientific paper entitled "Intensified fish culture combining water reconditioning with pollution abatement" by Dr. Paul B. Liao and Ronald D. Mayo, both of Kramer, Chin and Mayo Inc., Consulting Engineers, Seattle, Washington, U.S.A. The paper describes similar systems in detail and gives various useful parameters and formulae.

FOR THE HERPETOLOGIST'S BOOKSHELF

by Andrew Allen

PROGRESSING from simple introductory books, we come to works aimed at the knowledgeable layman. Emphasis is still upon general biological principles rather than mere cataloguing of species. With two exceptions the field is devoid of authoritative contemporary writing.

A passable account is *INTRODUCTION TO HERPETOLOGY* by C. J. and O. B. Goin, Freeman Press 1962 and 2nd edition 1971. For, despite the title, this book demands more effort than any that I reviewed last time, and assumes some biological background. It is directed principally towards American students in first year college courses, but could prove useful to a wider readership. Compact design and simple prose, marred admittedly by a staccato style, contrast with the average wordy jargonistic American textbook. Chapters cover structure, evolution, life history, adaptation, distribution, and characters of the major groups, always treated from the viewpoint of the general biologist.

However, the superficial treatment of behaviour and population biology leaves much to be desired; these topics are crucial in any modern introduction to herpetological thought. And the attempt to consider Reptiles and Amphibians in a single rounded account falls into several of the waiting traps; lumping both classes into a single discipline, 'Herpetology', is solely a product of history and convenience, should not obscure important differences between the groups. Living Reptiles and Amphibians are probably not more closely related to one another, ecologically or phylogenetically, than are Amphibia to certain living fish or Reptilia (excluding the tortoises) to birds. But that argument must be pursued another time.

Weighing these pros and cons, I suggest that *Introduction to Herpetology* merits a careful read as a

good overview, but boasts neither the authority, the presentation nor the prose to deserve a place on the bookshelf.

A step upwards in rigour brings us to that perennial classic *THE BIOLOGY OF THE AMPHIBIA* by G. K. Noble, first published 1931 but variously reprinted and re-edited since. The author was one of America's finest herpetologists, and his book remained . . . *THE WORK* . . . for three decades. It reflects the standards of scrupulous exactitude to be found in his detailed papers. Compact, and crammed with information, the approach falls just short of the advanced and this book should be comprehensible to all but the newest biological novice.

Anatomy and old-style physiology receive detailed and critical attention, while the younger disciplines of behaviour and ecology are scantily represented. The years pass relentlessly by, rendering much of the information obsolete and cruelly highlighting inequalities in coverage. Tiny but faultless drawings test the eyes, while Noble in his prose makes few concessions to gentle after-dinner readability. This is no companion to the vigorous theories of herpetology in the 70's.

It could also prove difficult to obtain. Few bookshops or libraries possess copies. But keep an eye on the second-hand shelves, and remember that several university libraries stock the book so that it should be accessible through inter-library loan. Yes, it has been superseded. But try and look at a copy and appreciate the high standards of herpetological writing that it sets.

Next time I shall discuss two more books in this field, both offering excellent contemporary accounts and, unlike today's pair, well worth purchasing for a place on the modern bookshelf.

FOR THE HERPETOLOGIST'S BOOKSHELF

by Andrew Allen

MY PREVIOUS two articles considered some rounded middleweight accounts of Reptile and Amphibian biology. Attempts to survey the entire field at an even more advanced level invariably suffer from one unavoidable fault—in addition, of course, to unwieldy size. As each topic receives more detailed treatment, so the overall coverage becomes patchy and unbalanced. But during this century three laudable attempts at an advanced overview have been made.

In one vast, handsome tome comes *Amphibia and Reptiles* by Hans Gadow (1901), in the Cambridge Natural History Series. This magnificent compilation in an antique tradition would still honour any bookshelf, thanks to Gadow's lucid prose and the gracious woodcuts. His treatment of anatomy, taxonomy and palaeontology never wavers from the rigorous standards of the time.

Naturally this book has passed completely out of date, particularly in its consideration of fossil herpetiles, a field changed beyond all recognition during the past fifty years. It remains solely of historic interest, an inspiration to young biologists of the period. And in addition it constitutes a daunting yardstick against which modern equivalents can be compared—and oft-times found wanting. Copies may be found in many reference and university libraries; allow yourself the pleasure of consulting one some rainy day.

Probably the nearest modern equivalent to the Cambridge Natural History Series is the French *Traite de Zoologie*, edited by Grassé (Masson, Paris). Reptiles and Amphibians occupy volume 14 of this gargantuan series. Volume 14 itself comprises three books; book 1 on the Amphibia has yet to appear (at time of writing), books 2 and 3 on the Reptilia take up 1,428 pages between them! Nearly a thousand illustrations grace those rich and shiny pages, with their scrupulous standards of presentation.

Chapters by various respected authors cover general biology, palaeontology, anatomy, embryology and taxonomy. As in the other works reviewed this month, subjects such as behaviour and ecology receive scant attention. And the level of contributions does fluctuate sharply about a generally elevated mean, with some accounts already appearing dated and jaded. However, powerful bibliographies and the assembling of so many facts into fairly small

space do guarantee the great usefulness of the volume.

In keeping with the standards, each book (as opposed to volume) costs around 240 French francs—i.e. upwards of £20 depending upon exchange rates. So *Traite de Zoologie* probably is not destined for the private bookshelf. But many libraries possess the series. I should also add that it's in French, but of the simply comprehensible scientific brand.

In German a rather similar conception is the *Handbuch der Zoologie*, edited by Krumbach and Kukenthal. However, at time of writing the herpetological sections have yet to appear; as soon as I meet a copy the comments will flow.

For an even more detailed and exhaustive attack the ongoing multi-volume *Biology of the Reptilia* (post 1969, Academic Press) cannot be bettered. Remarkable in scale and conception, the series finds few competitors in other biological areas. To date I have seen three volumes; more are on the way.

Each volume follows a central theme, with chapters by different authors. The contributors hail from many nations, accepted experts in their academic corner. Standards of presentation and editing leave little to be desired. Eventually the result should be an ultimate in reference works, the complete compendium of herpetological information. But of course the first volumes will be way out of date before the last ones emerge from the press. And only a few libraries are likely to invest in such a specialized series.

Volume 1 (374 pps, £4+) considers Reptile origins, bone structure, epiphyses, teeth, vertebrae, ribs and the tortoise shell. Volume 2 (374 pps, £5.50p) covers all the major sense organs, whilst Volume 3 deals with blood and endocrine organs. Morphology, physiology, embryology, behaviour and ecology should all be covered finally.

You will have gathered from the prices that *Biology of the Reptilia* cannot be wholeheartedly recommended for the home bookshelf. But locate the nearest copies; they could save you hours of eyestrain searching through individual journals on dark bookshelves.

In the next article I shall assess some books that look at Reptiles and Amphibians from a somewhat different angle, namely those highlighting and describing the range and variety of species across the continents.

it will be ready for a first-time start the following season. For more complicated troubles or replacement parts, Beresford and Son, Ace Works, Kitts Green, Birmingham 33, are the makers and have an efficient and reasonably priced repair service.

★ ★ ★

In conclusion, I would like to mention some more reading matter for aquatic bookworms. Tetramin issue a booklet entitled "The Successful Fish Hobbyist" which is intended as give-away advertising for their products. In spite of the expected commercial approach, the booklet caters for the beginner in aquarium-keeping superbly and is thoroughly interesting. It should be available free from dealers who sell Tetra products and is highly recommended for basic information.

For the Cichlid enthusiasts and the more advanced general aquarists, the new journal of the British Cichlid Association "Cichlidae" is a replacement for

the old "Cichlid Clarion." It is a remarkable improvement in that it appears to be professionally composed and printed, and concerns itself only with matters of aquatic interest. The Association's other internal business is detailed in a separate newsletter. The editor is Mr. Ian Sellick, 280 Northridge Way, Hemel Hempstead, Hertfordshire HP1 2AU.

Lastly, I recently subscribed to the "Marine Aquarist," via Tropical Marine Centre Ltd., 25 Hay Lane, Kingsbury, London, N.W.9, following their advertisements in this magazine. Apparently there have been changes in the editorial status so that publication will be monthly in future. The quality is really good and the information content very high. It is printed in the small American format, as for instance T.F.H., and contains many very exceptional photographs. Marine subjects only, of course, but so well produced that its topics should be interesting to everyone.

A. Jenno

HERPETOLOGICAL NOTES

by *Stephanie J. Peaker, M.Sc.*

THE TYPICAL TOADS (genus *Bufo*) usually settle well in the vivarium and a number of non-European species are suitable for housing indoors.

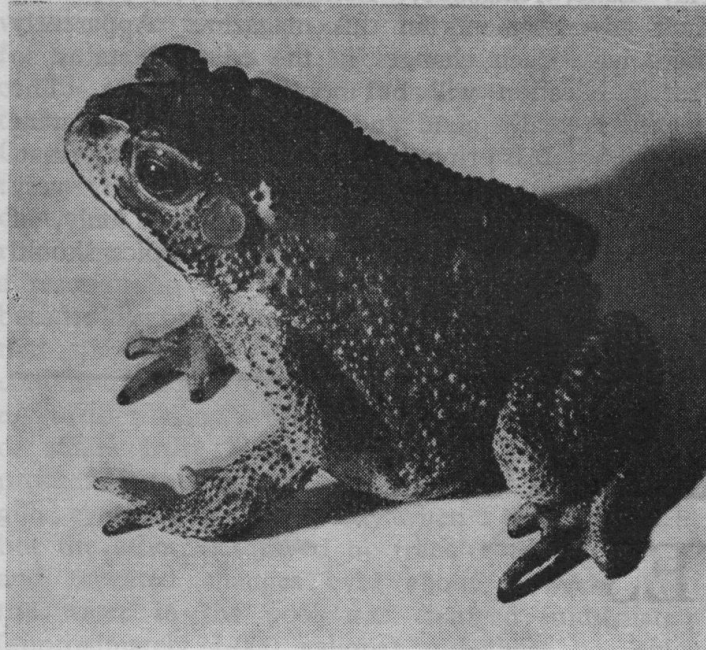
Although many people keep toads in aquarium tanks, unless modified they are not really sufficiently well ventilated and we have used wooden vivaria to good effect. If perforated zinc or hard plastic netting is used for the ventilation panels ensure that they are higher than the normal height of the nose of the toads in order to prevent the toads from rubbing their noses on the sharp surfaces. Most toads do not spend long periods in water and a dry area is thought essential. We have tried a number of cage-floor coverings from natural earth and peat to newspaper but find the methods used at Philadelphia Zoo (described by R. Conant in *International Zoo Yearbook*, volume 11, pp. 224-230, 1971) to be highly satisfactory. The floor is first lined with several sheets of newspaper and then a layer of smooth small pebbles (not chipped) is added. Into this can be sunk a pool which need not be large until breeding is attempted—an aspect I do urge everybody to try because this is the real test of our ability to keep amphibians and reptiles. Shelters of cork bark (soaked and boiled before use) are ideal and clumps of sphagnum moss can be placed over the

pebbles in places. Some of this moss can be kept damp. Growing plants can be added but only if good ventilation is achieved. If they are included in the set-up they are best planted in pots of potting compost and then changed from time to time. Many plants will grow at a prodigious rate in the heat of the vivarium.

To achieve a good circulation of air through the vivarium a fan-heater can be positioned to circulate warm air through a number of them. A carbon filament lamp controlled by a thermostat is an effective method of maintaining the required temperature. If the pond is very large a separate heater can be used for the water.

The vivarium, water and fittings must be kept clean but after a thorough cleansing, the furnishings should be put back in the same position; otherwise the toads virtually have to settle down all over again after each major clean-out. As will be appreciated with the ventilation, floor covering and furnishings, the aim is to prevent stagnation and the spread of possible infective agents in dank conditions. Nevertheless, some toads appreciate a soak in mud or burrowing in earth and separate containers can be let into the pebbles. Bacterial and fungal infections of the skin

are a danger to all amphibians and for toads a completely dry area should be available. Some herpetologists keep antibiotics in the water continuously but I never feel happy with this course of action. Certainly antibiotics can be added to the water for specific skin lesions or during the first few weeks as a prophylactic. Tetracycline powder can be obtained on veterinary prescription. It is clearly important to keep the water in the pond free from harmful bacteria. Regular



Bufo melanostictus, the Common Asian Toad

changing and even circulation through an ultra-violet sterilizer can be recommended.

Given a clean and airy vivarium at the right temperature there is no reason why toads should not thrive. In the past I have found that the first few weeks is the most difficult time. Minor lacerations can blow up into major skin infections and it is during this period that immersion in antibiotics, or even in severe cases, injection, can be valuable. For this reason quarantine all new arrivals for several weeks and do not purchase amphibians with damaged skins.

Toads can eat a great deal and a variety of food is appreciated. Depending upon size, all manner of food can be offered—earthworms, mealworms, flies, pink mice, locusts, spiders and, of course, hedgerow sweepings in the warmer parts of the year.

For tropical specimens a day temperature of 24-27°C (75-80°F) suits most species but some prefer somewhat lower temperatures, others somewhat higher. A fall in temperature at night is recommended and either a very dim light or no light at all should be employed at this time. To simulate rain, spraying tepid water in the vivarium several times per week can be suggested. In the wild toads are often active after rain, particularly in the evening.

As for inhabitants, a number of species can be obtained. For those preferring large toads then the so-called Marine Toad (*Bufo marinus*) from South America can be recommended. Smaller but very attractive are *Bufo regularis*, the Common African Toad; *Bufo carens*, an attractively marked red-backed species from East Africa; *Bufo melanostictus*, the Common Asian Toad with beautifully sculptured head features outlined in black or brown and, as the accompanying photograph shows, prominent black tubercles. A species that can still be obtained is Blomberg's Toad (*Bufo blombergi*) from Colombia, a large attractive species. This species was only discovered in 1951 and since then has been widely exported to zoos. However, there is some doubt as to its numbers in the wild and unless you have wide experience in breeding toads and feel you could in all probability breed this species too, then I recommend you do not buy specimens.

For the temperate vivarium the North American species of *Bufo* are ideal (e.g. *B. americanus*, *B. terrestris*, *B. woodhousei*, *B. valliceps*, *B. cognatus*), not forgetting of course *Bufo viridis*, the Green Toad of Europe.



Bufo blombergi

Finally I do strongly recommend the purchase of groups of the same species—they are more interesting when kept in groups or at least in pairs, and we shall never learn to breed amphibians if we only keep odd ones in communities of different species.

Chelonians

Chelonians need copper in trace amounts to incorporate in their shells and young specimens are prone to copper deficiency. For aquatic forms chopped bony fish fulfils the need but for tortoises sterile bone meal sprinkled along with vitamin supplements on the food is an ideal source of calcium and copper.

FOR THE HERPETOLOGIST'S BOOKSHELF

by Andrew Allen

PREVIOUS articles have evaluated books upon the general biology of Reptiles and Amphibians, the unifying principles of living phenomena. Today I move to works describing the range of species, with emphasis on living diversity. The two aspects are complementary, but demand different treatment and even attitudes of mind.

Volumes reviewed to date have possessed powerful central themes, integrating the threads of embryology, anatomy, evolution, ecology into balanced compositions depicting the herpetiles in a context of biological theory. By contrast descriptions of species tend to become catalogues; the skill of an author resides in ability to add colour and fascination to what are basically lists. A good study in this field should create wonder in the reader's mind, wonder at the varied forms (some of them apparently bizarre) in which these animals achieve equilibrium with the environment, scientific wonder at the source of such diversity, aesthetic appreciation of their beauty.

The books I mention attempt an illustrative spectrum across the entire range of form in different groups, habitats and continents. I shall discuss works dealing with narrow taxa or herpetofaunas of specific countries at a later date.

At the less detailed end of the scale is *Reptiles and Amphibians of the World* by Hans Hvass, Methuen 1964, translated from German by Dr. Gwynne Ververs. In a compact volume of 125 pages this covers a selected 230 species. For each there are apparently haphazard, brief comments on distribution, colour, habits, supplemented by numerous passable colour paintings. There is no bibliography! Overall effect is moderately agreeable, and the book could occupy a couple of hours reading or make a good present for a youngster.

A French volume to beautify the bookshelf or stimulate the kids is *Les Plus Beaux Reptiles* by Jean Guibé, in the Larousse Quarto Edition. The trifling text can be dismissed from consideration instantly. But the glossy photos are glorious, displayed to give

a sumptuous volume of the "coffee table" genre. It won't serve any practical purpose, for few species are illustrated. But the aesthetic value compensates. And the irrelevance of the text, plus use of Latin names, means that the language should bother no-one.

Rather more serious is *Reptiles and Amphibians of the World* (I apologise for the unimaginative titles; you will have to endure more of the same) by Maurice Burton, Orbis £2.50. Copies are in many bookshops at time of writing.

At first glance this also looks like a "coffee table" book, big and thin, profusely illustrated. Those illustrations meet the highest standards of modern colour photography, represent an artistic experience. Not only are they technically superb; they also show the beasts actually *doing* things. Lizards and toads spend long periods at rest, and may be simply snapped by anyone with equipment and competence. The resultant photos will identify the species, but otherwise possess all the vivacity of bad monumental sculpture. The art of reptile photography is in taking the picture at just that moment when the animal snaps up a passing wasp, courts, fights, dies.

But the text is somewhat better than trifling, more than just a pretty face on glossy paper. Maurice Burton has a reputation for writing good natural history prose. The account reads smoothly, moving swiftly from group to group, highlighting "characteristic" members and also certain aspects of general biology. The result is a definite and coherent text rather than an interjection of spurious comments between the photos.

The standard is not very demanding. A fifteen year old might lap up the new vistas, so entertainingly presented. Anyone arriving a novice to the subject would benefit from succulent foretaste of pleasures to come. But the experienced herpetologist feels a sense of *deja vu*; the information is too familiar, the examples legion. So browse happily, but do not expect much instruction or a work for future reference.

the fishes known loosely as Butterflyfishes.

Finally, I thank you for your very kind remarks about the small amount of assistance which I may have been able to render you, but deplore your unfortunate remarks about not trusting dealers. Until you do find a dealer, in whom you can place 100% trust (and I assure you that such men are, in my

experience, in a vast majority in this nation's Pet Industry) then you are going to lose a great deal of money and patience, and cost a lot of blameless creatures their lives.

A prime example of what I mean here is buying sessile invertebrates to house in an aquarium with a butterflyfish or vice versa!

FOR THE HERPETOLOGIST'S BOOKSHELF

by Andrew Allen

THIS month I discuss further books upon the diversity of reptile and amphibian form and species, starting with two in the Hamish Hamilton "World of Nature" series. These are *LIVING REPTILES OF THE WORLD* by Schmidt and Inger (1957), and *LIVING AMPHIBIANS OF THE WORLD* (1963) by the late Doris Cochran. Standards of presentation and approach are similar in both; the reptile volume is not on my own bookshelf, so I shall confine discussion to Cochran's work.

Her book is a visual treat, large pages of quality paper adorned by 222 superbly chosen illustrations, 77 in colour. These exemplify the tantalizing beauty of frogs and newts, their enormous variety of colour and shape, in a manner no prose could achieve. Many species illustrated will prove new to British herpetologists; the startling hues and bizarre form of several South American groups provided an aesthetic surprise for this reviewer (me, to be less pompous), reared on the subtler shades of European taxa. Marvel, for example, at the Two-toned arrow poison frog (*Phyllobates bicolor*), a fiery red anuran portrayed with clusters of black tadpoles clinging to its back; or the plastic-moulded Zetek's frog (*Atelopus zetecki*), all angles and gangling legs; or the Golden mantella (*Mantella aurantiaca*); or . . . but see for yourself.

Only a very talented text could hold its own beside such illustrations. Cochran's effort fails in this, but manages to be readable and interesting. Brief chapters on amphibian biology and care in captivity can be dismissed as weightless things. The rest of the account consists of family-by-family descriptions of the different groups.

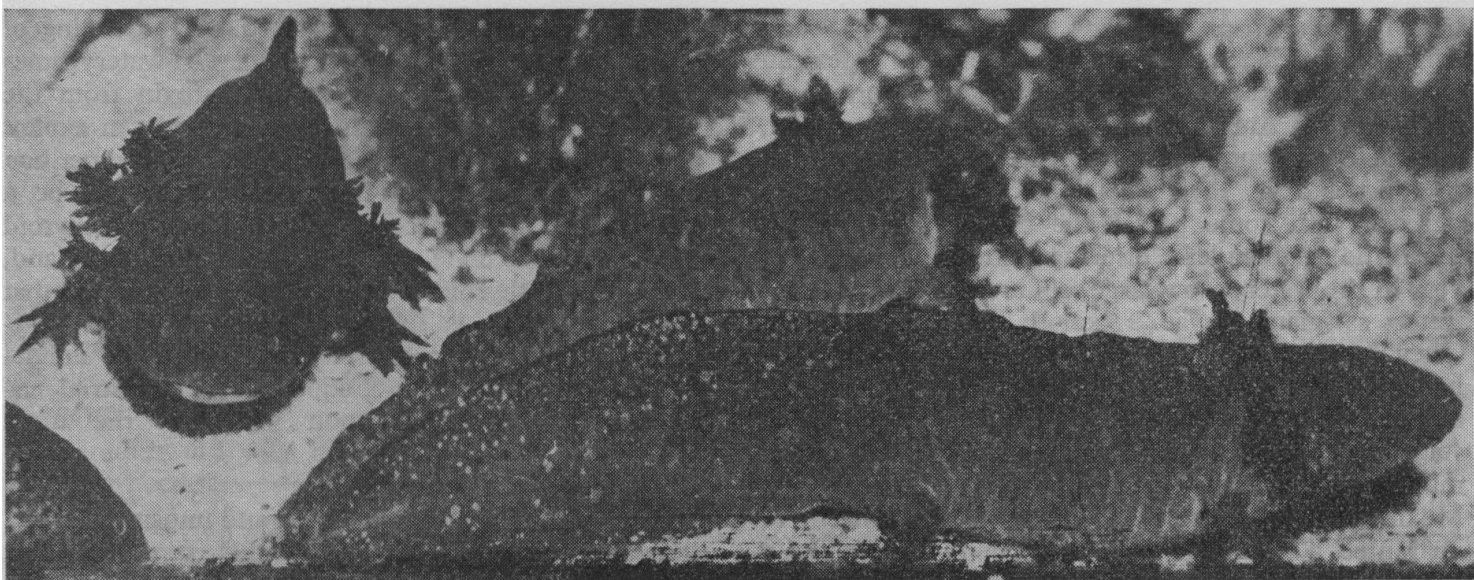
Caecilians receive scant attention, enough just to whet the appetite. Urodeles and anurans occupy more paper, as befits their species abundance. For each family a number of notable species are cursorily

described. No one animal receives detailed study, but the overview is good, studded with fascinating oddments of biology or legend. And although the author was American, species from every land take their rightful place. One can glean much unexpected information, unpretentiously presented, forming a haphazard rag-bag of riches rather than planned assemblage. High point of the text is the rigorous standard of systematics, low point the short bibliography. The end result is not a classic, but a book that pleases, and from which much may be learnt.

Older and less easy to find is *REPTILES OF THE WORLD* by R. L. Ditmars, Sturgis and Walton 1910. Though not on the bookshop shelves, several public, reference and university libraries hold copies. It might also be worth keeping an eye on the second-hand dealers, for species accounts date more slowly than those on general biology.

This book is not a masterpiece from the mould of Gadow (see a previous review) or Boulenger, two greats of the era. But good binding and compact presentation, added to other virtues, make this an honest work. It is a species by species account at the level of distribution and natural history, including detailed classifications and unusual anecdotes. The 373 pages are a mine of information to which I still refer often, penned by a man who possessed great practical experience in his subject gained from wide travels and zoo work.

Of course age brings faults. The classifications have been outdated by subsequent taxonomy. The numerous half tone photos were doubtless magnificent for their time, but appear drab and lifeless to our eyes. But this is not intended as a glossy book to look pretty; it is a working book, and still of use if the limitations are recognized.



THE AXOLOTL TALE

by Andrew Allen

FUNNY looking beasts. The axolotl caused quite a stir when unveiled before a blasé Paris of 1865, a Paris grown bored with the bizarre. The novelty remains: today kids from beau quartier and bidonville giggle uncertainly at the grotesque little monsters behind glass walls in the Jardin des Plantes.

No, axolotls don't look quite right (just as the spelling of their name is perpetual torture). The tiny legs are too weak for the thick nine-inch body, movements are inelegant, proportions unbalanced, the three pairs of gills too feathery. And sometimes there are albinos; staring pink eyes and toilet paper gills seem obscene features on the face of an amphibian. This is a beast whose symmetry has gone haywire, a gross sport transfixed as a giant, inflated tadpole.

Enough anthropomorphism. The axolotl still tantalizes and offends aesthetic sensibilities conditioned to clean lines and elegant movement in other newts, but now scientists know just what makes the creature tick. And the tale is purest factual magic.

The urodele genus *Ambystoma* is rich in species throughout north and central America. Most of the species are familiar salamanders with familiar habits. But a strain of neoteny runs through the group, like lunacy in a fated human line.

Neoteny is that condition where larval animals delay metamorphosis to the adult, spend their lives in a juvenile form, attaining a precocious sexual capacity

that permits them to breed without "growing up." Like lunacy in history, neoteny has played a major role in evolution, greater than one would expect of a metabolic aberration. Without neoteny, mankind would probably not be here; aeons ago precocious sexual maturity freed the ascidian larva from its sedentary parent and set it on the royal road to becoming, an active vertebrate. Humans bear considerable resemblance, both physical and mental, to juvenile apes; this is suggestive of neoteny. Returning to amphibians, Crowson has suggested, admittedly against the anatomical evidence, that the entire Urodela could have originated from neotenus tadpoles of primitive *Anura* (frogs and toads).

Whether the origin of urodeles was neotenus or no, neoteny occurs frequently in the group today. Occasionally tadpoles of our native newts grow into giant neotenus larvae. Some species live solely as tadpoles; they breed as tadpoles, no treatment will induce them to change into adults. We have no idea what the adult form would look like, it was discarded long ago (the blueprint may still live on in the historical record of the genes). Examples in this category are *Amphiuma means* from the U.S., and that remarkable cave denizen, the olm *Proteus anguinus*, from deepest Yugoslavia. But for flexibility of neoteny, axolotls take the prize.

Two ambystomids have been dubbed axolotls,

namely *Ambystoma tigrinum* from the U.S. and *Siredon mexicanum*. Both the Tiger and Mexican salamanders exist as normal adults, the former in nearly every American state. They hunt on land, hibernate on land, return to the water each spring to court and lay their eggs. Those eggs hatch into tadpoles. In some places the tadpoles develop on into little salamanders; elsewhere they live year after year in the water, grow large, court and spawn underwater as giant larvae. Axolotls have been born. They live and reproduce as an independent population, in some sort of dynamic equilibrium with their normal aquatic-terrestrial cousins. Sometimes the axolotl stage may be a rare, abnormal phenomenon. Or it may be the dominant phase, as in the lakes around Mexico City where it exists in numbers sufficient to guarantee a niche on the local menu, a reputedly succulent speciality.

Why such flexibility? Why do the tadpoles grow up in some places, remain axolotls in others? We know that if their ponds dry up the axolotls metamorphose into adults able to leave the water; if this did not happen they would bake to brittle parchment. Neoteny is much more common in cold high altitude waters than down on the plains. It is rare in coastal districts. It is practically universal in certain lakes of Mexico, Wyoming, Colorado; water and animals from these places contain very low Iodine titres. All these samples from a rag-bag of facts puzzled early scientists; today we know what controls normal amphibian development, and the facts move into their appointed places.

Development from egg to adult is programmed in the genetic message. And the thyroid gland calls the tune, orchestrates the sequential expression of genes to give different patterns of structure changing constantly with time. Under ultimate control from the brain, this gland produces the hormone thyroxin which acts on target cells throughout the larva to cause change. Levels of thyroxin rise constantly, and under its influence new structures are formed and old ones destroyed, giving an ordered progression to the young adult. Remove the thyroid and metamorphosis will stop dead; inject thyroxin and the tadpole will metamorphose explosively into a pipsqueek mini-newt.

Taking Tiger salamander tadpoles into the lab, we discover that temperature affects ability of target cells to respond to hormone; cold causes an extreme slowdown. Maintain an axolotl in Iodine free water and it will remain an axolotl; add Iodine and it will change to the adult. Iodine constitutes an essential part of the thyroxin molecule, which is a halogenated tyrosine derivative. So in the absence of environmental Iodine there is a thyroid failure, and in the absence of thyroxin development cannot proceed, new genes are not called into play.

Where metamorphosis is caused by the drying of ponds control stems from the brain. In watery times the brain inhibits production of thyroxin from the thyroid; the tadpole remains aquatic and can exploit aquatic food sources. As the ponds dry, competition for food increases and it is advantageous to be a salamander on land; accordingly the brain, via thyroid stimulating hormone produced in the pituitary gland, instructs the thyroid to secrete more thyroxin so that fast metamorphosis follows. Here the axolotl condition is an ecological strategy, allowing the animal to take full advantage of aquatic and terrestrial environments depending upon which is the more profitable.

For beasts of such exotic origin and unusual biology, axolotls fare surprisingly well in this country. Most are sufficiently hardy to spend the year in outdoor pools in southern England, overwintering beneath the ice. Indoors requirements are simple; they need only a large aquarium with six to eight inches of water plus a small island. The aquarium should not be exposed to the sun, and water must be kept scrupulously clean. Artificial heating is superfluous. Axolotls will thrive on a similar diet to large aquatic newts, namely earthworms, raw meat, enchytraeids, dipteran larvae and other gleanings from the pond. Eggs will often be laid at circa 65°F, hatching in about three weeks into miniatures which will wolf *Daphnia* and small enchytraeids.

Don't expend valuable inspiration on artistic aquarium design: axolotls are clumsy enough to uproot and mangle elegant plants. And be careful about company: fluorescent gills are tempting targets for many piscine and reptilian nibblers, while axolotls are bumbling carnivores that attack smaller fish, newts, and their own tasty progeny.

There is no need to waste money buying from commercial dealers. Many herpetologists breed surplus stock, and would be willing to give, sell or exchange. A request in *The Aquarist* could help, and I have noticed axolotls offered for exchange in the newsletter of the British Herpetological Society. Remember to establish exactly which species is involved, and something of the creature's history and origin. Source and prior treatment can affect hardiness and probability of metamorphosis under different régimes.

Growing familiarity with the axolotl does not lead to contempt. The mysteries of its condition evaporate before cold empirical reason, but wonder at this neotenus tale remains. The facts of developmental endocrinology are every bit as fascinating as former romantic eyewash about this so-called Peter Pan of the newts. And if we think it bizarre, remember that beauty and bizarritry (!?) are meaningless words to the axolotl. It survives.

supplied containing instructions on wattage requirements, installation, adjustment, guarantee, etc. Explanatory diagrams are included. I am informed that the instrument complies with the new Board of Trade regulations which are to be introduced shortly.

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A. JENNO.

FOR THE HERPETOLOGIST'S BOOKSHELF

by Andrew Allen

THIS MONTH I begin my appraisal of the vivarium literature, painfully aware that most existing works draw criticism rather than compliment. I state it plain: there are no competent, advanced vivarium guides in our language. And I know of no herpetologist in Britain qualified to write such a guide. Of simple introductory books I know five; the three reviewed this month are not impressive, the two described next month are of greater merit.

Simple indeed is *Keeping A Terrarium* by S. Schmidt (in translation), Lutterworth Press, 43 pps., 1974. The lettering is large, paper good, the colour plates admirable (save only one, labelled Wall lizard when it shows Sand lizard). The text describes a handful of species and their care, at a nobby level. Design of vivaria is mentioned, there are lists of foodstuffs. Technically this is a pleasing work to handle or skim through; but I do not rate it as an introductory vivarium guide.

The treatment is far too superficial, even for the intended readership. The practical details are minimal, to the point of being irrelevant. The gorgeous photo of a Green lizard would stimulate any kid to hare round the local pet store, and put down his parent's money on the counter. But get the beauty home, and what then? The sparse information will not help keep the beast alive, let alone in health. It will die, the conservationist will sigh, and perhaps one child will have been disillusioned by the aching sight of fading colours and those bloated, wandering ticks.

For this reason I regard *Keeping a Terrarium* as misdirected, and of little use. A book on reptiles and amphibians as such, at this level, of these standards of presentation, would have earned my applause. But this book is not a primer on the beauties of reptiles, nor yet a practical introduction to the vivarium. It falls between these stools. In this context suffice to say that it is not a working book, and will not help

even the raw young novice to successfully maintain his vivarium.

Nor do I like *Tortoises, Lizards and Other Reptiles* by David Le Roi 1958, Pets of Today series, Vane. This pocket-sized 96 page book contains chapters on constructing vivaria, feeding reptiles and amphibians, a few words on ailments, and comments on major species. The text is shallow, though with more practical advice than Schmidt, and a sound, if dated, section on constructing indoor cages and tanks. I dislike the absence of scientific names, and statements such as "there are only three distinct species of salamander!" The line drawings are pitiful (and I criticize from the Olympian heights of one whose drawings attracted this heartfelt comment from a Zoology tutor: "a stunted seven year old could do better"). The book has passed out of print, and few will clamour for its return.

Beginning the Terrarium is by Mervin F. Roberts, T.F.H. 1961. This provides a smattering of sound, if superficial, advice on setting up various types of vivaria—desert, woodland, bog, shoreline, aquatic—and unlike others from that publisher does not overwhelm with illustrations to the detriment of information. However the section on outdoor vivaria is miniscule, and I would contest the recommended dimensions of vivaria for different species. Pat formulae ("50 square inches per inch of shell length for the first turtle and 25 square inches per inch of shell for each additional turtle" etc.) ignore the enormous variability in habit and mobility between species under the glib umbrella of "turtle" or "lizard." And the formulae will lead to extreme overcrowding; use of the above neat maths would squeeze four three inch "turtles" into a vanishingly small mini-vivarium of 30 inches by 12 inches!

Next time I discuss two further introductory guides that attain higher standards, and should prove of practical help to child, hard-pressed parent of said child, and to the novice.

Lionfish cannot be recommended as suitable inhabitants of a community tank as they will eat any fish small enough for them to swallow. They are not aggressive towards fish comparable in size to themselves and are unlikely to initiate an attack, but their habit of suddenly erecting their dorsal spines when startled can accidentally cause poisoning of some innocent fish in the neighbourhood. This apparently does not apply to members of their own species, as ours behave with the utmost placidity towards each other and neither has suffered from living together.

In their native habitat lionfish only eat living prey. They live mainly in deep water at the edges of reefs, often lurking in caves or under rocks, flashing forward as a small fish approaches and, with a sharp inhalation, drawing it into their capacious mouths.

From the beginning our fish fed voraciously on small living shrimps and frozen misa shrimps. Fully grown shrimps at this stage, were ignored and lived undisturbed by the lionfish. We have tended to give them mainly living food, including small surplus fish from the tropical tanks, but lionfish can be accustomed to seizing and eating dead food, such as prawn, earth-

worm and even fragments of beef, as it sinks slowly through the water. In time some will retrieve it from the bottom of the aquarium.

Initially, to teach them to accept it, dead food should be dropped as near the heads of the lionfish as possible. With patience, it is not difficult to persuade them to take morsels from the fingers, care being exercised of course to avoid contact with their spines. They are greedy fish and require ample food if they are to make steady growth towards maturity.

Pterois volitans occurs naturally in the Indo-Pacific region, including the Red Sea. Adults live principally on the coral reefs but young fish inhabit brackish lagoons and estuaries.

Other species which become available from time to time are the White-fin lionfish, *Pterois radiata*, perhaps the most beautiful of the species, with dark narrow bands crossing the reddish-brown body and pectoral rays, varying from pink to white, extending to the end of the tail and the Spot-fin lionfish, *Pterois antennata*, irregularly banded and with feathery tentacles surmounting the eyes. Both species have a maximum length of eight inches.

HERPETOLOGISTS AND THE LAW

by Andrew Allen

FOR THE first time, capture or purchase of certain reptile and amphibian species has passed into the realm of legal control. This departure from the old *laissez-faire* days pleases the conservationist, and should prove of benefit to the serious vivarium keeper.

Formerly controls were solely through minor local regulations. For example: earlier this year two sand lizard hunters were fined £20 each for poaching twenty four animals from the famed beauty spots of Frensham Common in Surrey. Waverley District Council brought the action under National Trust bye-laws. But such legal coverage was inadequate with respect to 'reserves' in general, let alone localities without formal status.

The situation has changed with recent passing of the Wild Creatures and Wild Plant Protection Bill, steered through parliament by Mr. Peter Hardy, and linking into the Washington Convention on international trade in endangered species. It is today illegal to collect Natterjack toad (*Bufo calamita*), Sand lizard (*Lacerta agilis*) or Smooth snake (*Coronella austriaca*) in the field, or to import them from abroad. Authorities are empowered to hold doubtful specimens at the entry point, at importer's expense, until they have been identified by a competent herpe-

tologist. Maximum penalties for each offender are £100 per species.

In a trade where profit margins are thin, amateurs not rich, such fines should prove an adequate deterrent—offenders are more probable among private enthusiasts poaching or smuggling than among dealers who must advertise to sell.

Hopefully the bill foreshadows a day when the entire world herpetofauna will be guarded beneath an umbrella of fluid and flexible controls. Catching and import of rare species would be prohibited, but only regulated for other animals (e.g. import of baby terrapins would be cut to prevent enormous sales in the high street pet store, but a quota of animals for serious hobbyists made available through authorised dealers).

All this bears the odious stench of self-multiplying bureaucracy. But some regulation is imperative if rare species are to be maintained for naturalist and vivarium keeper, and new rarities not generated. The new laws were overdue, but should now provide a backbone to our national conservation programmes. Intelligent voluntary restraint by vivarium enthusiast and dealer would prevent the necessity for further red tape to cover species like Crested newt, of further laws in a country already overburdened with law.

Although this filter was designed for a marine set-up, where the ecosystem is very inflexible, I believe it could also be very advantageous to a fresh-water set-up where under-gravel filtration is used. The algal growth will help supplement the oxygenation brought about by the plant life in the aquarium which

is quite often poor with an under-gravel filter due to root disturbance.

Finally cost. I am happy to say that the complete set-up and installation cost me under £1 so that this kind of set-up may be enjoyed by even those on the lowest income.

FOR THE HERPETOLOGIST'S BOOKSHELF

by Andrew Allen

AFTER A FLURRY of criticism in my last review, it is a pleasure to discuss two unpretentious little books that offer lucid advice for those setting up their first vivarium. Like all introductory works they must needs be full of gaps and somewhat superficial, primers not manuals. But charming prose and thoughtful bibliographies over-ride this 'fault', render them invaluable to child or tyro, and a pleasing hour's reading for the more experienced.

The Vivarium and the Terrarium is by Joy O. I. Spoczynska (Nelson, 1967, 66pps.). The authoress is a schoolteacher with personal experience of guiding kids through the formative biological years, plus experience of writing in the erudite journals. These are good qualifications.

Her book is short on pretty pictures, strong on practical advice. Directed, perhaps, at ten to fifteen year-olds, the appropriate level and tone have been attained. The writing style is easy, the line drawings passable. Chapters cover the different groups, design and construction of indoor vivaria, instructions for establishing tropical and fern gardens in the house.

The excitements of the subject are conveyed, but supplemented by solid information on building vivaria, selecting plants, choosing appropriate animals, getting temperature, humidity and lighting just so. Emphasis rests on the enjoyment to be derived from studying undemanding species; gain experience on the simple things, and eventually the complex will fall into place. The young reader would delight in arranging a beautiful vivarium for a couple of toads, and not hanker too soon for iguanas and pythons. In addition this book would prove ideal for a biology teacher planning class projects, and able to add personal advice to the written word.

In similar vein is *Terrariums—an Insight into Container Gardening*, by John Hoke, 1972 and second edition 1974, Franklin Watts. This little book comprises 80pps. of large print, adorned by black and white photos that are both beautiful and in-

structive. It concerns itself with design, construction and maintenance of elegantly planted terraria, rather than with the specific care of reptiles.

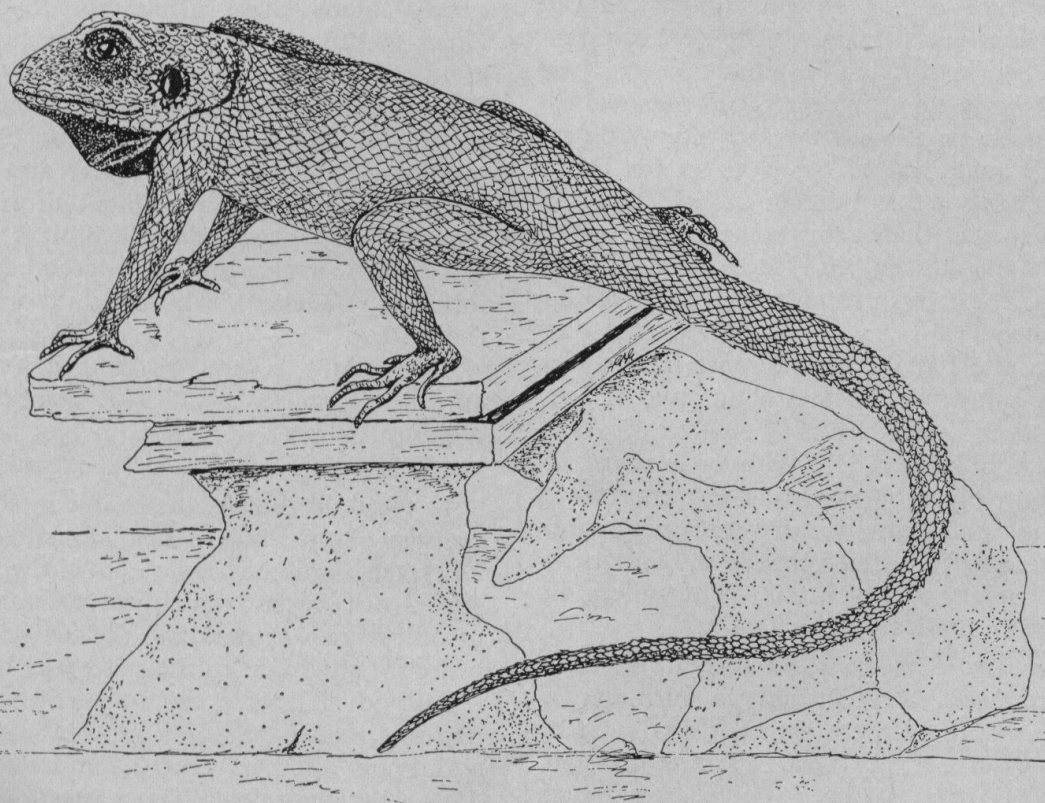
The attitude taken is admirable. Terraria are bits of nature brought into the home. Each terrarium should be a miniature functioning ecosystem, able to perpetuate itself. Terrarium management should be based on ecological understanding, and planned control of the environment. A trendy tone? Well, yes. But it is nicely put across, and backed by hard advice. Chapters deal with lighting, soil condition, moisture, temperature, seasonal variation, cleanliness and ventilation. Choice of plants receives attention. The merits of different containers—glasses, bowls, domes, cylinders, cases—are discussed. There is a good bibliography, referring to slightly more detailed works on ecology, reptiles and house plants.

For a child just taking a first interest in reptiles and vivaria, I would recommend that three small books be bought. One is Hoke's work on terraria, for its distillation of the ethos of vivarium management: the vivarium is not just a backdrop, a pretty frame, for the animals at its focus; it is a complete living system. The total system must work harmoniously if its occupants are to flourish. Such a working terrarium is the first key to success with reptiles. Second book would be a *Study of Reptiles and Amphibians* by Leutscher, reviewed in *The Aquarist* of January, 1974, for its painless introduction to the fascination of reptiles and amphibians as a biological group. Third would come Joy Spoczynska's book, for its practical advice on elementary care of vivaria and their inmates, in its unpretentious, responsible style. This trio should send any youngster off to a good start, initial sights set on readily attainable targets.

Unfortunately when the time comes to progress from these primers, there is little to progress too! My next article probes a particularly poor vivarium manual.

A RECENT IMPORTATION OF AGAMAS

by H. G. B. Gilpin



EARLY in January this year a friend of mine received a group of eleven so-called Rainbow Lizards—*Agama gama*—from Ghana. They were certified healthy by a veterinary surgeon before leaving Africa and travelled in a large, well perforated hardboard box, by air. Immediately on arrival they were placed in a heated laboratory tank. According to one authority, Agamas are best maintained at 37°-39°C., temperatures above 5°C. proving lethal. Personally I have found 30°C. acceptable.

Five days later, three of the lizards, a male and two females, came to me. All three were a dark, greenish-brown colour, rather lighter on the tail, their toes barred with light and dark brown. The male was 4 in. in overall length, his laterally flattened tail one

and a half times as long as his head and body, and the dewlap hanging beneath his lower jaw a reddish hue. He sported a low crest, just behind his head, and a line of spiked scales along the upper surface of the tail. Pointed scales tended to stand out along the sides of the tail, giving a prickly sensation when handled.

The females were 8 in. in overall length and lacked the dewlap and crest. All three lizards possessed prominent eye sockets, jaws equipped with strong, pointed teeth and relatively large auditory apertures, surrounded by small spines.

They were placed in a 30 in. long, 15 in. wide and 12 in. high glass-sided, angle iron vivarium, heated from above by one 60 watt and one 25 watt electric

light bulb. A rockery, surmounted by two overhanging slabs of slate immediately below the 60 watt bulb, and containing a shady retreat, occupied one corner. The floor level was divided by a "dry stone wall" into two halves. One half was covered with coral sand and the other with a slope of moist—not wet—soil, two inches deep in front rising to four inches deep at the back. A watervessel was sunk to the level of its rim in the soil, which was sprayed with a fine mist of water whenever it showed signs of becoming too dry. The reason for this arrangement was that, from their extended abdomens, both females appeared to be gravid and hopes are entertained that they will breed.

These Agamas are egg-layers and under natural conditions breeding takes place during or towards the end of the wet season. The female lowers her head, arches her body on stiffly stretched legs, raises her tail and turns her rear end towards any male in full colour. The male grasps her neck in his teeth and, with one foreleg across her back, slides his tail underneath hers so that their vents come into contact. Seminal fluid is introduced into the cloaca of the female by one of the two intromittant organs (hemipenes) of the male.

In due course, the female, by alternate use of her forefeet, scrapes a hole in the soil about two inches deep. Five to seven cream, leathery shelled eggs are deposited in the hole and covered with earth which is tamped firmly into place by prodding movements of the head. During the eight to 10 weeks incubation period, these eggs absorb water from the soil and grow considerably in weight and volume. The emerging young are miniature replicas of the adults.

Agamas are voracious feeders and catholic in diet. Basically they are insect eaters strongly favouring ants, but cases are on record of them eating a small snake, a scorpion, sea-slaters, a tiny bird, infant rats, their own offspring, brightly coloured fruits and bread crumbs (!).

My three fed freely within an hour or so of their arrival and during the first few days demolished three three-quarter-inch slugs, some scraps of raw beef, an earthworm and over a dozen locusts ranging in size from one inch hoppers to adults. The hoppers were swallowed whole but only the abdomens of the adult locusts were swallowed, the thorax, legs and wings being discarded. At present, owing to a temporary shortage of locusts, their diet consists mainly of gentles and blow-flies. The maggots are seized in the Agama's jaws, chewed once or twice and swallowed. The flies are usually taken when they crawl near the lizards but quite often an Agama makes a standing jump of a foot or more to seize an insect otherwise out of reach.

One of the most fascinating aspects of *Agama agama* is the facility with which the male changes colour.

The first indication I had of this occurred when he was taken in hand for detailed examination. Although he was unenthusiastic about being picked up, he did not struggle unduly nor, in spite of opening his mouth widely in a warning off gesture, did he attempt to bite. His head, gular sac and the middle of his tail, however, did turn dull red.

A more spectacular colour change, for no apparent reason, took place one evening at 6.00 p.m. when he was lying on the flat slab of slate beneath the stronger electric light bulb. His head, neck, throat, dewlap and the middle third of his tail turned a brilliant orange red whilst the remaining two thirds of his tail and the rest of his body became steel blue. This ornate colour phase lasted until 9.00 p.m. and then faded to the original brown. He has since assumed vivid coloration on a number of occasions. The females show little variation in colour. One, usually to be found in the shade, is invariably dark greenish brown with whitish underparts and the other, constantly found in the open, is a uniform pale, brownish cream. Both occasionally exhibit a reddish flush on the dorsal surface and the darker specimen, at rare intervals, develops a broad dull orange flash along the sides.

The bright coloration in males varies to some extent geographically. For example in Western Nigeria the head is orange, in Northern Nigeria deep yellow and in Eastern Nigeria vermilion.

In the wild these Agamas live in strongly territorial groups comprising males, females and juveniles. Only the dominant male shows the bright colour in sexual display and territorial defence and he reverts to dull brown as darkness approaches and the lizards retire for the night to their sleeping quarters.

Individual lizards can be identified by their gular patterns, consisting of a network of faint grey lines and spots on the greyish underside of the head. These patterns persist unchanged in any one lizard throughout life but no two animals possess identical designs.

My three Agamas spend most of the day in a state of immobility, the male and one female basking on the slate slab and the other female below it. Towards evening they become very active moving rapidly around the tank between "halt" periods when they pose with their legs so stiffly erected that the space between their abdomens and the ground is greater than the depth of the bodies.

Even when static during the day they remain acutely conscious of their surroundings and detect movements outside the vivarium eight feet and more away. Such movements do not disturb the Agama's immobility but if one approaches within fifteen inches of the vivarium, the females beat a hasty retreat into the fastnesses of the rockery and the male parades rapidly around his territory.

FOR THE HERPETOLOGIST'S BOOKSHELF

by Andrew Allen

THIS MONTH I gravitate down into the quality basement of the vivarium literature, to discuss *Reptiles and Amphibians in Your Home*, by John F. Breen, T.F.H. Publications, 1967, 281pps.

A few compliments can be hurried out of the way: the book is compact and well bound, full of attractive but static photographs. That summarizes all the virtues. Let us turn to the inadequacies.

Despite the title, there is no chapter on amphibians. In generous compensation, photographs of frogs and salamanders are scattered, like confetti, richly but at random, through the chapters on lizards, tortoises, etc. Most of the species described are North American, with chapters on crocodiles, lizards, snakes and tortoises giving shallow coverage of both the species themselves and of their care in captivity. The level of prose and respect for fact is not lofty. Try this little bouquet of aphorism, anthropomorphism and delusion:

'a sound basis for further reading'—the book has no bibliography!

'therefore this book contributes a great deal to the education and welfare of the coming generation'.

'even Ireland, with its very meagre reptile fauna has several native lizards—green ones at that!'

Yes!!! (Ireland has only one native lizard, and that's not green; Breen also makes the mistake of attributing this paucity to a vicious climate, not a history of isolation by the sea).

'snakes in general are among the hardiest of vertebrate animals under captive conditions'.

'there is little reason why the average mature individual should deny himself the pleasure and knowledge to be obtained by the keeping of Gila monsters and poisonous snakes'.

Snapping turtles are 'grotesque and amusing inmates'.

'Box turtles are highly intelligent, and like most intellectually endowed humans, are rugged individualists'.

Save for a handful of new facts I gained nothing from this book, which is seemingly directed at a fraternity described as 'collectors' and 'fanciers'.

In *The Aquarist* of December, 1974 I read a review by Eberharde Schulze of T.F.H. publication's rehash botch-job of Gunther Sterba's epic *Freshwater Fishes of the World*. *Reptiles and Amphibians in Your Home* appears to come from the same mould. Do not buy the book; borrow it from your library, if in cynical mood.

T.F.H. also produce a series of short colour publications upon reptiles, for sale in most pet shops. These are in the "Pet Care" series. Titles cover alligators, 'chamaeleons', frogs and toads, horned toads, snakes, turtles, salamanders and newts. I have not seen them all, and review in particular *Salamanders and Newts*, copyright Axelrod 1958. This is an improvement on Breen's attempt, with good photos on the 18 pages, and a text that is logically developed at a simple level. The nature of newts is introduced, a few hints as to their care in captivity, and comments on a few, mainly American, species. However, the text can pain, as these two quotes show:

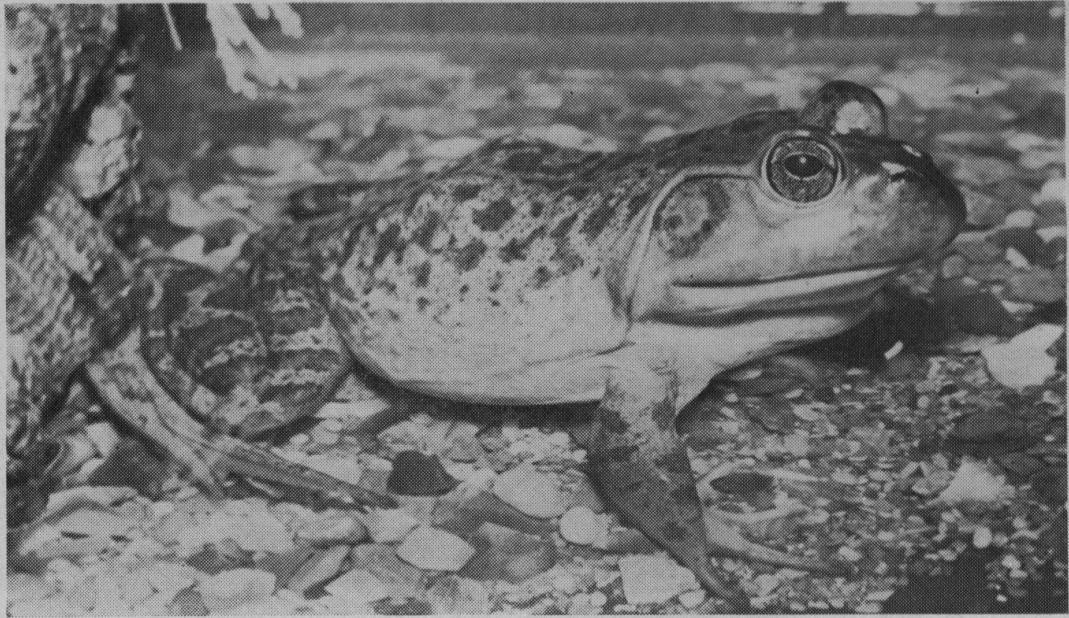
'Well, lizards are different than salamanders'.

'There are big newts and there are small newts and without any doubt you would feed big newts big things and small newts small things'.

The statement that the axolotls displayed in Paris in 1865 were the species *Ambystoma tigrinum* is incorrect.

Also American, and similar in style, are the 'Pet Library' books, e.g. *Enjoy Your Terrarium*, 1967, 32pps. Though of the same genre as the T.F.H. series, there is more meat in this thin booklet, which describes types of vivarium and care of some major groups. It is also noteworthy for the photograph, captioned 'this man is never bored', of a clean-cut, all-American youth staring glassily at a vast cage clogged with greenery, within which no animal is to be seen.

There are various colourful American booklets in the pet shops; it would not be objective to dismiss them all on the basis of my small sample. Suffice to say that none I have seen merit attention. Next time I shall discuss a more competent and pleasing sector of the vivarium literature.



THE BULL FROG

by Andrew Allen

Rana catesbeiana is undeniably the most impressive batrachian from North America, and among the most splendid in its colours. To most people it is *the* frog, that big green creature of the imagination that basks always on great lily pads.

It is the largest frog in North America, often six inches in length, with a record of eight inches—plus lots and lots of leg! It may be readily distinguished from other large New World frogs through the total absence of dorsolateral ridges along the trunk.

Most bull-frogs are coloured a vivid and unbroken grass-green, a lovely colour, proper to the smooth, enamelled surface of these amphibians. The belly is white or pale grey. But colour variations abound, and the green often becomes mottled with olive, or grey, or brown, a patterned mosaic that in the deep South tends towards black.

The species lives across most of the United States, but its stronghold is in the South and East. Once absent from the West coast, the natural limits to its distribution have been obscured by a series of introductions, and bull-frogs now inhabit California and other Pacific states. To the North, the bull-frog edges into Canada, to outposts in British Columbia,

the Great Lakes, New Brunswick, the Gaspée of Quebec, and Nova Scotia (including Cape Breton island)—but cannot be numbered among the truly hardy frogs of the continent. Thanks to further introductions, it is now established in Cuba, Mexico, and an assortment of offshore islands, large and small.

The bull-frog is impressive not only in dimensions, but in voice. Its call is a sonorous bass roar, a resonating boom most offensive to musical ears, optimistically rendered by Conant as *Jug o' Rum, Jug o' Rum, Jug O' RUM*. Vocally, it is first cousin to Concorde, rendering large areas uninhabitable to those with delicate eardrums. The call is generated and resonated within a single internal vocal sac.

In the North, cold weather mercifully curtails the breeding season and vocal activity to two months, usually May and June. But in the South, breeding occurs continuously between January and October, and the torture is prolonged. The female lays up to twenty thousand eggs, which hatch within a week. The tadpoles take between one and three years to develop, and themselves grow to six or seven inches in length. Bull-frogs can breed only in permanent water bodies that are in no danger of drying out.

Bull-frogs are truly aquatic, and encountered but

rarely in broken country or beside small ponds and streams. They pass their lives in lakes, canals and rivers, among the reed beds of the marshes, among the cotton-tufted sedges of the fens, beside the dark pools that open into the Sphagnum of the bogs—wherever there is a great open water, and a sun that shines. They are not to be found beneath the swamp alders, or in the forest, or in other dark places. Basking on tangled vegetation at the water's edge, or . . . yes . . . on a lily pad, they possess that love of the sun so rare among amphibians, but shared with those ecological cousins in Europe, the Edible and Marsh frogs (*R. esculenta* and *R. ridibunda*).

Sometimes an injudicious approach will precipitate a long leap into the water. Sometimes, bull-frogs show an amazing unconcern and, besotted with the sun, ignore a falling shadow or a stamping foot. One such, beside a remote Cape Breton lake, let me stoop down and stare it in the eye from two inches, a disconcerting experience for both concerned.

The appetite of the bull-frog matches that considerable volume. In short: it will eat almost anything, from a beetle to a mouse, anything that moves and is not too small to be noticed, so large as to be a predator. A bird in flight, a shrew, a vole, another bull-frog: all these have passed down the capacious, indiscriminate, bull-frog gullet. But aspiration oft exceeds ability. The frog has rather poor eyesight. A passing dragonfly will stimulate a gigantic leap, and a shattering belly-flop splash into the water. The frog surfaces, returns to its sun-pad. The dragonfly continues. Five minutes later—repeat performance—like result. It is good entertainment, for the observer. And sometimes those optimistic leaps must bring reward, for Natural Selection does not smile on the waste of valuable energy.

It will not have passed unnoticed that the bull-frog is likely to pose certain problems to the vivarium keeper. It requires strong sun and, if from the South of the range, a tolerably warm temperature. Those enormous leaps render it completely unsuitable as an inmate of any indoor vivarium. No living-room tank, except on a Blenheim scale, could encompass such acrobatics. In a small vivarium it is certain to damage its skin against walls and roof, causing skin lesions and the entry of a variety of pathogens. A large greenhouse or conservatory might prove the answer to these problems, with or without supplementary heating according to the local climate and geographical origin of the animals.

But the voice . . . is a different class or problem, a quite Royal Problem. With tact, and soft sell, and a box of chocolates, one can sometimes persuade a doubting family that the call of a tree frog is music most lyrical, a romantic trill from the Southern olive groves, associated with cicadas, aioli, cypresses and mellow walls. One would lie, but one might succeed. A North Sea foghorn at 2 a.m., from a dozen feet, requires doubtless a different technique, one that has so far escaped me, and a much richer and more persuasive set of lies. Then there are the neighbours: a foghorn audible at several hundred yards may be acceptable on Dartmoor, but does not win friends in Tooting, where it may also contravene local bye-laws.

These are minor blemishes. The bull-frog is a magnificent frog in its colour and scale of life, one that makes a powerful impact on the herpetologist. And unlike such other giants as the Goliath frog and Blomberg's toad, it may be viewed without the bother of organizing a tropical expedition, just by purchasing an air ticket to any major centre in the Eastern U.S. That is all that really need be said.

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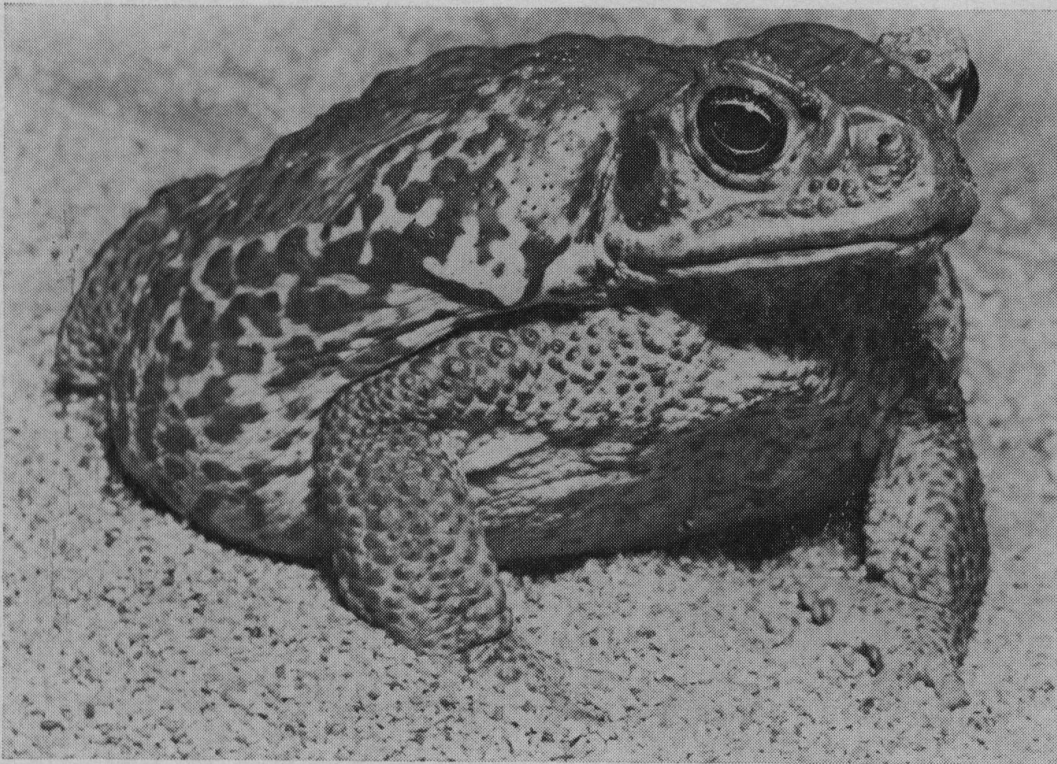
THE GIANT TOAD

by Andrew Allen

Bufo marinus is not the largest toad in the world; that distinction probably falls to *B. blombergi*, a spectacular batrachian from remote Columbia, or to the Rococo toad *B. paracnemis* from Brazil and Bolivia, both of which frequently exceed lengths of ten inches. But the Giant (so-called Marine) toad runs them close in the dimension stakes, with a maximum recorded length of nine and three-eighth inches. That is quite enough, particularly in an animal as rotund as the toad. The homely British toad rarely surpasses four inches, though I measured one member of its Southern sub-species *B. b. spinosus* that was eight inches long.

pests—one toad consumes a hundred beetles a week over a lifetime that often exceeds twenty years. The species is imported regularly into Britain, and sells at a moderate price. With their abundance in the wild and precocious fecundity, these are ideal amphibians for the herpetologist who wants to be certain that his activities cause no harm to natural populations.

Across their natural range, the Giant toads exhibit a most impressive ecological tolerance, exploiting an impressive array of different habitats. To the traveller in north Brazil, Venezuela, Guyana or the Carribean, this is the ubiquitous toad of the neotropics, at home in forest, marsh or savannah, from



Even if not the *most* giant of toads, *B. marinus* is certainly the most abundant and accessible of the giant toad species. It is distributed across northern South America, through Central America, and into the southern United States. A series of introductions have extended this range to Hawii, Puerto Rico, Haiti and the Solomon islands, indeed to most lands where sugar is grown, for the Giant toad is an important agent of biological control in the war against beetle

the arid plains to the lakes, from sea level to the high plateaux, even into mildly saline waters that are barred to most amphibians. The advent of man has boosted populations, a statement that the herpetologist can make but rarely, a statement certainly untrue for most European species. Giant toads attain their highest densities on cultivated land, and abound in the South American villages, living in the houses, the gutters, the outbuildings. Often they are feared, but

tolerated because their consumption of pest insects is so prodigious.

The only limiting factor known to control their distribution is temperature. Cold weather sets limits in the southern United States and on the higher mountains of South America, but other abiotic checks upon the species, save for high salinity and extreme dehydration, have not been demonstrated.

Few predators care to tackle this toad, for its swollen parotid glands exude a milky poison that inflames mucus membranes, paralyzes muscles and causes the heart to slow, or to stop beating. As in most bufonid poisons, the active chemicals are related to digitalin and, used judiciously, could have wide applications in heart therapy. The deaths of inquisitive dogs are reported sufficiently often to become commonplace, but the tales of paralysis, sickness and contortion grow no prettier with the repetition. Certain native predators have evolved subtle techniques to cope with this bundle of poison; mongoose and mustelids rip away the skin with their claws, while large crows disembowel the toads with strokes of the beak, and leave only the skin. Legends that this toad can actively squirt poison have never, to my knowledge, been justified, though it does employ powerful muscles to squeeze the secretion through the large pores on its skin.

In addition to anti-predator devices, catholic diet, and broad ecological tolerance, a key reason for the success of the species is its fecundity. Each female lays up to 40,000 eggs (our Common toad lays between 2,000 and 6,000), and may spawn more than once in a year if conditions permit. Breeding is usually governed by time and duration of the rainy season, and may be explosive if breeding waters are ephemeral.

The call of the male is a low frequency trill, of around 600 Hz. Call frequency in batrachians appears to be simply correlated with body size: the tiny American bufonid, *B. quercus*, sings at 5,200 Hz. Within the species *B. viridis*, the largest individuals from Israel sing at 1,100 Hz, while the smallest toads in Austria sing at 1,500 Hz. Here the differing frequency is a by-product of size, which is related to water loss and adaptation to different climates.

It is not only from the viewpoint of conservation that *B. marinus* makes an ideal toad for the vivarium. In virtually every respect it is an easy species, and only in very incompetent hands will it fail to live twenty years and spawn regularly.

Firstly, it is not demanding in terms of space. A pair will live successfully and comfortably in a two-foot aquarium, or any larger size. This may prove unsatisfactory for those who would watch their toads in movement, and is certainly too small for the purposes of breeding. But it illustrates the principle that giant toads may be housed in an average vivarium, their requirements for exercise not matching their

volume. I would contrast this situation with the care of another anuran giant, the Bull-frog *Rana catesbaeina*, discussed in another article. The giant leaps of the frog, its tendency to panic and its foghorn voice all render it unsuitable for the indoor vivarium. But the Giant toad is stolid and sensible, less noisy, and less inclined to waste energy in senseless acrobatics.

In terms of vivarium layout—almost anything goes. Ignore potted experts with potted recipes; when a species has a narrow ecological tolerance it is essential to get conditions just right, but this is mere pedantry with an animal as tolerant as the Giant toad. People have housed these toads in semi-aquatic conditions, without ill-effect, though this is probably not the optimum method, and imposes the need to regularly filter or change the water. Equally they thrive in a fairly dry vivarium, with just a small water bowl, though a refreshing shower at three day intervals will be much appreciated. Half flowerpots or other shelters should be provided. They will thrive also in a thick glutinous mud. Peat should be avoided as a substrate.

Finesse in design is quite superfluous. Giant toads are anti-aesthetes, and tend to park their substantial weight just where it so pleases them, and it often pleases them to sit on delicate ferns or lovely marginals. A simple design is preferable, also, for hygiene, as Giant toads foul up their quarters at a greater rate than smaller, more abstemious kin.

The most stringent requirements concern temperature. These are not hardy animals, and ordinary British temperatures fall well below their optimum. A mean temperature of 80°F is preferable, raised perhaps to 85° by day, and 70-75° at night.

Feeding Giant toads is purest simplicity. They will take anything that moves, but is not so small as to earn their contempt. Mice, chicks and lizards are consumed with ease. But as they prosper equally on locusts, bluebottles, mealworms, maggots and earthworms, it is perhaps better to feed the latter set where there is a lower possibility of 'cruelty.'" Still, I am not here to moralize. Although these toads will survive for a fair time on a monotonous diet, their long term health requires that the menu be varied to ensure a balanced spectrum of nutrients and vitamins, and particularly to avoid calcium deficiency. If the diet is for some reason monotonous, it should be supplemented with an appropriate vitamin preparation. The other essential is quantity: their appetite is colossal, and batrachian bliss demands a never-ending input of food, a demand that places you in the unenviable position of legendary Sisyphus.

As a curiosity, the Giant toad is one of only two batrachians that will, in my experience, catch and eat such stationary foods as pet meat and stew. Most other frogs and toads take only moving prey. Unfortunately, only a small proportion of these toads

acquire the habit, and it scarcely offers an alternative to the capture or breeding of live foods.

It will have become sufficiently obvious that the Giant toad is not the ideal community animal, eating anything smaller than itself, and contaminating the common water supply with its potent secretions. I do know of instances where they have successfully

been housed with other species, including terrapins and large lizards, but cannot summon the courage to predict "ideal" combinations. However, they are interesting animals on their own, and a good choice for the herpetologist who seeks to study something exotic, yet, for reasons of time or inclination, does not want to be faced with the subtle problems posed by many tropical species.

VIEWPOINT continued from page 152

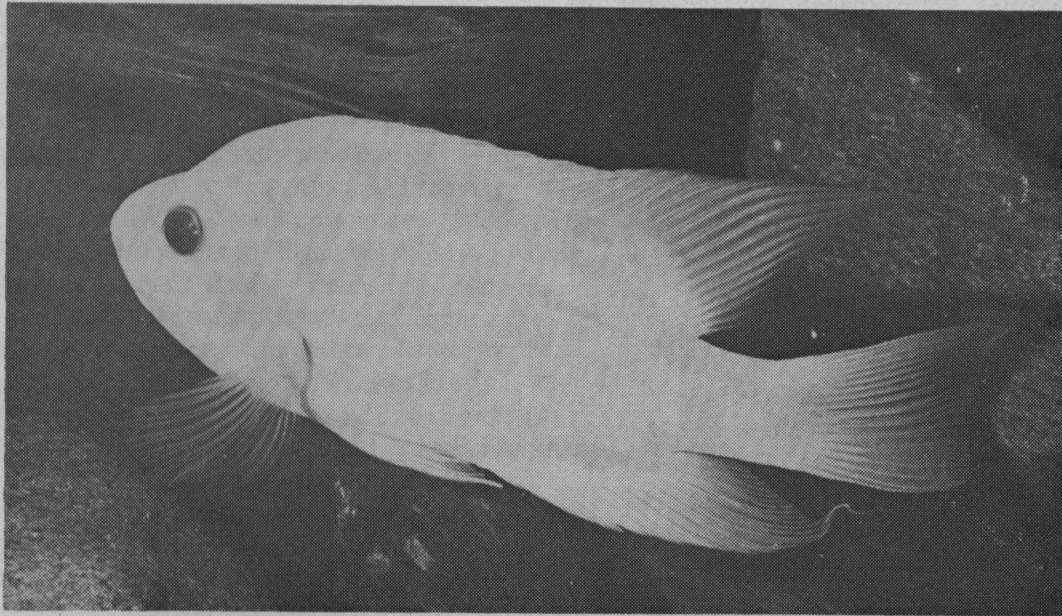
differences between similar species and in fact a long-standing query of mine regarding distinction between *Calichthys calichthys* and *Hoplosternum thoracatum* was immediately settled. Price is 59p from Miss Fran Rogers of 255 Lewisham Way, London SE4.

Secondly, the British Koi-Keepers' Association has revamped its newsletter into a fully-fledged journal which is extremely well-produced and full of interesting articles on Koi and related topics. Internal politics are kept to a minimum and the whole thing is very

informative. Acquisition is by membership, information on this being available from Miss Valerie Frost of 76 Edward St., Southborough, Nr. Tunbridge Wells, Kent.

* * *

Finally this month I would like to thank Mrs. D. Tyrer of Cellar Aquatics, Milnthorpe, Cumbria, and Mr. A. Adams of Comberton, Cambridge, who very kindly sent me old reading material in response to my recent appeal in these pages.



THE RED DEVIL

Written and Illustrated by Jorgen Hansen and Pamela Stewart

WE OBTAINED OUR two devil cichlids, *Cichlasoma citrinellum*, together with four Oscar, *Astronotus ocellatus*; as they were all of approximately the same size, we placed them together in a 200-litre chipboard tank. In the course of relatively few hours we realized that these two species should absolutely not be placed together. The larger of the red devils lived

up to its name in its behaviour towards the others, so we moved the four Oscars to another tank, leaving the devils to themselves in the original tank.

We were, and still are, unsure as to whether we had a pair or not, but one thing was clear from the start—the larger (about 30 cm. or 12 ins.) could not stand the sight of the smaller (about 20 cm. or 8 ins.). To

FOR THE HERPETOLOGIST'S BOOKSHELF

by *Andrew Allen*

AFTER THE displeasure of reviewing a very poor vivarium book (*Reptiles and Amphibians in Your Home*, by Breen, T.F.H.), let me now discuss the most charming of them all. I refer, of course, to *Living With Reptiles* by Kathleen Pickard-Smith, Nelson.

This is a highly personal account of one woman's individual experiences with reptiles. The writing is fluid and crisp, the account makes truly compulsive reading. Follow the author through the starting joys and pangs, meet her animal friends, Ig, Drag, the famous Green lizards, a host of species familiar and exotic, villains and charmers, a panorama of characters to enthrall and captivate. Enjoy descriptions of animal private lives, loves, and relationships, as sensitive as any penned by the literary naturalists. And through the lizards and toads meet, in the background, a very nice person.

These words could give a somewhat misleading impression, suggesting a gushing flood of sentiment such as might be penned by Miss Hazel Fortescue of 'Love Nest' Worthing about her manicured poodle 'Dearie'. This is an individual book about animals, written with obvious affection and sympathy. It is not soft or sentimental: my comments, in that case, would be less friendly. The reptiles are left as reptiles, not transmuted into smiling little miniature people. And Miss Pickard-Smith is candid about her failures and disappointments. Lizards sometimes do eat one another. Favourite animals do remorselessly die after months of personal attention and doctoring; after they die you often discover how easily they . . . could . . . have been saved. The book portrays anguish as well as joy, the resilience needed if appreciation of animals is to be personal as well as scientific. It is a book of greater intensity than could be conceived by any fancier or hobbyist.

And one learns from it—even if, as in my case, the philosophy towards animals is very different. Though in no sense a manual, the pages are crammed with information. I learnt more vivarium lore from Miss Pickard-Smith than from the sum of all vivarium manuals yet published. There are fascinating hints,

much data on care of different species, the recounting of pitfalls tumbled into, advice on what to do—how to improvise—when things don't run by the text book. Coping with problems is a subject the good books do not deign to consider; perhaps if you follow their advice no problems ever crop up? Breen's book claims that it 'contributes a great deal to the education and welfare of the coming generation'. Miss Pickard-Smith makes no such claim, and we like her the better for this. Hers is not a proud book, though it would be justification for pride. One senses in its unpretentiousness a desire to communicate pleasure rather than to get the name in print.

There are a selection of black and white photos depicting vivaria and their occupants. Technically these are not classics in the superb modern genre, but they do enhance the individualistic impact. Most libraries will be able to get you a copy, but this is worth a cherished place on the bookshelf. It must remain the only herpetological example of its kind; the impact can occur once only, and similar attempts, even if technically more proficient, would just be boring imitations.

In a similar tradition of sound vivarium keeping is the little booklet *Hardy Reptiles and Amphibians*, by L. G. Payne in the 'Water Life' series, 32 pps. This is a compact storehouse of useful information for the inexperienced herpetologist. Design of vivaria is fully discussed, with practical construction details, including excellent accounts of the outdoor reptiliary and a home-made lizard house. There are sections on community groupings, foods, and descriptions of hardy European species (plus a few intruders like the axolotl) and their requirements. The readable text is supplemented by rather dull and dated black and white photos. In its solid merit it contrasts sharply with the glossy but slick T.F.H. brochures discussed earlier. Unfortunately it is now out of print.

Next time I discuss two vivarium manuals suitable for practical day-to-day use.

A MIXED BAG

by H. G. B. Gilpin

EARLY this year some friends of mine presented me with examples of three intriguing species they had encountered living at a fairly high altitude in Majorca. These included two amphibians, a Green Toad, or as it is sometimes called Changeable Toad, *Bufo viridis*, a Laughing Frog, *Rana ridibunda*, and a Wall Gecko, *Tarentola mauritanica*.

Whilst by no means unfamiliar to me in the wild state, these were the first amphibians of their kind I had kept in confinement. On arrival both were placed in an unheated, glass sided, angle iron vivarium measuring thirty inches by eight inches by eight inches.

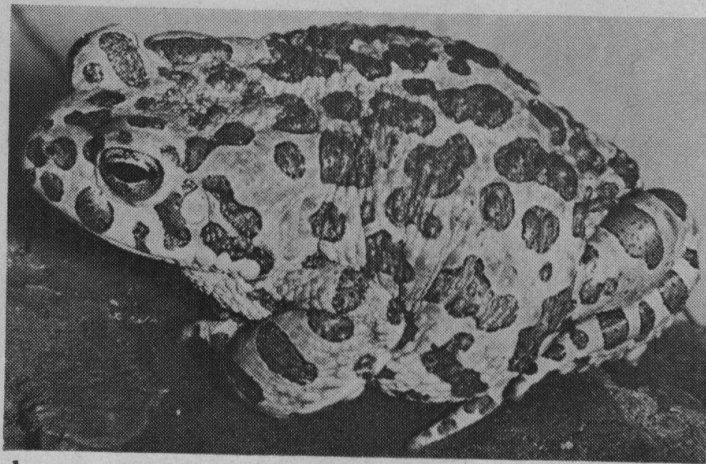
The floor of the vivarium is covered to a depth of two inches with a mixture of sand and loam and furnished with a large "rock" and a piece of old, gnarled tree bark. A vessel, some one inch deep and large enough to accommodate both Anurans at the same time, is set in the soil and filled almost to the top with water, so that no undue flooding occurs when the animals sit in it. Moss is arranged over most of the exposed soil but bare patches are left under and around the bark and "rock" to enable the creatures to bury themselves without difficulty whenever they feel the urge to do so. The vivarium is kept on top of a low bookcase in a shady corner of the living room.

Food is supplied in as large a variety as possible and includes slugs, up to three quarters of an inch in length, small earthworms, blowflies, maggots, spiders, woodlice and, when the other items are in short supply (earthworms were particularly scarce during the spell of hot, dry weather), mealworms. The hard-skinned mealworms are the least popular offering but are taken fairly readily as a last resort.

B. viridis is a handsome toad. My specimen, probably a female, is 7 cms. in overall length which suggests that it is immature, as fully grown members of this species reach 9 cms or even more from nose to vent.

Coloration in this species is somewhat variable. Mine is basically creamy brown on the dorsal surface, heavily marked with numerous, clearly defined and irregularly shaped dark brown patches. These patches tend to become green in a subdued light and the

ground colour also takes on a greenish tinge. The ventral area is greyish white. Many small, round warts are sprinkled over the back and the flattish parotid glands are bean shaped. The webs of the hind feet are comparatively poorly developed and the dark pupils of the protruberant eyes are circled by golden yellow rims.

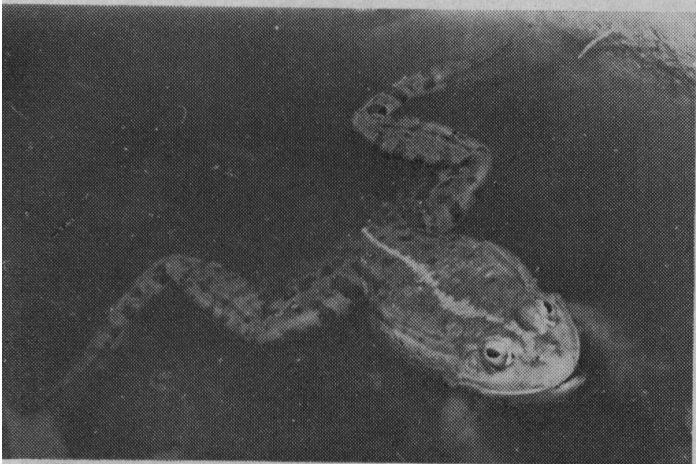


Green Toad

Green toads make very satisfactory vivarium inmates. Judging from my specimen, they are phlegmatic animals, not given to dashing about their quarters, even when closely approached. Neither do they appear distressed when taken into the hand. Mine remains largely quiescent when held, merely emitting a series of muted, rather musical croaks as a mild protest against the indignity of such a close restriction. It spends much of its time in full view, crouched on the summit of the "rock," only occasionally seeking seclusion by burying itself beneath the soil.

Green Toads are said to swim and jump better than other toads. Mine, however, although it spends some time sitting in its water bowl, has given little indication of jumping ability. Spread over much of Eastern Europe, Green Toads inhabit both mountainous and coastal regions and are tolerant of brackish water. They hibernate during the winter, emerging in April to breed. The reproductive cycle is completed during August, after which both adults and the fully developed young settle into their winter retreats.

Laughing Frogs, also known as Marsh Frogs, again adapt well to life in confinement. They are attractive animals and, reaching a length of 15 cms. to 17 cms. are the largest European representatives of their order.



Laughing Frog

My Laughing Frog is still quite small, being no more than 6 cms. in total length. In spite of its modest size, the day after it came into my possession deposited a clump of spawn, about the size of a half walnut shell, in the water vessel. Unfortunately most of the eggs carried white spots, indicating infertility. This animal is most appealing and bears some resemblance to the Edible Frog, *Rana esculenta*. Its snout is rather pointed and the tympanic membranes prominent. The bright green back is ornamented with well spaced, irregularly edged brown patches. Two light brown bands pass from the nostrils, through the eyes, to the posterior end of the body and broad cream bands extend along the upper jaws below the

eyes and tympanic membranes, changing to green in front of the eyes. The sides are brownish cream, marbled with dark brown and the legs brownish green decorated with brown patches. The underside of the body is cream and the dark pupils of the eyes are rimmed with brownish gold.

R. ridibunda is easier to maintain than most frogs in confinement as far as my own experience goes, largely because it does not leap frantically from one end of the vivarium to the other when disturbed and consequently does not damage itself by crashing against the glass, a hazard sometimes encountered with captive frogs. Its placid disposition (for a frog), makes it easy to catch when needed for close examination. Much of its time is spent buried in the soil beneath the bark but it is frequently seen sitting solemnly in the water vessel completely indifferent to movement outside the vivarium.

The Laughing Frog is an East European species but has survived its introduction to the Romney Marsh area in Kent in 1933. Usually found in large stretches of water, its breeding season extends from April to July.

The Wall or Moorish Gecko, current member of the considerable number of these animals I have kept, at 9 cms. long is not yet fully grown. It is a light coloured individual and more nervous than most I have encountered, spending most of its time hidden from view on the far side of the horizontal log resting on the dry sand covered floor of its quarters. After some weeks in my possession it deposited three oval, pure white eggs, each .8 cms. long, one on the visible side of the log and two on the sand. I have bred *T. mauritanica* on a number of occasions but have small hope of a successful hatching from these particular eggs.

PROTECTION SYSTEMS FOR THERMOSTATS

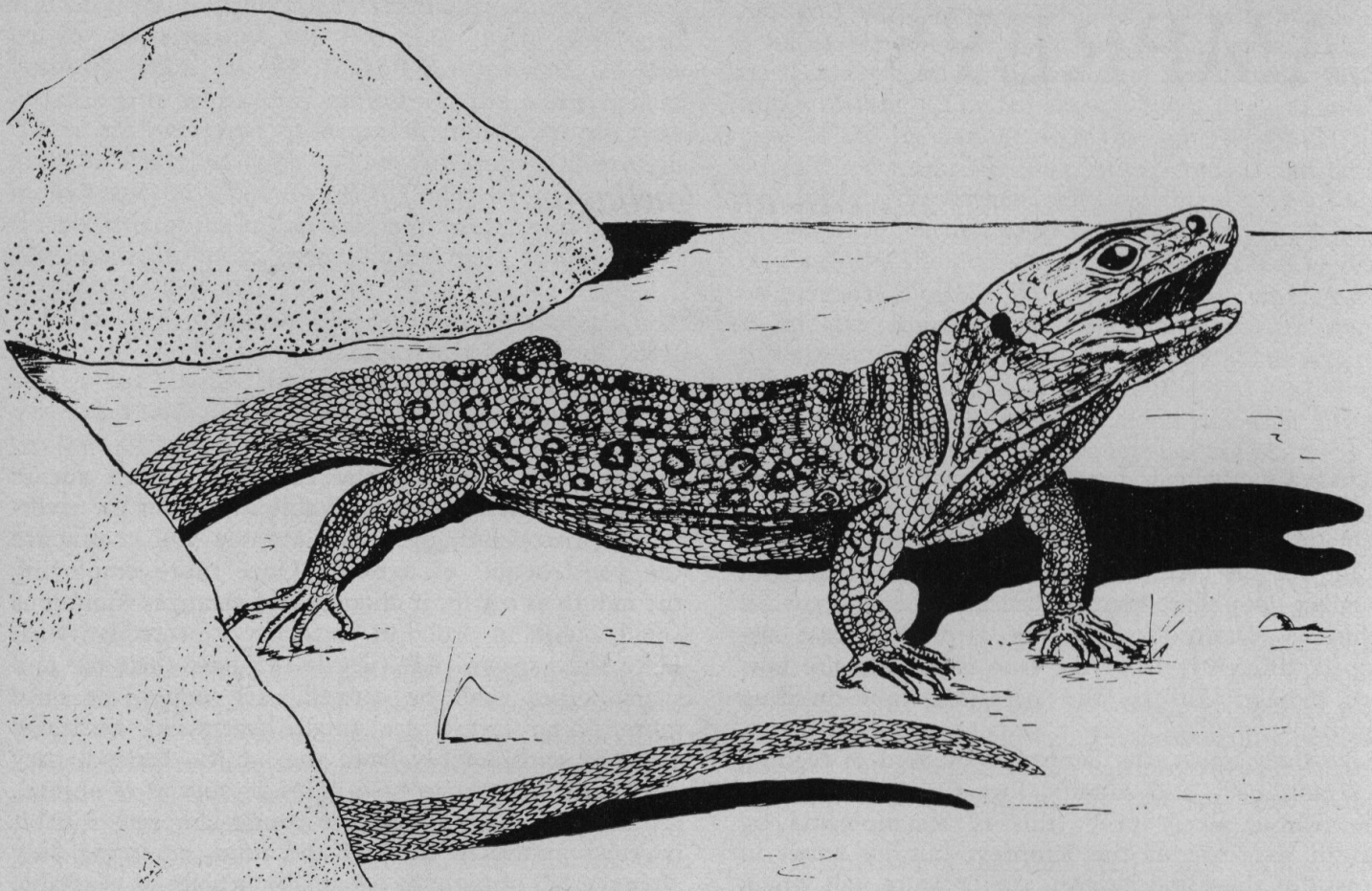
(continued from page 273)

For those people who have tanks in a very cold environment, such as an unheated garden shed in winter, and who therefore fear the thermostat failing to switch on rather than the reverse, fig. 2 takes care of their problem. With this arrangement *a* is set to 8 and *b* to 74. Thermostat *a* again does the switching whilst *b* remains open on standby.

Anyone wishing to protect against both kinds of failure may do so by employing the circuit shown in fig. 3. This uses three thermostats and works in the following manner. Normal switching is carried out by thermostat *a* which is set at 78. If these contacts fail to OPEN the temperature of the tank will rise to around 82, when thermostat *c* comes into operation and the tank is then maintained at around this temperature. If, on the other hand the contacts of *a* fail to CLOSE, the water temperature will fall to

around 74 and *b* will take control. Thus if the aquarist notices that his thermometer reads in the low seventies or in the low eighties, instead of the high seventies, he will know that thermostat *a* has ceased to function and he should replace it as soon as possible. In either event, no great harm will have come to his fish.

I have a biggish tank containing two large Tinfoil Barbs, old friends of mine, and they are protected by this last system; it was expensive to install but worth every penny for the peace of mind. I have used three Slick Stats clipped onto the bank of the tank. Immersion-type thermostats could have been used but they are less convenient to set. I must say that to date I have had no trouble of any kind with my thermostats but if anything does go wrong, my Tinfoils will not suffer!



Lacerta lapida

Written & illustrated by H. G. B. Gilpin

TO MY MIND, by far the most magnificent of European lizards is the Ocellated or Eyed Lizard, *Lacerta lepida*. Rivalling the brilliant green of the Jersey Lizard, *Lacerta viridis*, its back and sides are further ornamented with circular markings reminiscent of the "eyes" on a peacock's tail. Furthermore it has the dignity of size, commonly reaching two feet in length and exceptionally thirty two inches.

My first encounter with the species was on a visit

to Spain. We were driving away from Lake Medina where amongst the grass at the water's edge we found many beautiful little green Tree Frogs, *Hyla hylarum*, and a big green Marsh Frog, *Rana ridibunda*, when we saw a dead Ocellated Lizard lying in the middle of the road. It was a fine specimen, sixteen inches long with broad blue patches standing out vividly against the green of its sides. We often found dead reptiles on the less frequently used roads in

Spain but in a country so rich in predatory birds the corpses were very quickly salvaged.

On one occasion we saw a Black Kite swoop down and seize a snake in its talons only a few score yards in front of the car. Shortly afterwards we saw three large terrapins, *Clemmys leprosa*, basking on the muddy bank of a roadside ditch. They were far more nervous than most of the smaller examples of their race met with in vivaria and "plopped" into the water before we could vacate the car.

My next view of an Ocellated Lizard under natural conditions occurred the following year when visiting Portugal. We were walking through the Foros do Arras, across rough ground between the cork oaks, and came to a pool beside the track. Not far from the water two immature Ocellated Lizards, each about sixteen inches long, were basking in the sun. Alerted by our approach, they quickly disappeared into the undergrowth.

The following day, not far from Castello de Vide, we drew off the track and walked through a farm not far from the Portuguese Spanish border. The surrounding land was largely barren, covered with rough grass and many enormous boulders. On a partially clear space, posed like a stone image, was a large Ocellated Lizard all of twenty four inches in overall length. For several seconds it remained immobile, head raised, front legs stiffly erect and body held rigidly tense. Then it flashed across the ground and disappeared into a horizontal crevice between two big boulders.

Congratulating myself that there was ever possibility of securing it for at least temporary examination, I hastened towards its retreat. My enthusiasm for handling the animal underwent a marked diminution as I examined its refuge. The opening, amply large enough to admit a hand, allowed sufficient light to enter to give me a clear view of the lizard, pressed against the wall at the far end with its head facing outwards and a malevolent gleam in its eyes.

It was a superb specimen, very heavily built, with a head two inches across at its widest part. It was the head that reduced my hope of grasping the animal in my bare hands to vanishing point. Remembering, however, the many times I had picked up lizards with menacing mouths and dangerous looking jaws perfectly safely in vivaria, I decided to test the situation further. To this end I secured a long stick, varying from a half to one inch in diameter and very gently eased it forwards until it was just in front of the lizard's head. A quick snap of its jaws, which completely severed the end of the stick, convinced me that no attempt to capture a fully adult member of the species should be made without proper equipment. Guy Mountfort's description of Eyed Lizards as ferocious seemed well merited.

This specimen was beautifully coloured, basically

green with the top of its massive head infused with brown. Its brownish-green back was laced with green and yellow lines and plentifully bejewelled with "eye-like" markings. Its legs, tail and sides were a brighter green, that of the sides marked with arresting vivid blue patches, rimmed with black. The long tapering tail occupied some two thirds of its total length.

Ocellated Lizards are largely ground dwelling but sometimes climb upwards into bushes and trees. They are active fast moving creatures and tremendous jumpers, capable of clearing five feet in a horizontal leap.

Under pressure they have been known to jump down from a height of sixteen feet, when escaping from an enemy in a tree, without apparent injury.

They feed upon insects, mice, birds, eggs, snakes and lizards and are said to take some fruit. They do a great deal of damage to ground nesting birds and have been seen dragging chicks, sitting birds and half-grown rabbits from their holes. Breeding colonies of Bee-eaters have been found with innumerable tracks of Ocellated Lizards around the nesting burrows.

I have seen Ocellated Lizards offered for sale on occasion but have so far resisted the temptation to buy them. Their carnivorous and cannibalistic habits are a disadvantage in confinement. Their willingness and ability to inflict an unpleasant bite also reduces their suitability for inclusion in vivaria. The bite is not poisonous, of course, but the saliva around the teeth can be toxic and the development of a septic condition around a wound is not unknown. Ditmars describes them as hardy in confinement, however, and with adequate accommodation they would indubitably prove uncommonly interesting.

FOOD FOR SOME!

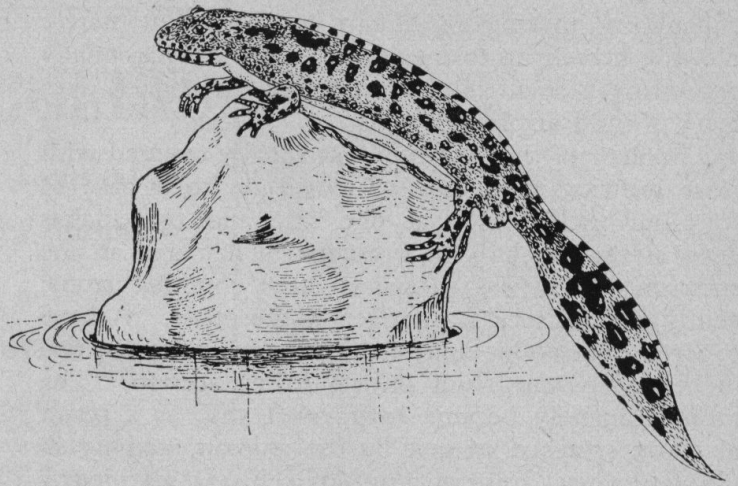
By Hilary Maynard

My 1st is in HOOP but not in KEG,
My 2nd is in ANKLE and also in LEG.
My 3rd is in PARIS but not in ROME,
My 4th is in FAIRYLAND and also in GNOME.
My 5th is in MANLINESS and also in MALE,
My 6th is in YORKSHIRE but not in DALE.
My 7th is in EXPERIMENT but not in PROOF,
My 8th is in ANVIL but not in HOOF.
My 9th is in PLANET but not in MARS,
My 10th is in WEATHER but not in STARS.
My 11th is in NUMEROUS but not in MANY,
My 12th is in WHERE but not in ANY.
My last is in MUG but not in DISH,
My whole are quite liked by Paradise Fish!

Answer on page 312

Triturus *alpestris*

by H. G. B. Gilpin



IT WAS whilst spending a few weeks, one August, at Unterwasser, 3,000 feet up in the Swiss Alps, that I first encountered Alpine Newts, *Triturus alpestris*, living under entirely natural conditions.

One day, having driven along the Linthkral Canal from Lake Zurich towards Nafelo, I turned off the main route and ascended along four miles of very winding road into the mountains to Obersee. After parking the car, I walked over the grassy banks of the almost dried up river bed separating the lake from the forested mountain sides.

A great many Viviparous Lizards were in evidence, mainly young ones, ranging from one to two inches in overall length. I did not collect any of these, owing to the difficulty in obtaining sufficient minute insects to support them until I returned to England. Three adults were found sunning themselves on a long, recumbent tree trunk, secured and transported safely in polythene bags half filled with dry moss.

Examination of the underside of the tree trunk revealed examples of *Rana temporaria* and *Bufo bufo*. Frogs and toads generally were frequently observed in this and other areas visited during my stay in the Swiss Alps, their abundance no doubt largely explained by the profusion of insect life, particularly beautiful, black banded, emerald green grasshoppers with a red stripe on the lower edges of the femurs of their elongated hind legs. Most of these were not fully adult, probably in the fourth instar stage, and presumably provided ample food supplies for both lizards and amphibians.

It was whilst turning over fairly heavy sections of fallen trees that I caught sight of my first Alpine Newts in their native habitat. Exposure of one dampish spot revealed three of them, a male and two females, curled up together. They showed little response to being disturbed and were easily secured.

Although Alpine Newts, the most colourful of European species, often finish breeding by the end

of May, reproduction is delayed until the end of summer in high altitudes, the young, in spite of becoming sexually developed, sometimes remaining in the larval stage until the next year. My three, however, were no longer in breeding condition. Their dorsal surfaces were dark, marbled, greyish black and undersides a vivid red.

In the breeding season the males grow low, black spotted, yellow crests and their sides turn yellow speckled with black, their lower borders being enriched with blue stripes. Their underparts remain permanently red. The males are smaller than the duller-hued females and measure between two and three-quarters and three inches in length. The females often reach four inches and in exceptional cases four and a half inches.

The three Alpine Newts were brought back to England together with a frog, *Rana esculenta*, caught on the day we crossed over the border into Austria and visited Lake Constance. The surrounding area was broad, flat and boggy with many ditches and extensive reed beds. Edible frogs were very numerous as were their three to three and a half inches long brown spotted, olive tadpoles.

All four amphibians travelled in polythene bags packed with damp moss and reached England five days after the urodeles were first caught, all of them in excellent condition.

They were immediately transferred to an unheated and well established glass-sided vivarium three feet long by fourteen inches wide and fourteen inches high inhabited by three Crested Newts, *Triturus cristata*, and a pair of common toads, *Bufo bufo*. The female of this pair was a long time resident and is still alive after many years in my possession. She was an adult when originally caught and to my knowledge must now be at least ten years old. For many years I used her as a demonstration animal for biology lessons, a chore she faced with apparent

equanimity, making no attempt to escape but merely blowing herself up to maximum size and occasionally depositing a small pool of water on the bench as a mark of mild displeasure.

The floor of the vivarium was thickly covered with close growing moss pressed down on to a base of soil four inches deep at one side and two inches deep at the other. This presented a flat area at one end, on which was placed a large rounded stone, gently sloping to a level space at the other. A little concrete pool, about eight inches by four inches by two inches deep was sunk in the lower section. The moss ultimately became bedraggled and, as a result of water splashed over it by the animals' activity in the water vessel, somewhat muddy. This was rectified by replacing it with fresh supplies every couple of months.

The arrangement suited all the amphibians admirably and some were on view at almost any hour of the day. The Alpine Newts were the most retiring of them all and spent a great deal of time buried beneath the moss, only occasionally visiting the water or moving around the open parts of their quarters. The conditions evidently suited them very well, as although the *Rana esculenta* only survived for two and a half years, the Alpine Newts were still fat and healthy five years later.

Feeding presented no difficulties. The toads took adult locusts from time to time and the frog accepted locust hoppers. All the creatures fed freely on small earthworms and half to one inch long slugs, which were supplied every other day.

THE BLACK GHOST KNIFEFISH

by Barry Black

THIS is a seldom imported species which comes under the common name of Black Ghost Knifefish although it is not the true Black Ghost. Ghost usually refers to fish that are translucent or white in appearance but in this fish ghost refers to the fact that the natives believe that their spirits inhabit these fish when they die. *Apteronotus* (formerly *Sternarchus*) *leptorhynchus* along with the other nine species in the genus, hail from the Amazonian river system where they inhabit the quiet backwaters and lakes under roots, logs and in weedbeds. It is a nocturnal fish and hunts at night using weak electrical impulses for navigation and location of prey, since its eyes are poorly developed. The most distinguishing feature of this genus is the long filamentous dorsal fin and the presence of a caudal fin which is most unusual in knife-fishes. The anal fin is extremely long, containing about 150 rays and is the main form of propulsion. By undulating the anal fin the fish can move forward and by reversing the undulations it can travel backwards with the same ease. Due to its streamlined shape it can attain speed in both directions and so can approach its prey with the minimum of body movement. Also it can escape from predator or fish net by reversing rapidly, making it difficult to catch.

Apteronotus leptorhynchus is a chocolate brown colour and, because it has small scales, has a velvety appearance. A creamy-coloured stripe extends from

the snout along the back to the caudal where there is another cream band on the caudal peduncle. The anal fin rays are brown with a clear membrane and the anal opening is very far forward, just behind the gills. The filamentous dorsal fin is seldom displayed as it is usually depressed into a groove along the back of the fish. No ventral fins are present.

Feeding presents no problem as this fish will eat almost anything, including all types of worms and insects, raw meat, small fish and prawns. It has no teeth but hard jaws and pharyngeal bones, so when a worm is taken it is drawn in and out rapidly while being bitten and then chewed up. These knifefishes are shy at first but can be tempted out of hiding if food is offered and if the tank is dimly lit. Because of their nocturnal habits they must be fed when the lights have been turned off. This is so they will not starve due to the other inhabitants taking all the daytime food.

A. leptorhynchus is not a community fish as it exceeds 10 inches in length and has a large appetite but it does live well with other, not too aggressive, large fish. This knifefish prefers temperatures slightly higher than most fish, approximately 78°F-84°F, as it is sensitive to chills. It also seems better in slightly acidic water with little water movement. It is not aggressive but quarrels do break out between rival knifefishes so I advise one specimen to one tank.

A male *Podarcis sicula*, captured in Sorrento, which belongs to the southern subspecies *Campestris*.



TWO WALL LIZARDS FROM ITALY

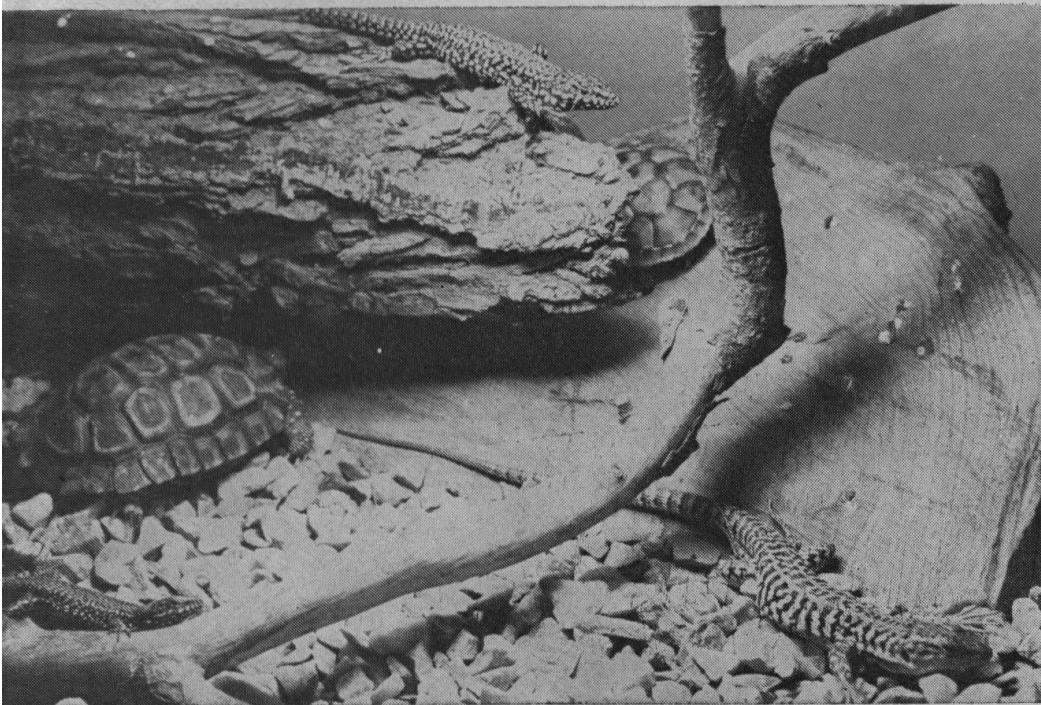
Written & Illustrated by Chris Mattison

CERTAIN small lively lizards are a characteristic feature of the reptile fauna of Southern Europe. Many of them are brightly marked in green, black, and occasionally blue, and as a group they are popularly known as Wall Lizards. Although they are correctly referred to by the generic name *Podarcis*, many text books still refer to them under the older name of *Lacerta*, a name which is now reserved for a small number of the species which were formerly regarded as one large genus. The Italian peninsular is inhabited by two of the most handsome species, *Podarcis muralis*, and *Podarcis sicula*.

The former is also found in France, parts of Spain, etc., and has a number of sub-species, many of which are restricted to isolated groups of islands. The back is usually a varying shade of green, overmarked with a network of black, which colour also predominates on the head and flanks (see fig. 1). The underparts can be white, pale yellow, or brick-red, often edged along the flanks with a row of blue scales, these being more obvious in males. These lizards are active during the hottest part of the day and are often to be seen basking on walls, piles of logs, and along roadsides, dis-

appearing at incredible speed if approached too closely. Females in my collection laid clutches of four and five eggs during May and June, which took from forty-one to forty-five days to hatch. The young, which measure about two inches in total length compared with the eight to ten inches of the adults lack the green coloration, and feed on the smallest insects, such as aphids, small maggots and grubs, etc.

The other Wall Lizard of Italy, *P. sicula*, is sometimes known as the Ruin Lizard, and if anything it is even more colourful, and more agile. The grass-green back only has black markings along the central strip, and the flanks are barred, rather than mottled, with black (see fig. 2). The blue scales often extend to the bases of the fore-limbs in adult males, particularly in the breeding season. This species is slightly larger than *P. muralis*, males sometimes reaching almost twelve inches in total length, of which about two-thirds is tail, and is more heavily built. Like *P. muralis*, the Ruin Lizard is a sun-lover, and can be seen in enormous numbers in suitable habitats, which include walls, the edges of paths, and old buildings. Anyone who has visited the Roman ruins at Pompeii on a hot



Left: A section of the author's vivarium which contains several wall lizards, geckos and young tortoises.

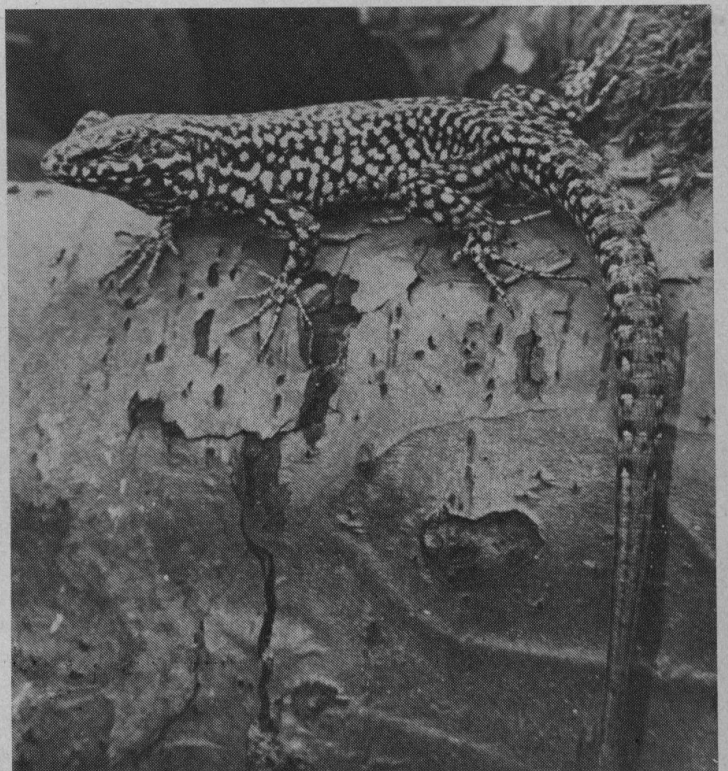
Below: A male *Podarcis muralis*, from Pisa, of the subspecies *brueggmanni* which is common all throughout Tuscany.

summers day can hardly have failed to notice the hundreds of lizards on the ancient walls, and in particular on the tiers of the amphitheatre, and these will have been Ruin Lizards of the sub-species *campestris*, which inhabits Yugoslavia.

Capturing either of these species can be very difficult—I found that a small running noose attached to the end of a thin pole was the most successful although I still only managed to secure a very small percentage of the individuals seen. However, both species are frequently imported, and distributed through the pet trade, and although there is no doubt that they make excellent vivarium exhibits when in good condition, certain factors should be borne in mind when considering their accommodation and subsequent maintenance. Because these lizards are diurnal, and rely on the sun's rays to bring their body temperature up to the required level, facilities for basking in the sun or a suitable substitute are essential. In my experience, a normal light bulb with a reflector is satisfactory provided that it is of sufficient strength. A temperature of 100 degrees F. immediately beneath the bulb should be aimed at, and suitable basking sites in the form of logs, rocks, etc., provided in this area. In order that the lizards can retreat from the heat source once their body temperature is raised sufficiently, it is a good idea to use a rectangular vivarium (a 36 × 15 × 12 aquarium is ideal for a small group), with the light fitting situated near one end in order to give a thermal gradient whereby the lizards can maintain their correct body temperature by shuffling from hot to cool areas at will, as they do in their natural surroundings. Substrate can be sand, gravel, etc., and plenty of hiding places should be provided as they like to have a secure retreat when the light goes out at night.

Food consists of any small insects or grubs, such as grasshoppers, mealworms, maggots, flies, etc., but the keyword is variety. Unless the lizards are exposed to uninterrupted sunlight they will benefit from an occasional supplement of vitamins which can be sprinkled on their food, or, preferably, dropped into their water, which should be renewed daily.

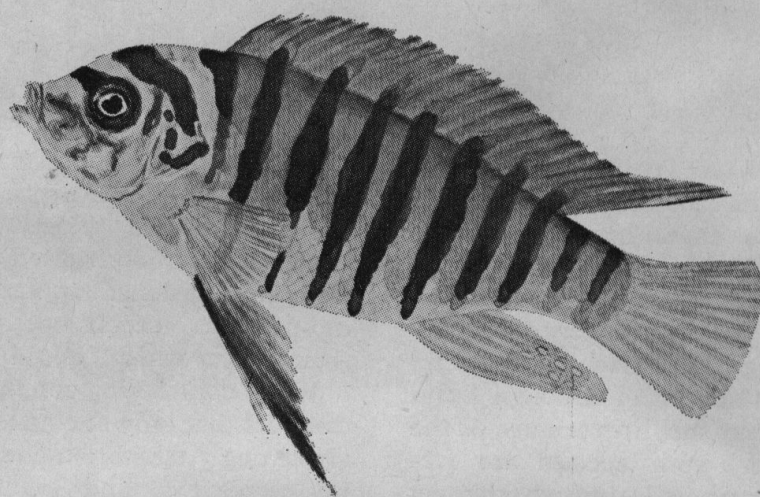
When considering communities of these species it is essential that only one male of each is included as they are strongly territorial, and a second male will quickly be persecuted, and eventually killed if unable to escape, as in the confines of a vivarium. Several



females will, however, live peaceably with one male, although the latter will undoubtedly command the most favourable basking and hiding positions. The males are instantly recognisable as being more colourful, larger, and more robust in appearance, especially in the neck and head region. As a guide to numbers, my own vivarium, measuring 30×15×12 high, contains four *P. muralis*, two *P. sicula*, including a male of each, a Wall Lizard of another species, three young Geckos, and two hatchling tortoises. A hollow log provides an abundance of hiding places, and succulent plants, in well-hidden pots give a natural appearance to the set-up. During the egg-laying

season the females dug into the soil in these pots to deposit their eggs and they were then covered with a polythene bag and removed to a warm room for the eggs to incubate. The soil was lightly watered when necessary, and the polythene bags prevented too much evaporation, as well as confining the young lizards as they hatched and emerged from the soil.

A final word of warning for intending Wall Lizard collectors and keepers—like their British relatives, both of these species part with their tails readily when held by them, and although these can be regenerated the subsequent replacements are but pale imitations of the originals.



Pseudotropheus zebra

Written & illustrated by Jack Hems

THERE are at least 200 different species of cichlid fishes found in Lake Malawi (Nyasa). *Pseudotropheus zebra* is one of the smaller species which occurs naturally there and nowhere else and is becoming increasingly popular as an aquarium inmate. It is widespread in this vast inland lake in a variety of races and colour forms which include white, pinkish, yellow, orange and blue. In some forms the colours of the two sexes are very dissimilar. Therefore it is easy to understand why differences in coloration between males and females of the same species led, and will presumably lead for a time, to some con-

fusion and mixtapes in identification.

Although vertical dark bars adorn the sides of the blue form, in general the other colour forms show only a suspicion, or absence, of vertical markings. They do, however, display some dark irregular blotchings. For all that, the colours of the males are always brighter during courtship and breeding.

The best-known colour form of *P. zebra* is blue: a medium to greyish blue. Adorning this visually pleasing ground are seven or more darker blue bars that extend from the lower part of the long-based dorsal fin to the belly. The anal fin of the male, and

Hyla arborea

by H. G. B. Gilpin



I HAVE seen these delightful little Tree Frogs in several southern European countries, particularly on the marsh lands of the Camargue in southern France. On one occasion in the Camargue, after a heavy shower of rain, I found a number of them clinging to the leaves and stems of tall bushes along the roadside. Since it was ten days or so before my return to this country, I decided to postpone collecting any until the day before leaving. This was an error. The weather turned very hot and sunny and no more were seen.

I was more fortunate this October in Corfu. One morning, when exploring the dried up marsh lands and dense reed beds about half a mile from the Lagoon, where the empty carapaces of several tortoises were discovered and a magnificent thirteen inch green lizard, *Lacerta viridis*, was found several feet above the ground in an uncomfortably dense growth of bramble, a single *Hyla* was seen clinging to a stem in a small clump of reeds, its green back fully exposed to the sun. It made no attempt to escape and was easily secured.

No more Tree Frogs were seen, in spite of considerable travelling throughout the island, until the little village of Potamos was reached, one hot, sunny morning after rain had fallen heavily the previous day. Here the road, lined with tall growing reeds, passed over a clear, slow moving river. The continuous calling of innumerable frogs indicated that this was indeed a happy hunting ground. At first none was visible but as soon as the eyes became adjusted to the contrasting bright light and deep shade amongst the leaves, several were distinguished. European Tree Frogs must be amongst the easiest frogs to capture. Usually they remained immobile on their chosen spots, relying on the merging of their bright green backs with the green leaves to afford them adequate camouflage. Without difficulty four were secured and transferred to travelling bags.

Having collected as many frogs as I needed, I walked along a pathway beside the river lined on one side with trees, bushes, passion flowers and opuntia cacti and the other with reeds.

Without any special searching many—thirty or more—*Hyla hylas* were seen, mostly clinging to the shoulders of leaves exposed to the sun but some grasping the vertical stems. The majority were about two inches in length but some were considerably smaller. One was observed, its eyes glued on a Wall Butterfly resting on a leaf some eight inches away. Suddenly it leapt forward and touched the insect with its tongue but failed to hold it securely. Knowing the efficiency with which Tree Frogs can seize prey at the end of a jump I concluded this was one lucky butterfly.

Tree Frogs spend the spring and early summer near water in which their eggs are laid, each clump of spawn being about the size of a walnut. By late summer they have moved away from the water into trees, bushes and reeds. The presence of Tree Frogs in an area is usually first detected by the noise they make. This is considerable and once heard difficult to mistake. The sound consists of a staccato series of rather harsh double croaks rapidly repeated and reminiscent of the muted quacking of Khaki Campbell ducks. Continuous enough to almost merit classification as a song, it can be heard from quite a long way away.

The vocal efforts of these frogs can be embarrassing, as I found to my cost whilst sitting in the departure lounge at Corfu airport. Without warning, they gave voice loud and clear to the amusement of the few travellers who evidently identified the contents of my hand luggage and the consternation of the many who did not. I boarded the airplane with some trepidation, fearing that a repeat performance on the part of

the frogs would lead to my being held suspect of carrying some new form of time bomb! Mercifully they remained silent throughout the flight and we reached home without further incident.

On arrival the five Tree Frogs were placed in an all glass vivarium, seventeen inches by eleven inches by eleven inches, covered at the top by a close fitting hard-board lid. A perforated panel admits air and a circular hole five inches in diameter, to which is attached a muslin sleeve closed by a draw-string, allows a hand to be placed in the vivarium without danger of the animals or the flying insects they feed on escaping.

A two inch layer of peat over the floor of the vivarium is covered with damp, growing moss, except for one spot where a bowl of water is embedded. Plants arranged along the back, their pots hidden by moss, include a geranium, hart's tongue fern and a small fig. Their broad leaves provide admirable resting places for the frogs. The vivarium is unheated—Tree Frogs are unable to survive high temperatures in confinement—and kept in the living room where it makes a very pleasing display.

The frogs themselves are fascinating little creatures. Their smooth, clear green backs give the impression of highly glazed porcelain and are separated from the whitish, granular underparts by an irregular yellow line bordered below with black. This stripe extends from the nostrils to the groin, where it bends sharply into a branch called the hip sling. The oval bodies narrow markedly where they join the hind legs and the heads are rounded in front. The eye pupil is vertical and the toes on both fore and hind feet are furnished at the tips with small, round suction discs enabling them to walk up a vertical sheet of glass or pause clinging to it almost indefinitely. The deeply indented webs on the hind feet extend half way along the longest toe and the clearly distinguishable tympanum is covered with a fold of skin. Most of my specimens have dark brown patches on the throat suggesting they are males. When croaking their vocal sacs, normally covered by

the brown patches, inflate into a bladder almost as large as the head.

The green dorsal colour is not constant but varies with environment, age, skin sloughing and the stimulus of mating. Of my five, all of which were green when collected, two are now a medium brown. This may possibly change again to yellow or even blue or black. It appears the ability to change colour varies with different individuals.

European Tree Frogs breed from May to June, the actual mating only lasting two days. The eggs hatch after ten to twelve days into tiny tadpoles no more than one sixth of an inch long. Metamorphosis takes about three months and sexual maturity is not attained until the fourth year.

These little frogs make excellent vivarium inmates. Their small size safeguards the vegetation from damage. They are always on view spending most of their time on the upper leaves of the plants or clinging to the glass sides of their quarters, although they do descend to ground level when hunting food or taking an occasional dip in the water.

Some text books suggest they will eat insects, small earthworms, mealworms and caterpillars in confinement. Personally I have been unable to persuade them to accept anything other than flying insects. Blowflies and grasshoppers are snapped up within seconds of their introduction. The frogs show great expertise in capturing winged prey, often leaping six inches or more to seize a temporarily stationary insect, after watching it intently until it settles. They rarely miss their objective.

At one time Tree Frogs were kept as weather prophets on the false assumption that they climbed upwards when rain was imminent and descended to lower levels in dry periods. I have old copies of the "Aquarist" where they were offered for sale at 3d each!

Under wild conditions they hibernate in the ground during winter.

WHAT IS YOUR OPINION? *Continued from page 425*

the tap, and is very soft, but I have no idea about its pH. I am now going to write to Mr. J. Hutchings, who had a letter about guppies published in your October column; another good point about your feature. Please carry on the good work." (Readers thinking about using potting composts of any kind under the gravel in an aquarium should take care: these products are produced for the growing of pot plants in greenhouses or rooms. Some contain lime that could render aquarium water excessively alkaline.) One additional tip for those whose aquarium plants may not be thriving: make sure that cover glasses are kept clean. Deposits of dust, fluff, congealed fish food, mineral salts left after aquarium water has evaporated, and layers of algae on cover glasses all cut

down the light that should pass through and reach the plants beneath. A nail-brush, used under running water from a shower spray, makes a useful implement to keep cover glasses clean. Make a monthly scrubbing part of your maintenance routine.

For a future issue please send me your views on any of the points raised above or hereafter: (a) dwarf cichlids; (b) problems with ponds and pond fishes in winter; (c) home raised live foods; (d) floating plants; (e) aeration; (f) power filters; features you enjoy and new features you would like to see included; (g) first foods for fry; (h) the most helpful/interesting character you know associated with the hobby—and what you have learned from him or her.