The Aquarist

and Pondkeeper

JANUARY 1964

MONTHLY
Vol. XXVIII No. 10

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The AQUARIST
AND PONDKEEPER

Founded in 1924 as "The Amateur Aquarist"

THE BUTTS, HALF ACRE, BRENTFORD, MIDDLESEX
Telephone: ISLeworth 6221

PUBLISHED MONTHLY

SUBSCRIPTION RATES

The Aquarist will be sent post free for one year to any address for £1 8s. 0d. Half-yearly 14s. 0d. Canada, U.S.A. $4.00 yearly; $2.00 half-yearly.

QUERIES

Postal replies are made to all specialised queries accompanied by a stamped, addressed envelope. *This privilege is afforded only to registered readers and direct subscribers.* Subscription forms can be obtained on application. In all cases letters should be addressed to the Editor.

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The Growth and Age of Fish

MANY factors affect the growth of a fish once it has reached maturity and developed fully from its newly hatched or alevin stage. Perhaps the most remarkable feature is that, unlike mammals including human beings, whose bones grow up to a certain point and then become 'set', beyond which stage they grow no longer, fishes have bones that can develop and grow just as long as they live. Provided that water conditions are satisfactory, and food is constantly available in sufficient quantities, fishes may keep on growing until they die. In actual fact, other considerations enter into the matter, but in principle, this holds true for nearly all fishes. As food is more plentiful in the sea than in rivers and lakes, marine fishes usually reach a larger size in old age than those from fresh water.

The rate and progress of growth varies a good deal with different kinds of fishes, and in different stages in a fish's existence, but increase in size is generally constant: that is to say, a fish never really stops growing at all from the moment it leaves the egg. As with all creatures, the fastest rate of growth is in the very earliest stages. An alevin's size is governed by the individual size of its egg, which in turn is governed by the number of eggs that can be produced and accommodated inside its mother's body. Whilst ensconsed within the tough walls of its egg, the alevin cannot develop larger than the size that almost fills the sphere as it curls round inside. But once clear of the egg, and with the last remnants of the egg yolk absorbed in its body, the young fish knows no restrictions of the speed of growth.

Often fishes from minute eggs grow quicker than those from larger ones, and most marine fishes develop from very small eggs, much smaller than those of freshwater species. The ultimate size of the adult fish is no guide to the size of its eggs, and often newly hatched fish from tiny eggs are much smaller than those from larger eggs which, however, are far smaller when mature. Thus trout fry are half an inch in length or rather more, yet baby swordfish, whose mother is many hundreds of times larger than the mother trout, are only a quarter of an inch long.

As a rule, baby fish are fairly like their parents, but there are some kinds in which the young are quite unrecognisable as such. Even so, the physical transformation of fishes is never as great as that of many insects, which go through several quite distinct forms. The nearest example to that among fishes is the striking metamorphosis of eels, which at one time held up the discovery of the real secret of the

A fish in which considerable physical transformation takes place during its early life is the common eel

eel's life, people not connecting tiny elvers in their three earliest stages of development with the adult fish at all.

Flat fishes also undergo a quite marked transformation in their early stages, changing from vertical swimming fish from the egg into flat creatures lying on the bottom, whose left eye moves round to the right. This whole process is usually complete in about a fortnight.

The scales of a fish can be "read" for positive signs of growth and development just as tree-rings can be interpreted by the forester, and, of course, it is not difficult to take up fish under observation in tanks and measure them at intervals.

Water temperature has a good deal to do with the speed of growth. Fishes in cold seas nearly always grow very slowly, although they may sometimes, as do cod, reach much greater sizes in the long run.

Food supplies influence the rate of growth, as all aquarists know, and animal food, primarily other small fishes, increases the rate of growth more effectively than vegetable diets.

Acid waters can retard the rate of growth, too. Trout in a peat stream are smaller in the first few years of their life than those in a chalk stream, where the water is alkaline. The difference may be as much as twelve times as great for the chalk stream fish. Tails and heads grow quicker than the rest of the body, and sometimes the relative slowness of the body growth results in queer transformations among dorsal fins, which move along the back at different ages.

When maturity is reached and a fish is ready to spawn, growth slows down considerably, because food products are needed for reproductive purposes. Also, many fishes starve themselves during spawning, and so have to build up depleted body tissues afterwards before they can grow appreciably again.

Some fishes reach maturity quickly, like the goby, which breeds and dies within the year, and others develop quite slowly, like the king salmon, which does not spawn before its fourth or fifth year. As a rough average, a fish can breed at about one-third of the way through its life span. After the final stage, growth is usually only slight each year, and depends a lot upon spawning.

As far as we know, only serious depletion of available food will cause a fish actually to shrink after a certain point has been reached: the trout in Loch Leven in Scotland, for instance, which drop down to long, half-starved specimens of about ¼ lb. once they have reached a maximum of around 3 lb. It is not thought that anything like this happens with sea fishes.

The spawnings that so greatly affect a fish's life depend for their number upon its length of life, and here we enter an even more difficult field of study. Positive evidence of the ages of fishes is notoriously difficult to obtain, and the clear view of science, already unbelievably sketchy, is clouded over with legends, hearsay and false beliefs.

Two species that spring to mind at once whenever the age of fish is mentioned are pike and carp. There is no doubt whatever that both these fish live longer than most, but they are also responsible for many of the legends of fish longevity. The worst one was that of the Mannheim pike. The story went that in 1497 it was caught in the Kaiserwag Lake, in Germany, bearing a brass ring round its neck with the inscription: "I am the fish which was first of all put into this lake by the hands of the Governor of the Universe, Frederick II, 5th October, 1230". Its skeleton was kept in Mannheim Cathedral for many years, and the story was swallowed by many scientists, among them Metchnikoff of the Pasteur Institute. Yet when a German anatomist examined the skeleton, it was found to consist of the vertebrae of several fish strung together! Similar cases are equally unreliable, including the carp marked in 1788 in Australia and caught again in 1933.

So many factors affect the age reached by fishes, that anything over 100 can be discounted at once. Here are some reliable records of maximum (and therefore not necessarily usual) ages in years: catfish, 60; eel, 55; mirror carp, 47; sturgeon, 38; goldfish, 30; plaice, 25; bream, 18; haddock, 14; salmon, 13; rudd, 10; perch, 12; dace, 8; mackerel, 4; grayling, 3. Some of these were aquarium-kept specimens, and possibly therefore artificial records.

Carp get a lot of publicity for their alleged longevity, and Buffon, an otherwise reliable naturalist, believed that ages of 150 were not uncommon. But in the cold light of scientific proof, the most aged carp of which there is definite proof was under 50, and it is believed most die before they are 25.

Most river dace die before their tenth birthdays, and gudgeon seldom live longer than 7 years. Most ruffe die even younger, at 4 or 5 years, and not many male roach reach the age of 8. Female roach, by the way, live to about 11 or 12 years. The females of most coarse fish live longer than their mates.

David Gunston

Photo: W. J. Howes

The trout is a species whose growth rates and feeding requirements have been most carefully studied because of its popularity for the table

These Elephants are Jumpers!

by T. ROLAN

DESCRIBED variously by my friends as ugly, fascinating, bizarre, "more like birds than fish" or "like a guitar with a beak", and by some authorities as being among the most intelligent of fishes, the elephant fish can at least be sure of not being passed by without comment. Several kinds of fishes have in fact received the name elephant or elephant-nose in the dealers' lists, but the species most commonly arriving with African imports at the present time is *Gnathonemus petersii*, and this one cannot properly be said to be an elephant-'nose' for the reasons given below.

Nightly Frolics

My elephants are of the species named above, and I have become very fond of them. I was warned when I bought them that they are jumpers, although this behaviour can scarcely be suspected at first sight of them, the body being flat from side to side and generally rather rectangular in appearance. However, one of them soon showed its jumping power when I left the tank partly uncovered whilst I was transferring them from the transport container, and so did two more a week or so later when a slight gap (about ½ in.) was left between the cover glasses. These last jumps occurred at night, and from talks with other aquarists I get the impression that it is then that this habit is most likely to be indulged in. Although the body length of my specimens is about 5 inches, their slender form can be projected through the narrowest of chinks.

Enlarged view of the head of a dead elephant fish with a probe inserted into its mouth to demonstrate its position

Elephant fish (about half life size)

The most unusual feature of the fish is, of course, the half-inch or so long downwardly curved 'trunk', but this name is not really apt for the appendage, since it is more like a fleshy, cylindrical lower 'lip' or 'chin'. Most people are surprised to find that the mouth is in fact above this so-called 'trunk'.

It seems to be a highly sensitive organ, and it is movable: the fish continually gently probe with it in the plants and sand, and occasionally even use it to touch one another or to administer a sort of flip. Probably something like a sensation of taste is aroused in the fish from this projection. I have examined the inside of the mouth of one of the deceased jumpers and found some prominent teeth to be present towards the back and at the top.

There is nothing beautiful about the elephant's colour, which is dark brown with two pale vertical bars towards the rear of the body. Their swimming movements are unusual, and it is the fluttering quality of these (together with the bird-like head) that gives the impression that one is watching a bird in the water.

Playful Fish

Like other members of their group (the mormyrids), they show alternate short backward and forward movements some of the time. It is, however, their speed, agility and manoeuvrability when at 'play', and the quite definite character of this play, with one another that is to me their greatest charm. Then one is reminded of the behaviour of sporting dolphins or porpoises, and probably it is in the exuberance of these non-aggressive chases and elusions

at night that their leaps from the water take place. A good deal of their time seems to be spent at this play, and for this reason I think they should be kept at least in pairs. They appear to be oblivious to the presence of other fishes, and mine live with a small shoal of platys and swordtails. Occasionally the elephants seek the seclusion of the plants and rest for short periods close to the sand.

Food seems to be taken mostly from the bottom of the aquarium, despite the seeming hindrance of their chin projection, but occasionally they nose (chin?) around the worm cradle in their tank when there is food in it. They also catch *Tubifex* and white worms in mid-water sometimes. These worms form the main diet of my fish, but dried food is also given and it is possible that some of this is taken from the bottom during their questing along the sand surface. One of my specimens was thin when purchased; it refused to take food and died after about a week.

Water temperature should be in the upper ranges of aquarium temperatures for the elephants, at 78-80°F (about 26°C). In my aquarium the water is filtered, but there is no other aeration, and the tank had been set up for about a month before the elephants arrived. If I can remember to keep the covers tight closed, I very much hope they'll be with me for some time.

The Java Medaka *(Oryzias javanicus)*

by JACK HEMS

ORYZIAS javanicus, commonly called the Java medaka, is native to Indonesia and the Malay Peninsula in general. It belongs to the family Cyprinodontidae, and has most of the qualities that tropical aquarists look for in a fish. That is to say, it is mild-mannered and small enough to be kept with several other members of its own kind in a 4- or 5-gallon tank, or given a home in a community aquarium housing a collection of inoffensive fishes of about its own size. A further point in its favour is that it is always on the go, at or near the surface of the water. Next, it has a temperature range of from 70°F (21°C) to 80°F (27°C), and readily eats any live or dried food. Lastly, it is not difficult to breed.

Like *O. latipes*, its larger and better known relative from Japan, the Java medaka was first introduced to aquarists more than half a century ago. Reliable German authorities give the date of its domestication as 1910.

Appearance

It is not easy to describe the fish's coloration because it varies from a somewhat greyish, glass-like transparency, overcast here and there with an elusive pinkish to bluish sheen, to a dull leaden hue lightening to silvery white ringed with yellow on the anterior lower sides and underparts.

The fins are silvery clear, except for a narrow white margin to the long-based, serrated-edged anal fin, and white tips to the short ventral and longish dorsal fins. The latter is set close to the caudal appendage. This has a thin piping of white along its bottom edge. There is an attractive glitter of green on the gill-covers, but the most striking thing about this fish is its eyes, which are black encircled with rims of light-reflecting sapphire blue.

Sexing

The sexes of adult fish are fairly easy to tell apart; the slimmer-bodied male has a deeper (anteriorly) anal fin, and a more pointed dorsal fin than the female. Furthermore, the white margins to his fins are broader and more ragged-looking along the edges than those of the female.

Fed often and well, and given a reasonable amount of swimming space in clean well-aerated water, the species may reach 1½ in. in length. Domestication, however, tends

Java medaka

to produce smaller specimens than those collected in the wild.

When a pair of *O. javanicus* are ripe for spawning, a condition most likely to be attained if the temperature of the water is raised to about 80°F (27°C) and such exciting things as mosquito larvae or Grindal worms are included in its diet, the male hovers around the female, cutting capers, opening and closing his fins and, every now and again, swimming up to her spawn-distended sides.

Breeding

Soon a cluster of eggs will be seen bunched at her vent. These, it is reasonable to assume, are fertilised when the male makes one of his excited approaches. The next stage in the breeding procedure is for the female to brush the eggs off, one by one, on to the plant life. And this, in brief, is the performance that will be repeated at irregular intervals over a period of several days to a fortnight or more.

The eggs take about a fortnight to hatch, but it is hardly necessary to add that as they are extruded on different days they do not hatch out at the same time. None the less, when they do, the lively fry are capable of taking Infusoria or micro worms right away.

So long as the parent fish are kept well fed, they seldom take any notice of their eggs or young, but to safeguard the fry from any sudden lapse into cannibalism, matted growths of plants are recommended in the upper levels of the water.

The fry make rapid progress for a month or two, after which growth slows up. Nevertheless, all being well, the fry of a single spawning (the adult fish may spawn four or five times in a year) should be laying eggs of their own before 9 months are out.

With the steady increase of interest now being paid to cyprinodonts of all kinds, it is to be hoped that *O. javanicus* will attain the popularity it so richly and belatedly deserves.

Algae and the Aquarist

by BARRY R. JAMES

WHAT does the word algae mean to the aquarist or pondkeeper? Invariably it conjures up visions of murky green water, skeins of blanket weed infesting a pond, or perhaps that irritating layer of opaque greenness that seems to cover the glass of an aquarium as fast as the scraper removes it.

What do algae mean to the botanist? He sees them in a different light: as the simplest forms of plant life that are the sole representatives of the plant kingdom inhabiting the oceans. As organisms that have adapted themselves to life in such unlikely habitats as tree trunks, stagnant ditches, bare mountain rocks and, of course, the sea.

A marine biologist would be ever aware that certain algae form the sole diet of the whalebone whales, and are the basis of the entire cycle of the biology of the oceans. A biochemist would know that certain marine algae produce such diverse products as fertilisers and media for the culture of bacteria on a controlled scale in the laboratory.

For the better understanding of the algae, scientists have recruited the aid of the microscope; for many species are so minute as to be individually invisible to the naked eye.

The simplest algae consist of but a single cell. Those living in water often possess tiny 'hairs' known as flagella which are capable of vibrating and propelling the plant through the water. These algae under suitable conditions are capable of rapid proliferation, and are often responsible for green water. Such a plant is called *Chlamydomonas*. Untold millions of these tiny cells may occur in a few cubic feet of water under the right circumstances, which are: an abundance of sunlight and heavy concentrations of mineral and organic matter. At a certain point, however, chronic overcrowding occurs and individuals begin to die. Then bacteria in turn multiply, feeding on the dead bodies. This causes the water to turn grey and have an obnoxious smell, a condition with which most aquarists are familiar, and one which is fatal to fishes. Such a condition occurred on a massive scale in the seas off Florida in 1947, when certain flagellates (an order of plants closely related to algae) multiplied to such an extent as to turn the sea red. It is estimated that 50 million fishes died as a result. Incidentally, for those interested in figures, scientists estimated that a pint of this water contained 60 millions of these organisms.

One of the reproductive cycles of the unicellular algae involves the formation of thick-walled spores, which may dry out for long periods and yet still be viable when placed in water again. These spores are carried by air currents and account for the formation of green water, even in distilled water, if it is exposed to the air.

Volvox is a multicellular alga in which the individual cells resemble chlamydomonids, but are distributed over the surface of a mucilaginous ball, about one-sixteenth of an inch in diameter. These cells are attached to one another by protoplasmic strands. Only certain cells are motile and these drive the colony about, while others are specialised for reproduction.

These simple mobile algae possess what is known as an eye spot, which is sensitive to light and enables its owner to move towards the areas of greatest light-intensity. These plants have 'organs' called chloroplasts, which contain that magic ingredient chlorophyll whose functions are too well known to be discussed here.

Blanket weed is the name given to several species of thread algae, one of which is *Spirogyra*. The threads consist of chains of cells formed into a simple body called a thallus. The filaments are unbranched and are of no definite length, growth continuing until breakage occurs, normally through the action of outside forces such as water currents. These cells are enclosed in a mucilaginous sheath, which feels slimy to the touch. The most characteristic feature of this species is the spirally coiled chromatophores (chloroplasts).

Vaucheria is similar in form, and is well known to aquarists by sight, if not by name, for it has tiny protrusions called rhizoids, with which it fixes itself on to plants, rocks and the glass, from which it is almost impossible to remove by physical means.

Other types of algae which trouble the aquarist are the diatoms, which may cover the glass with a hard brown covering usually under poor light conditions. Another is the blue-green alga, which forms continuous soft sheets, easily removed with a scraper, but which grows almost as quickly. This type is relished by the sucker loaches and catfish and many other fishes. Blue-green alga needs an abundant supply of light, and infestation in the aquarium may often by cured simply by decreasing the wattage of the bulb or by moving the tank to a darker portion of the room.

However, it is in the sea that the algae reach the zenith of their abundance and complexity. Here they take the place of the higher plants on land; some species, such as the giant kelp (*Nereocystis*) of the Pacific, may reach 150 feet in length, and another which is found off Cape Horn, attains 300 feet, rising from a depth of 50 feet to the surface.

These species belong to the Phaeophyceae or brown seaweeds, to which the common bladder wrack (*Fucus spiralis*) also belongs. Another important group confined exclusively to the sea are the red seaweeds (Rhodophyceae). Both these types reach a complexity far in excess of the most complicated green algae.

Although the freshwater aquarist knows only too well how easy it is to grow algae under artificial conditions, the marine aquarist has been unable to cultivate the higher algae in salt water, under the same conditions, for reasons not yet understood. This is rather unfortunate. Some of the marine algae are far more beautiful than the flowering plants that are their contemporaries in the freshwater aquarium. Of course, there are so many factors inherent in the life of the oceans such as tides, pressure, temperature and water currents, as well as the extremely complicated relationships between its denizens, that it may be some time before marine fanciers can show their fishes off against a living background of plants, instead of lifeless preserved coral.

Certain types of algae are relished by many fishes as food, in particular the mollies, the sucker catfishes and loaches, and many semi-brackish and marine species.

The motile algae are also the first food of many fish fry and also of live foods such as *Daphnia*, which feed almost exclusively on algae. Some of the thread algae also provide a good spawning medium for egg-layers, and as hiding places for the resultant young.

Taken all round, though, algae are pests, and must be controlled or eliminated if the higher plants are to be given

a chance of survival and the decorative appearance of the aquarium is to be maintained.

There are three main methods of eliminating algae, the first of which is by physical means. This includes the scraping and scrubbing of the glass and rocks with the removal of the debris, and for the thread algae by the use of a twig on which the filaments may be rolled up and removed, and the introduction of algae-eating fishes. The second method is by the introduction of chemicals. This process is in its infancy and liable to be fraught with dangers, if carried out indiscriminately. Chemicals used include: iron filings, copper sulphate (which, however, is lethal to higher plants and fishes in even small concentrations) and the addition of 100 millilitres of a 3 per cent boric acid solution to every 100 litres of water (see Hans Frey, *Dictionary of Tropical Fishes*).

The third and most important method of keeping an aquarium free of algae is by creating healthy water conditions. These include the presence of adequate numbers of the higher plants to use up as much as possible of the waste products dissolved in the water. Sufficient but not excess of light to encourage speedy and healthy growth of higher plants, and a population of fishes sufficient for the size of the tank. Soft acid water also seems to hinder the growth of algae and the use of a peat filter is therefore beneficial.

A group closely related to the algae is called the Flagellata. Scientists have been unable to decide whether these organisms are animals or plants, as they show great affinity to both. Such a creature is *Euglena*, which closely resembles the protozoans on one hand, but which possesses a chloroplast, and therefore is able to engage in photosynthesis, which puts it with the plants.

Euglena is of interest to aquarists as it is an excellent first food for fry, and may be cultured for this purpose. Pure cultures for starting may be obtained from firms specialising in the production of live foods. A culture medium should be prepared by boiling a little rice or wheat and this should be added to a jar one-third filled with tap water. The jar should be covered with a piece of cloth and placed in a dark cupboard for 2 or 3 weeks. The solution will then have taken on a milky appearance indicating that plenty of bacteria, on which the *Euglena* will feed, are present. The portion of *Euglena* is now added and the jar placed in a sunny place and left for around 6 weeks, when a good culture of *Euglena* will have developed, and may be fed to fry either by a drip tube or a pipette.

The Australian Rainbow Fish

by MIKE THOMAS

I OFTEN wonder why this very attractive fish is not more popular amongst aquarists. The Australian rainbow (*Melanotaenia maccullochi*) has so many good points in its favour, i.e. very hardy, only grows to about 3 in., is very peaceable amongst all fishes and eats anything. On top of all this I have yet to find an egg-layer which is more suitable for the beginner to spawn.

The body shape is fairly streamlined, and the fish moves with remarkable speed at times. The finnage, which is usually erect, displays the unusual but interesting double or split dorsal. The colouring although not spectacular, is very attractive, especially when viewed in sunlight. These fish fare best if kept in a shoal and prefer a temperature around 75°F (24°C).

Breeding these fish is not only simple but interesting. Sexing can be difficult if the fish are not in ideal condition. When kept in a shoal the males will often show off to each other, by erecting their fins boldly and chasing each other. The males' colour intensifies and a beautiful golden band appears from the front of the dorsal down to the snout. When viewed head on the male's contours form a sharp v, whereas the female is slightly u-shaped. Even when a female is in ideal spawning condition she is never bulging with eggs and in this way may, to the beginner, look like a poor coloured male.

The breeding tank should be at least 18 in. by 10 in. by 10 in. and preferably 24 in. by 12 in. by 12 in., and one of many spawning media can be used. Nylon mops or coconut fibres are very good and a thin layer of gravel over the base of the tank often makes the fish feel more at home. The nature of the water does not seem to be very important, although they seem to prefer it slightly alkaline and fairly hard. A temperature around 74°F (24°C) seems to be ideal, and a small amount of salt in the water gives better results in hatching the eggs and inducing the pair to spawn.

Australian rainbows spawn over a period of about 4 days, and like sunshine on their tank if possible. Quite often a pair do not start to spawn until they have been together for several days. The eggs are fairly large, amber in colour and very easily seen. They hang individually from the spawning media by a short filamentous thread. The eggs take about 6 or 7 days to hatch and the dark fry 'hang' on for 2 days. The parents can be left in with the eggs until they start to hatch, when they are best removed. The young are first fed on Infusoria or an artificial substitute, but the fry grow quicker than most other fish, even keeping up with toothcarps, for the first 5 or 6 weeks. Brine shrimps, *Daphnia* and chopped *Tubifex* are readily taken as well as dried food.

Australian rainbow (half natural size)

Care must be taken not to foul the tank and the young rainbows seem rather susceptible to 'bad' water. Spawnings are not very large and I find 70 a good number to raise.

The young quickly shoal and form a most pleasing picture—why not try some in your tank?

EXOTIC GOLDFISH

Can We 'Improve' on Existing Varieties?

by C. E. C. COLE

MY article last month concluded with the sentence " . . . no one can tell what effect the various character-bearing factors will have upon each other when they are first introduced". That is an indisputable fact!

The goldfish (common goldfish, that is) has bred in astronomical numbers for several hundred years—yet the fish we buy for a shilling or two and put into our aquaria or outdoor pools are identical in appearance with those that our fathers, grandfathers and great grandfathers might have purchased. This seems to indicate that it is a true-breeding fish. But what of the many 'sports' displaying one, two, three or more 'new' characters?

Fish bearing these abnormalities have usually been isolated and specially treated by man to emphasise and increase their unusual features, but in numbers they are only the tiniest fraction of 1 per cent of goldfish. In the first place the differences must be attributable to mutations.

A mutation is a change in normal factors at work in the development of a fish so that some characters they control manifest themselves in an abnormal manner. It is not always immediately apparent that a mutation has taken place.

Most have occurred in large breeding establishments, where quantity rather than quality is the main consideration, and time during the breeding season is at a premium. In such places unless the mutation has caused a very marked difference in the appearance of the fish, they are unlikely to be noticed. In any case, with large numbers of breeding fish spawning indiscriminately, nobody is in the position to do other than guess at the possible parents of the abnormalities. So the origin of the new characters is lost for all time.

The enthusiastic amateur goldfish keeper and breeder (with comparatively few fishes and time to devote to close study of them) is in a better position to spot any abnormal development among his pets.

Too often, however, even the amateurs allow all their adult fish to spawn together, and if this is normal procedure, they are in no better position than the commercial breeder to pinpoint responsibility for any new developments that might occur.

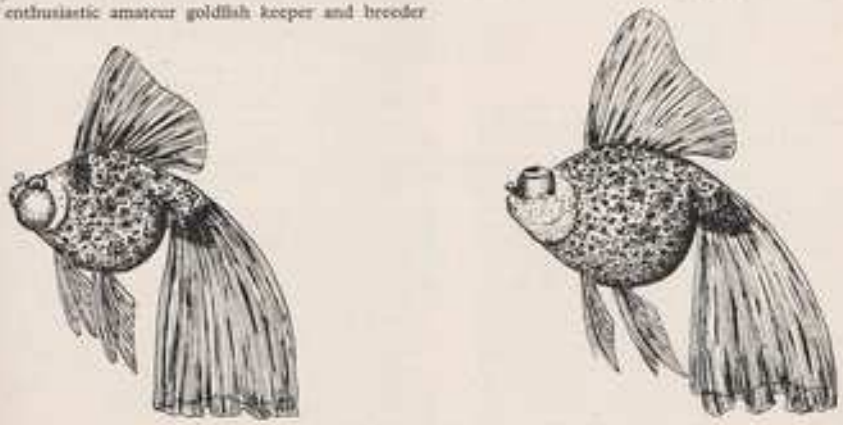
It is only the chap who keeps breeding fish apart, mates a selected male with a selected female, and follows up by raising each spawning separately, who has taken the first step towards knowing with any certainty what is going on in his establishment. And even then, unless he keeps careful records in black and white, his memory may play tricks and confuse him.

So we are left with the position at the present day—after hundreds of years we have a large number of abnormal fish breeding true for perhaps one or two characters, but never for all. Where do we go from here?

This is where the newcomer to the hobby, prepared to devote considerable time, space and enthusiasm to experimenting, stands nearly as much chance as the old, dyed-in-the-wool expert, be he amateur or professional.

The field is wide open! Perhaps you would like to 'improve' the existing variations by taking a character from one fish and implanting it upon another—one that already possesses more than its full share. Conversely, possibly your interest lies in analysing the various factors which together produce, say, an oranda.

For the first-mentioned, those wanting to still further embellish existing variations, I have sketched a few hypothetical ultimates. You may be pleased with them or recoil



Hypothetical goldfish varieties to be developed from existing varieties: left, a nacreous bubble-eyed veiltail; right, a nacreous celestial veiltail

in horror? For the second group, the people who want to know why, those with enquiring minds and the strength to resist cries of dismay from fanciers, there exists any number of possible experimental matings with our friend the common goldfish as a basis in each one. What would happen if an oranda was mated to a common goldfish? Everyone has been so busy trying to get further and further from our streamlined friend that no one really knows. Will you be the first? There are theories, of course, but sometimes theories have to be changed when new facts emerge.

Then, of course, there are all the other varieties which could be similarly mated to common goldfish. Would the progeny from all these crossings be indistinguishable, or would they be vastly different? And what of the results of matings of the progeny among themselves?

I do urge in all seriousness, however, whatever you ultimately decide to do, that a careful record of experiment and results is kept, and that fry from the crossings are not carelessly disposed of without a full explanation of their history. In this way we can keep our stock no worse than it is now, and begin to acquire some sure knowledge of the make-up of our fish.

For the future? A metallic pearl-scaled bubble-eyed celestial oranda

Black Widow Fish *(Gymnocorymbus ternetzi)*

HERE is a characin which is striking in appearance for two reasons, the somewhat disc-like shape, an effect produced by the almost transparent caudal fin and the comparative depth of the darkly coloured anal fin, and also the intense black and sparkling silver of the body colouring. This lack of more vivid colours by no means places the fish at a disadvantage in the community tank when in company with more colourful species, they only seem to enhance the black widow and so help it to command immediate attention.

Although the fish will take dry foods, for really tip-top condition a liberal amount of live foods must be provided and is indeed essential for consistently good breeding results. The sexes are mainly distinguished by the greater rotundity of the female's body when in breeding condition. The presence of a ripe female will generally produce an intensification and extension of the black on the male's body.

Normally a temperature of 75°F (24°C) is suitable but when breeding is desired a temperature of around 78°F (25° C) is needed for conditioning and the sexes should be parted while this is carried out. A 24 in. by 12 in. by 12 in. tank is a satisfactory size for a breeding tank and this should be set up at least a week before the pair are introduced. The set-up for this tank I find is best as follows. Leave the base of the tank clear of sand or gravel and use a 6 inch depth of water. In my part of the country tap water is suitable but it is on the soft side. In those districts where the water is inclined to be hard this can be softened by the addition of filtered rain water. Provided that the breeding pair are sufficiently conditioned I do not think, within reason of course, the type of water is all that important. As spawning medium, if plants are to be used then I suggest that a canopy of floating plants encourages the best results: plants such as water hyacinths, with their long trailing roots on which the fish can spawn. On the other hand two or three bunches of willow root can be tied to corks and floated. The willow root should be thoroughly cleaned and sterilised by boiling before use. Bring the water temperature of the breeding tank up to 80°F (27°C) and leave it for a week.

Maintain this temperature throughout the breeding period, the hatching stage and right up to the time when the fry are 6 weeks old, then drop it gradually to 75°F (24°C).

Introduce the breeding pair during the evening and if conditioning was sufficient spawning usually takes place early the following morning soon after dawn. The spawning will last from 2 to 3 hours, after which the pair should be removed from the breeding tank. At the suggested temperature hatching should take place in 24 to 36 hours, after which for a further 48 hours the fry will be in the process of feeding from the yolk sac; then they will be seen to be free-swimming and ready for taking Infusoria, which should be fed for a fortnight. After that heavier food must be given, such as micro worms. Keep the Infusoria going at the same time for a further week to feed those fry which may be a little backward, then it can be stopped altogether.

Brine shrimps can be introduced next along with finely shredded white worms. At a month old the fry may be given dried fry food and a little later finely ground dried *Daphnia*. Variety is helpful in promoting good growth and development.

Jas. Stott

Safety Measures in Winter

What the Pond Owner Should Do

by A. BOARDER

THIS month and February are usually the worst months of the year for severe frosts. Last winter was so severe that thousands of pondkeepers lost all their fishes, and even in natural waters many fishes died. There are, however, a few precautions that can be taken to prevent too many losses.

The majority of fishes lost last winter were not killed by the cold alone. During cold periods fishes remain dormant and keep to the lower parts of the pond. What does kill most fishes is the fact that the water is so often very impure at the beginning of the winter, perhaps because of over-feeding during the summer and the accumulation of decaying fallen leaves and decaying plants in the pond. In normal times the water is able to give off much of the foul gas produced by this decay, but once the pond freezes over this foul gas is trapped in and fresh oxygen cannot enter.

It is apparent then that one of the most important things that should have been done is to clean out the medium sized pond before the severe weather commenced. The water will then be in a fairly pure state and the fishes will have a better chance of survival. Having cleaned out the pond it is important to stop using all dried foods, for any uneaten will, of course, add to the pollution. A few broken worms can be given if the fishes appear to take the first piece or two offered.

One or two things can be done to assist in keeping the fishes safe in very cold weather. I mentioned the medium sized pond, and this I consider to be not more than 12 ft. by 10 ft. and with an average depth of 2 ft. Such a pond needs the attention described above, but if the pond is larger than this it may not be necessary to clean it out as often. The smaller the pond the harder will it be to keep fishes safe in it, and the more difficult will it be to keep the water in good heart. The same things apply to the pond as to the indoor tank: the smaller it is the harder it is to keep in good condition.

It is advisable to keep open one part of the pond when freezing occurs. The safest way is to place a water-can of boiling water on the ice to form a round hole. It is dangerous to hit the ice, as fishes could be stunned. Some pondkeepers float a log in the water to absorb some of the exertion from expanding ice. It has been stated that if the pond has sloping sides the ice will slide up and not crack the sides as it would do in a pond with vertical sides. This is a happy thought but quite erroneous, as once freezing occurs ice will form on the sides as well as the surface and nothing will induce this ice to slide up. If one has electricity available it is easy to install a heater which would keep at least one part of the pond open. This need only be switched on during severe weather.

Another method which pondkeepers might care to try is the box method. Obtain a fairly strong box not less than 18 inches square, remove the bottom carefully and make a lid from it. The idea is to weight the box so that it sinks into the water until not less than 6 inches protrude above the top of the water (it may be possible to stand the box on bricks placed on the pond bottom). The box can be weighted with pieces of lead or other heavy material. The lid is now treated by adding to its underneath a layer of thick insulating board. The top of the lid is covered with roofing felt and all is ready for the freeze-up. The lid need not be kept in position but laid on only when bad frosts are expected. This covered box will allow a certain amount of water inside the box to stand a very good chance of never freezing. The small open water will allow for the expansion of the ice in the rest of the pond.

Should a layer of snow lie on a frozen pond it should be swept off as soon as possible as the water beneath the ice will soon tend to become foul if no light reaches it. Once ice melts in a pond it is a good plan to change as much of the water as possible, as it often becomes brown-looking and rather impure. Remember, do not feed at all in very cold weather; the fishes are more likely to survive if left alone.

. . . . . and, for the tropical fish-keeper

Safeguards against Power Cuts

TO remove the worry of possible power cuts this winter, of which we have already been warned, and to economise in the number of units of electricity normally used during the coldest months of the year, it is a good idea to insulate your tropical tank, or tanks, against rapid loss of heat.

This can be achieved in several ways, but perhaps the easiest is also the most effective. It merely entails sticking pieces of old blanket, thick flannel, thin foam rubber or, more up to date, expanded polystyrene sheet to the glass base, back and ends of the tank, and then covering them with matching enamel-painted strong card, hardboard or linoleum panels cut to fit level with the inside edges of the frame. A few blobs of a strong-holding adhesive will secure these heat-retaining panels to the lagging pads.

Although much will depend on individual circumstances it will be rare indeed if, after an internal fuse or breakdown in the local electricity supply, a tank so protected loses more than 1°F (about 0.5°C) of heat in twice as many hours. Added protection against protracted pre-dawn failures in supply can be given by spreading an old rug or a couple of thick newspapers over the aquarium last thing at night.

Finally, as most aquaria in the home stand with their backs against a wall, and fish house tanks invariably receive top light through a glass roof, the partial lagging of the frames should cause no deterioration in the growth of the plant life.

J.H.

Pond Life under the Microscope

by RAY PALMER

Photomicrographs by the author

THERE must be many aquarists and owners of garden ponds whose interest in Nature extends beyond fish-keeping, who are in some degree naturalists rather than fish fanciers. To any such as seek an additional hobby, I would recommend the microscopic study of pond life. If several micro-aquaria are kept it provides a welcome occupation during the off-season of other hobbies, when inclement weather makes outdoor activity impossible, or during the long dark evenings when one gets tired of reading or watching television.

It is equally suitable for young or old. To the young it provides an excellent introduction to the more serious study of biology, as it includes such a variety of organisms from the most simple one-celled creatures upwards. To the aged, who are no longer able to engage in very active outdoor activities, the study of pond life by their own fireside can be of absorbing interest.

A microscope of some form is essential. It need only be of simple type, though the larger instruments with their various refinements make the work much easier and more interesting. No doubt there are some possessors of microscopes who have never used them for this purpose, and such fortunate people have a fascinating new world of investigation open to them.

To those who contemplate purchasing a secondhand microscope I strongly recommend a binocular. The old type of Wenham binocular microscope can often be picked up fairly cheaply, and as very high powers are not needed for pond life these microscopes are very suitable. The wonderful stereoscopic effect produced by the binocular vision has to be seen to be appreciated, and there is remarkable depth of focus with the lower powers, so that when a drop of water is examined objects in different planes are visible at the same time. I obtained an old microscope of this type for about £7 a few years ago. It had a full range of objectives from ½ inch down to ⅛ inch, also a mechanical stage, which is so valuable when chasing a moving creature across a slide. A dark-ground condenser is also a most valuable asset, as by its use objects can be seen in brilliant natural colours against a black background, and when observed through a binocular instrument under such conditions the results can be truly marvellous.

Collections of pond life can be made during the autumn and kept for later study as required. Jam jars make excellent micro-aquaria and can be labelled with the source of the catch and fitted with loose covers to keep out dust but admit sufficient air. Some living pond weed and duckweed should always be included, also some natural sediment from the bed of the pond, which will eventually settle and leave the water quite clear. If these jars are kept in a normally heated room, it will be possible to find microscopic life in them even in the depth of winter.

It is interesting to take several natural ponds and keep a micro-aquarium for each. Collections can be made at different times of the year and added to the appropriate jars, which will thus contain a representative collection from each pond, which can be studied at leisure.

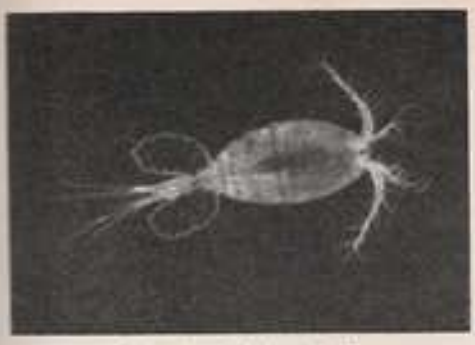
The botanist will naturally turn his attention to the microscopic plants—the desmids, diatoms and algae, also the borderline organisms, such as *Volvox*, that seem to be midway between the vegetable and animal kingdoms.

The brick-builder rotifer (Melicerta ringens) protruding from its tube attached to a leaf of duckweed (magnified by about 30)

The zoologist has a wider field, from the Protozoa (the lowly one-celled animalcules) to those which become increasingly complex in the ascending scale. Some of the most fascinating and beautiful creatures the pond-life collector will encounter are the rotifers, which although quite microscopic are highly specialised animals, with a great deal of complicated organisation in their tiny bodies.

I have spent many an evening watching rotifers, purely for entertainment and enjoyment of their beautiful forms and fascinating habits. Some of the free living rotifers are very active and it is difficult to keep them in the field of vision even with a mechanical stage; others may be found attached to objects by their foot and vibrating their wreaths of cilia to make a vortex in the water and thus draw in particles of food material. As their bodies are transparent all the internal organs are visible, and the gizzard can be seen working vigorously masticating the food that is drawn in.

The tube-dwelling rotifers are some of the most beautiful and interesting, and being fixed to one point are the easiest to observe. One of the best known is called the brick-builder, because it makes a tube of little bricks or pellets from the sediment it collects out of the water. The little brown tube is often found attached to the leaves or roots of duckweed. If it is watched patiently a strange flower-like head will appear, with rounded ear-like lobes and a curious 'face'. The 'flower' expands and turns about in various directions, while particles of material rushing towards it show that a stream of water is passing through it.



Cyclops (magnified by about 30)

it is feeding and at the same time collecting building material. Suddenly it stops and a pair of little 'hands' appear and place a new brick into position, patting it carefully into place, after which the collecting is resumed. It is a sight that leaves one amazed that a being so incredibly minute can show such beauty and perfection of form, and be so marvellously equipped for the strange activities it performs with such accuracy. It is like a peep into another world, of which the ordinary person has no knowledge, and a world which is equally unconscious of the existence of our larger world.

Leaving the purely microscopic creatures, those quite invisible to the naked eye, we find many others which, though visible, need a microscope for their proper examination. Prominent among these are the tiny crustaceans known as water fleas. These include several very distinct types, of which *Daphnia*, *Cyclops* and *Cypris* are the best known, and they provide some of the favourite subjects for beginners in microscopy, as well as being extensively used by aquarists as food for fishes.

The hydras, our freshwater representatives of the sea anemones, are also interesting creatures for microscopic examination, though too large to see all at once, except under the lowest power. There are also numerous insect larvae, worms, mites, water bears and so forth, all of fascinating interest.

In this short article I have merely tried to indicate the scope of the microscopic study of pond life, and the great interest that awaits anyone who takes it up. Perhaps the best comprehensive book on the subject is *Microscopic Freshwater Life* by F. J. W. Plaskitt (Chapman & Hall, 1926), and John Clegg's *Freshwater Life of the British Isles* (Warne, 1959) has chapters on the micro-plants and -animals. There are also many valuable old books on microscopy to be found in libraries, or occasionally picked up secondhand, mostly dating from a period 50 to 100 years ago, when the subject was extremely popular.

A Breeder's Record for the Nigger Barb

by J. M. STOCKLEY

Nigger barbs (male above, female below)

I HAVE been keeping tropical fish for about 5 years and still consider myself an amateur in the world of breeding the egglayers. Like many readers, I had only experience of breeding guppies, swordtails and platys.

Having taken a liking to the nigger barb and deciding that it would brighten up my rather colourless aquarium, I purchased four fish of this species (unsexed). After about 8 to 10 weeks I was quite sure that I had two males and two females. The males had their wonderful breeding colours of black and red and the females were full with spawn.

Deciding that the best time for mating was in the early morning I removed the two females and one male from the community tanks last thing at night and put them into a 24 in. by 12 in. by 12 in. aquarium full of water and without plants. I placed in the centre of this tank some nylon spinning wool (white), which I scattered over the bottom of the tank and held down on the bottom with a fairly large stone. A thin layer of gravel was already on the bottom of the tank.

The next morning about 8 a.m. spawning had not actually taken place but the three fishes were swimming madly about the tank.

Having to go to work, I was quite prepared to arrive home and find three exhausted fish and no eggs, but on the contrary, when I looked into the tank, I found eggs on the wool. I immediately removed the adult fish, thinking that most of the spawning would have been eaten.

Now came the exciting interim period, waiting to see whether there were many eggs and whether they would hatch.

After 3 days I noticed that there were tiny 'splinters' on the front glass and on the nylon wool. I now put in five

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

Realising that the fish had died of starvation, although I had given them enough food in the early stages of life, I started all over again but with one big difference, which I feel is the secret of breeding egglayers: I lowered the level of the water in the tank to exactly 6 in. from the bottom and then followed the same procedure as before except that I introduced the fry food into the tank as soon as the eggs were noticed in the nylon wool and gravel. This time the spawning was larger and the parents could not get so many of the eggs on the bottom, owing to the new depth of the water in the tank and the white nylon wool, which, I feel sure, acted as camouflage!

I hardly lost a fish, and as I write this I am sitting by the side of my aquarium, which contains 70 nigger barbs about ¾ in. long and which are just over 6 weeks old.

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

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

Book Review

Reptiles of Australia by Eric Worrell. 207 pages, plus 60 pages of illustrations (many in colour). Angus & Robertson. 35s.

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

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

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

ROBERT BUSTARD

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

by Dr. D. A. CONROY

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

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

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

FOODS FOR COLDWATER FISHES

Diet of the Pond Goldfish

by A. BOARDER

PROBABLY there are more aquarists who keep goldfish in ponds than those who have them in tanks or who breed indoors. The feeding of pond goldfish depends on several factors: the number of fish in the pond and their size; the amount of natural food already available in the pond.

A freshly constructed pond is not likely to contain as much nourishment for the fish as one that is of old standing with plenty of growing water plants and low forms of animal life.

The time of the year is also very important, as obviously goldfish do not need anywhere near as much food when the water becomes colder as during the summer. Also it must be remembered that the condition of the water bears considerable effect on the feeding needs of the inhabitants. If the water is pure and well oxygenated the fish will eat far more than if the water is foul, and the sight of goldfish mouthing at the surface does not mean that they are hungry and need feeding; they are just gasping for air.

Not only is it necessary to know something of the types of foods which can be used but the frequency of such feeds is also important. There is, however, a very simple test to find out if the fish are 'on the feed'. When all other factors are favourable, if a piece of dry brown bread is thrown on the water the fish will soon be up at it and start to nibble vigorously. When this is seen more food can be given, but never too much at once. Goldfish of all varieties will take in a small amount of food at a time and then chew it over in their mouths for some minutes before swallowing it and looking for more. It is a good idea always to give food in the same place in the pond as the fish soon learn to go to that spot for food when hungry. Unless fine foods are used, which would float on the surface, I do not consider a feeding ring necessary for the pond.

Dried Foods

The kinds of dried foods that goldfish will eat are too numerous for complete mention. Almost any food eaten by humans will be accepted by them. There are plenty of packet dried foods on the market and these are a very good all round stand-by for regular feeding. Many will contain broken dog biscuit and similar material but this is a good food for goldfish and provided that over-feeding is not done packet food is quite safe. To supplement this, rolled oats are eagerly taken, as would be Bemax, but I consider this food too expensive for feeding to pond fish, although it has excellent properties when used sparingly for feeding young fish kept in tanks. A little dry brown bread can always be used but make sure that too much is not given at a time. Pieces of broken plain biscuits can be used as well. Small pieces of cheese will be accepted, as will small pieces of meat, chopped heart and liver. Be careful with liver, as this can tend to pollute the water if used too freely. Another splendid source of food can be found in many of the dried types of dog and cat foods. This may come as a surprise to many but I have used plenty of dried cat food for many years with good results and other pondkeepers have used some tinned dog food with equal success.

The live foods which can be given to goldfish in the open pond are also numerous. First and foremost must come the garden worm. It is the cheapest conditioning food I know and is also a safe one. By safe I mean that as it does not live in water it is not likely to be the carrier of pests which live in the water. For the pond, any sized worms can be used as long as there are medium-sized goldfish in it. The worms should all be broken or cut up with a pair of scissors. There is no need to keep the worms in moss to clean them before feeding with them, as there is not likely to be anything in them to harm the fish. Be careful how you keep the worms, for if left in earth in warm weather they soon die and will smell very badly and so are of no use as fish food. I find that they keep best in decaying leaves in a dark cool place.

A favourite live food with most fishes is the maggot, but it is well to break these before feeding with them. Then meal worms, frog tadpoles, crushed water snails, wasp grubs, fresh ant pupae, blood worms, gnat larvae, *Tubifex* and white worms can also be used. Care should be taken with those live foods that live in the water as they can be carriers of pests such as flukes and fish lice. I have not included water fleas (*Daphnia*) as I think these are best kept for feeding young fish in tanks.

Some Fallacies

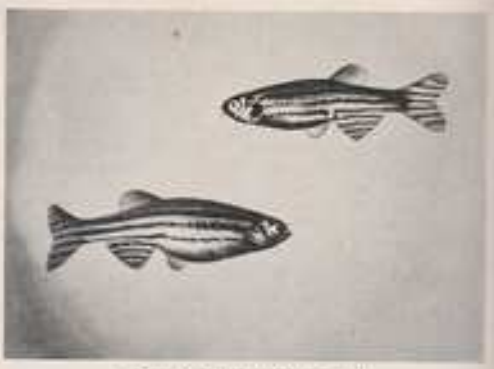
With white worms (enchytrae) it will be found that many may be needed to make a good feed for large goldfish and so it is probable that they will only be used when the pondkeeper has more than enough for younger fish that are being grown on. I consider white worms a very safe and excellent food and one that is not likely to carry any pests. I have seen it written that too many white worms are fattening. I cannot understand this statement, as I have never yet seen any fat in a goldfish. (Many strange things can be found in some books about fishes: one is that different varieties of goldfish should never be placed together or they will fight—this is something I have yet to see. The goldfish is the most inoffensive fish I know and if several rush for the one piece of falling food the ones disappointed never make the slightest attempt to attack the fortunate one. Another "gem" I found in the same book was that green tench live for 7 years. How strange to read this, as I have three fine green tench in my pond in the prime of condition and I bred them in 1947. I think they are good for at least another 20 years!)

Although I have mentioned some kinds of food which can be regularly fed to pond goldfish I recommend that the same foods should not be given day after day. A change is very good for their health, and if dried foods are given for 3 days or more it is well to with-hold these for a day and either feed with live foods or not feed at all. Always remember that goldfish can go for very long periods without food and that it is important to their well-being to have to go a bit hungry occasionally to save them from getting lazy. A very active fish is the one likely to give the less trouble in the pond.

In my next article on feeding I will deal with the feeding of all types of goldfish in tanks and also with feeding fry from the egg to the adult fish.

How to Breed Zebras of Good Quality

by A. JENNO



Zebra danio (Brachydanio rerio)

ALTHOUGH zebras are usually considered to be one of the easiest fishes to breed, this is not always so if one wishes to raise good quality fishes in large quantities.

There are two main problems encountered with these fish. They are carnivorous and require a diet which is practically all meat. Whereas such fishes as the barbs thrive on large amounts of algae together with live foods, the zebras will not bother with green foods and it will be found that large quantities of live foods, in appropriate sizes, will be required to raise a good spawning successfully. The second problem concerns the fact that the eggs take 3 or 4 days to hatch. In this time many can be lost to bacteria, snails etc., and therefore extra cleanliness is required when setting up the spawning tank.

Before attempting to breed, it is essential that the breeders should be of good size and in top condition, with the female visibly full of spawn. My own method of conditioning is to split the sexes in separate tanks and to feed heavily with a diet mainly consisting of white worm and chopped earthworm; other items being live *Daphnia* and good quality dried food.

If gravel is used in the conditioning tank it will be found that feeds will need to be small and frequent as food will be lost in the gravel if too much is given at once. I find it better to leave the bottom of the tank bare and this enables me to feed with large quantities of food at each feed without the danger of lost food polluting the water. My fish are usually fed four times daily and by using this method it is possible to have food available in the tanks at all times. Care must be taken not to overdo this, of course, and any food which is not eaten should not be left in the tank.

Sexing zebras which are in breeding condition is very easy. Apart from the fact that the female's abdomen is visibly distended with eggs, the colours of the sexes are quite different. The stripes of the male are a brilliant gold and blue while the female's are silver and blue.

When the female is seen to be full of spawn and the colour of the males is really brilliant then it can be assumed that the fish are ready to breed. As the female scatters eggs all over the tank during spawning it is advisable to use two males with one female to ensure fertilisation of as many eggs as possible.

For spawning a trio of zebras I usually use a tank size 18 in. by 10 in. The tank is cleaned out with salt and throughly rinsed with clean water, care being taken to see that all snails are removed. The bottom of the tank is then covered to a depth of about an inch and a half with small pebbles which have been sterilised by boiling; the purpose of these being to catch and hide the eggs from the parents. Also, to make sure that the parents eat only a minimum quantity of the eggs, the depth of water over the pebbles is never more than about 4 inches. If it is deeper than this the fish will eat a lot of the eggs while they are still sinking through the water, before they reach safety amoeg the pebbles.

The thermostat and heater should be cleaned and also any wiring which passes below the water surface. The tank can then be filled with fresh tap water to the desired depth and allowed to age for 2 days. A cover glass should be used to prevent the entrance of dust etc. Temperature should be set at about 80-82°F (27-28°C); quite strong aeration is beneficial.

Zebras do not appear to be fussy about the hardness or pH values of the water in which they breed. My own local tap water has a total hardness of 250 parts per million (as calcium carbonate) and is pH 7.4, and even this extreme does not seem to bother them.

If the trio of fish is introduced to the tank in the late evening, they will usually spawn the next morning. After the preliminary driving by the males the female will dash up the tank, spraying eggs everywhere, closely followed by the males spraying their milt over the eggs. This sometimes goes on for as long as 4 to 5 hours before the female has been cleaned right out. It is now that the fish will seriously begin to hunt for eggs and they should, of course, be removed immediately they start doing this.

At a temperature of about 82°F (28°C) the eggs take 3 or 4 days to hatch and during this time the tank should be covered to prevent the entrance of light. When first hatched the young appear as small splinters hanging on the glass sides of the tank. If examined with a magnifying glass they seem to be all eyes and tail. This 'hanging-on' period lasts 2 or 3 days, after which time the fry become free-swimming. It has been noticed that during the hanging-on period the fry do not seem to wriggle as do the young of many other species, but remain motionless the whole time.

First food for the free-swimming fry can be hard-boiled egg yolk squeezed through a handkerchief, or a proprietary liquid fry food. Both these foods can pollute the water if fed in excess, so some care should be taken when using them. For an average spawning I usually feed two drops of liquid fry food four times daily. After about 1 week the fry will be large enough to take newly hatched brine shrimp and it is advisable to remove the pebbles carefully from the tank floor at this time otherwise much of the shrimp will be lost.

When feeding with brine shrimp, siphon the live shrimp

(*Please turn to page* 188)

South African Clawed Toads

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

by ROBERT BUSTARD, B.Sc.

Photographs by the author

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

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

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

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

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

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

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

Gill's clawed toad (Xenopus gilli)

are strictly carnivorous and will eat any aquatic animals. In captivity, earthworms are the most suitable diet but raw meat or fish can be cut into strips and will be eagerly accepted. In laboratories they are often fed exclusively on liver. Feeding presents quite a problem to the kindly collector as usually his clawed toads are grossly overfed, which is not a kind thing to do. They have enormous appetites and seldom turn down food, so that unless they are given very small amounts at one time, it is best to feed them only twice a week. In nature clawed toads are popular because they eat countless millions of mosquito larvae.

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

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

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

Zebras of Good Quality

continued from page 186

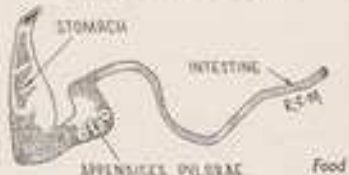
into a clean white handkerchief and then gently wash under a running tap to remove the salt from their bodies as much as possible. Try not to put eggshells and dead shrimp into the tank. The first feeding with brine shrimp should be small and the fry should be watched to ensure that the shrimp is being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

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

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

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

Fish Enteritis



Food tract of a fish

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

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

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

R. E. Macdonald

COLDWATER FISH-KEEPING QUERIES answered by A. BOARDER

Many queries from readers of "The Aquarist" are answered by post each month, all aspects of the fancy being covered. Not all queries and answers can be published, and a stamped self-addressed envelope should be sent so that a direct reply can be given.

A goldfish I have had for over 2 years has suddenly started to turn black. This started at the nose and is spreading to the dorsal fin. Why is this?

This may be a form of melanism and cannot be accounted for, or it may be that the fish has received some damage, either through pests or fungus disease. In the latter case as the new growth forms it may be black to start with and then later on this will disappear. When young goldfish change colour from bronze to red, at first the top of the fish goes quite black, but clears as the red colour becomes more pronounced on the rest of the fish. It is not a disease and will cause the fish no inconvenience.

My pond has been a greenish brown for some weeks and yet I have a fountain going often. I have a number of young goldfish in the pond and am afraid to empty it. What can I do?

The colour is caused by algae and Infusoria. The playing of the fountain will not clear this. As a matter of fact the young goldfish have been feeding on this and so it has done a good job, although perhaps is not nice to look at. You can remove a large quantity of the water and fill up with fresh. This will help and at this time of the year it is probable that the trouble will not recur. You can empty the water out through a net or strainer to catch any small fish.

I am making a fish house and intend to make a small pool at one end. The house will be heated. Which amphibians can I keep and what plants for a raised portion please? I am fond of green tree frogs and could prevent these escaping.

You could keep a few pond terrapins, axolotls, tropical newts etc. English newts, frogs and toads would go into the water to breed but leave after. Tree frogs will not go in the water all the time and like to climb about on tree branches. For surrounding plants you could have *Mimulus* and numularia. These soon spread and if partly in the water would come to no harm.

I am intending making a pool in the garden and wonder if there is anything I can colour the concrete with to make it look more attractive?

It is possible to buy colouring agents to mix with the cement. This is more satisfactory than trying to paint the concrete when the pond is completed. However, even if the concrete was left uncoloured it would soon take on a greenish or more natural hue, once the sun gets to the water.

I have a 9 ft. by 9 ft. garden pond in which I have 24 goldfish, 6 inches long. Now that the water plants have died down I am concerned about the lack of oxygen in the water. Could I have a large aerator or would a fountain help?

In an open pond there is usually sufficient oxygen entering the water from the atmosphere all the time. However, you have many fish in your pond and you may find that the water becomes contaminated by the decaying water plants, such as water lily leaves etc. A fountain would help as long as the water was fairly pure but if it is polluted even a fountain might not be of much use. See that the water is in good condition and change most of it if it smells or has a muddy hue.

Can you please identify the leaves I am sending, which grew around my pond?

The leaves had become dried, but there was enough to enable me to recognise it as *Mimulus* or musk. This is a good pond-side plant and flowers with a yellow flower. There are some good varieties of it which have handsome mottled flowers, and very large ones, too.

I have a coldwater tank, 18 in. by 10 in., and had a goldfish and two shubunkins. Last August I added two more goldfish. Since then they have started to die off. What is the reason?

Your trouble was over-crowding. You do not say the size of the fish but it is reasonable to suppose that they were 2 to 3 in. long overall. If so the tank is too small to hold these fish and to keep them in a healthy condition. A couple of goldfish are enough for such a tank. It is always much more difficult to keep fishes healthy in a small tank than in a larger one.

I want to start goldfish breeding on a commercial basis. Can you give me any information on the prospect?

As you are living in Malta, you have a climate which should be ideal for the purpose. My book, *Coldwater Fishkeeping (The Aquarist)* has all the information you need to be successful at your venture. Whether you will be able to find a ready market for the fish is another question. Many thousands of goldfish are bred in Italy every year and exported from there. Before you get too involved it would be wise to make some enquiries of dealers to see if they can take any fish from you.

I have a good sized tank with various varieties of goldfish in it. I have some comets but they do not seem to do well; they have lost some scales and dash about frequently. They did have some flukes on them but I have got rid of them. What can I do?

I think that comets are not a very good fish for a tank. They are so active and fast swimming that they do better in an open pond. They may have lost some scales as a result of the fluke infection or they may have been attacked by some other form of parasite. Try them in a salt bath for a day or two and if they do not respond I advise you to place them in a pond.

Can you advise me on a form of heater to put in my pond to prevent the water from freezing over as thickly as it did last year?

You could have a 150 watt tank heater in the pond, which would keep at least one portion of the water open, or you could get an 80 foot cable heater which could be immersed in the pond. I have several of these G.E.C. cable heaters in use as soil and greenhouse heating cables and they are water-, heat- and frost-proof. These are advertised in gardening papers or your electrical dealer might help.

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The colour is caused by algae and Infusoria. The playing of the fountain will not clear this. As a matter of fact the young goldfish have been feeding on this and so it has done a good job, although perhaps is not nice to look at. You can remove a large quantity of the water and fill up with fresh. This will help and at this time of the year it is probable that the trouble will not recur. You can empty the water out through a net or strainer to catch any small fish.

I am making a fish house and intend to make a small pool at one end. The house will be heated. Which amphibians can I keep and what plants for a raised portion please? I am fond of green tree frogs and could prevent these escaping.

You could keep a few pond terrapins, axolotls, tropical newts etc. English newts, frogs and toads would go into the water to breed but leave after. Tree frogs will not go in the water all the time and like to climb about on tree branches. For surrounding plants you could have *Mimulus* and numularia. These soon spread and if partly in the water would come to no harm.

I am intending making a pool in the garden and wonder if there is anything I can colour the concrete with to make it look more attractive?

It is possible to buy colouring agents to mix with the cement. This is more satisfactory than trying to paint the concrete when the pond is completed. However, even if the concrete was left uncoloured it would soon take on a greenish or more natural hue, once the sun gets to the water.

I have a 9 ft. by 9 ft. garden pond in which I have 24 goldfish, 6 inches long. Now that the water plants have died down I am concerned about the lack of oxygen in the water. Could I have a large aerator or would a fountain help?

In an open pond there is usually sufficient oxygen entering the water from the atmosphere all the time. However, you have many fish in your pond and you may find that the water becomes contaminated by the decaying water plants, such as water lily leaves etc. A fountain would help as long as the water was fairly pure but if it is polluted even a fountain might not be of much use. See that the water is in good condition and change most of it if it smells or has a muddy hue.

Can you please identify the leaves I am sending, which grew around my pond?

The leaves had become dried, but there was enough to enable me to recognise it as *Mimulus* or musk. This is a good pond-side plant and flowers with a yellow flower. There are some good varieties of it which have handsome mottled flowers, and very large ones, too.

I have a coldwater tank, 18 in. by 10 in., and had a goldfish and two shubunkins. Last August I added two more goldfish. Since then they have started to die off. What is the reason?

Your trouble was over-crowding. You do not say the size of the fish but it is reasonable to suppose that they were 2 to 3 in. long overall. If so the tank is too small to hold these fish and to keep them in a healthy condition. A couple of goldfish are enough for such a tank. It is always much more difficult to keep fishes healthy in a small tank than in a larger one.

I want to start goldfish breeding on a commercial basis. Can you give me any information on the prospect?

As you are living in Malta, you have a climate which should be ideal for the purpose. My book, *Coldwater Fishkeeping (The Aquarist)* has all the information you need to be successful at your venture. Whether you will be able to find a ready market for the fish is another question. Many thousands of goldfish are bred in Italy every year and exported from there. Before you get too involved it would be wise to make some enquiries of dealers to see if they can take any fish from you.

I have a good sized tank with various varieties of goldfish in it. I have some comets but they do not seem to do well; they have lost some scales and dash about frequently. They did have some flukes on them but I have got rid of them. What can I do?

I think that comets are not a very good fish for a tank. They are so active and fast swimming that they do better in an open pond. They may have lost some scales as a result of the fluke infection or they may have been attacked by some other form of parasite. Try them in a salt bath for a day or two and if they do not respond I advise you to place them in a pond.

Can you advise me on a form of heater to put in my pond to prevent the water from freezing over as thickly as it did last year?

You could have a 150 watt tank heater in the pond, which would keep at least one portion of the water open, or you could get an 80 foot cable heater which could be immersed in the pond. I have several of these G.E.C. cable heaters in use as soil and greenhouse heating cables and they are water-, heat- and frost-proof. These are advertised in gardening papers or your electrical dealer might help.

Our Readers WRITE

A Show Mourned

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

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

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

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

T. H. MARSHALL,
Buckhurst Hill, Essex.

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

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

Message of Thanks

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

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

Questions of Herpetological interest

answered by

ROBERT BUSTARD, B.Sc.

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

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

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

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

News from AQUARISTS' SOCIETIES

Monthly reports from Secretaries of aquarists' societies for inclusion on this page should reach the Editor by the 15th of the month preceding the month of publication.

MEMBERS of the **Hastings and Bexhill A.S.** were given a most interesting lecture recently by Mrs. Inskipp on "The Problems of Living in Water" when they met for their monthly general meeting. Mrs. Inskipp illustrated her talk with slides showing magnified pictures of various forms of pond life, including many well-known live fish foods such as Daphnia and Tubifex Worms. A Barb Table Show was also held. Later in the evening new members were invited to put questions to the more experienced aquarists, which resulted in a lively discussion about how far one can flout the accepted rules of fishkeeping without ill effects.

The results of the 'Home Aquaria' Competition were as follow: 1, C. George, 86 pts.; 2, A. Wray, 85 pts.; 3, F. Martin, 60 pts.; 4, J. Santer, 28 pts. Mr. Santer also won the Singapore Bowl for the best collection of plants.

At the next "At Home" meeting, members will discuss their experiences in breeding.

* * *

NEWS reaches us regarding the existence of **Wigan and District A.S.** It was formed in March 1963 and the president and chairman is Mr. T. P. Whalley. Junior members are enrolled as well as adults, and all visitors are welcome to the monthly meetings, held at the Raven Hotel, Wigan, every fourth week. All enquiries should be made to the chairman, at 12, Wiend, Wigan, or to the secretary, Mrs. L. J. Fraser, 1, Sunnyside Road, Bryn, Nr. Wigan.

* * *

THE **Riverside A.S.** will hold their Annual Show on Sunday, 7th June, 1964. Details from E. Davies, show secretary, 140, Cleverley Estate, Wormholt Road, W.12. Telephone: SHE 5673.

* * *

THE annual general meeting of the **Hounslow and District A.S.** was held recently, when the following officers were elected for 1964: Chairman, Mr. R. Luff; secretary, Mr. D. J. Woodward; treasurer, Mr. R. Barber; show secretary, Mr. H. Pratt; press secretary, Mr. R. Bosin; Librarian, Mr. Perrotti; public relations officer, Mrs. J. Scurry; Area members, Mr. R. Scurry and Mr. T. Smith. The secretary stated the society had had a very good year. The membership had increased and there had been a large increase in the number of entries for the table shows held during the year. Attendances at the fortnightly meeting had also been larger than the previous year.

At the annual dinner and presentation of prizes, Mrs. Joan Nettleton presented the prizes to the winners, among which was Master Chris Smith the highest points winner. He was awarded both the junior and senior points shields. The Society meets at 20, Heath Road, Hounslow, the secretary being Mr. D. J. Woodward, 18, Ellerdine Road, Hounslow. Tel.: ISLeworth 9458.

* * *

AT the annual general meeting of the **Don Valley A.S.** which was held recently, the officers elected were as follow: Chairman-treasurer, N. Guy; secretary, E. Ward, 2, Milton Road, Carcroft, Nr. Doncaster; show secretary, Mrs. R. Glidden.

* * *

THE results of the **Merseyside A.S.** club table show were as follow: Guppies: 1, C. Colling; 2, L. Court; 3, H. Stamper. Livebearers: 1, H. Stamper; 2, K. Parker; 3, L. Court. Labyrinths: 1, 2 and 3, L. Court. Characins: 1 and 3, F. Mulla; 2, L. Court. Barbs: 1 and 2, K. Parker; 3, H. Stamper. Cichlids: 1, H. Stamper; 2 and 3, R. Moorcroft. Top Minnows: 1, H. Swanson; 2, R. Jarvis. Catfish and Loach: 1, K. Parker; 2, T. Lambert; 3, F. Mulla. A.O.V.: 1, F. Mulla; 2, [lost]; F. Mulla and L. Court. Best fish in show: Top Minnow entered by H. Swanson.

* * *

THE programme of the **Leyne Aquarists** has been a full one recently. They made a visit to Blackpool for a social evening with the Blackpool Fylde & District Aquarists and all members had a very pleasant night out. Mr. F. Aveyard of Morecambe won the Raffle, and Miss G. Morgan and Mr. J. Mills won Booby Prizes in the Fish Drive. In the six fish competition, Blackpool shared the honours with Leyne, each society taking three firsts. At the next meeting, Mr. W. Barker of Morecambe gave a very interesting talk on keeping Terrapins. He brought along live specimens to demonstrate his talk and these proved to be of great interest to members. A furnished aquarium was on show in the Sefton Road Church schoolroom during the flower show. The tank was set up by Mrs. Smith of Morecambe and looked a picture against a background of beautiful blooms.

Recently, Mr. D. James of Morecambe gave a talk on Electricity in the Aquarium, and demonstrated how a heater and thermostat worked. He pointed out the safety precautions to be taken when electricity is in or near water.

Members and friends made a trip to Belle Vue Manchester for The British Aquarists Festival which is the twelfth exhibition of its kind to be held there, apart from the wonderful fish on show the Festival is a general get together of all Northern Aquarists, the place where one makes and welcomes new and old friends. At the last meeting of the month, Mrs. Smith of Morecambe loaned a tape recording made by the late Mr. H. Smith. The tape consisted of four short talks and was so good that it held the interest of members from start to finish and all those present had a most enjoyable evening. The secretary is Mr. J. Mills, 13, Brookfield View, Bolton-Le-Sands.

* * *

THE **Macclesfield A.S.'s** open table show was a great success. There were 116 entries and a colour film show was put on by the Irish Tourist Board and this was enjoyed by all. The results were as follow: Best fish in show: H. W. Hughes (Belle Vue). Livebearers: 1, W. H. Smith (Stretford); 2, M. C. Davis (Derby); 3, W. H. Smith (Stretford). Labyrinth: 1, Mr. Davis (Derby); 2, D. Leicester (Belle Vue); 3, W. H. Smith (Stretford). Characin, Carps, Danio: 1, J. Smith (North Staffs); 2, R. Hampson (Attleborough); 3, Mr. Davis (Derby). Barbs: 1, Mr. Crichton (Stretford); 2, Mr. Watts (Attleborough); 3, Mr. Davis (Derby). Cichlids: 1, H. W. Hughes (Belle Vue); 2, Stella Davis (Derby); 3, S. B. Cass (M.A.S.). Loach, Cats, A.O.V.: 1, Anton Barnett Cass (M.A.S.); 2 and 3, Mr. Davis (Derby). Guppies: 1, 2 and 3, Mr. Hickson (Belle Vue). Junior Prize: Anton Barnett Cass (M.A.S.).

IN their challenge match against Tadcaster, **Thorne A.S.** were successful, the results being as follow: Thorne 48 points, Tadcaster 24 points. Best fish of the show went to Mr. A. Rodgett of Thorne with a comb tail. Judge was Mr. Skinner. The Thorne society held their annual dinner and social recently when the awards were presented for the past year. Plaques were received by the following members: Aquarist of the Year: Mr. N. Sanders; Table Shows: Mr. N. Sanders; Breeders Egglayers: Mr. G. Lowe; Breeders Livebearers: Mr. M. Holroyd; Furnished Aquaria went jointly to Mrs. B. Sanders and Mr. K. Brant.

* * *

AT the annual general meeting of the **Tottenham and District A.S.** the following officers were elected to serve on the committee: President, H. Brant; chairman, L. Clements; secretary, Miss P. Hawes, 26, St. Georges Road, Edmonton, N.9.; treasurer, R. Morrans; show secretary, R. Elsdon; F.B.A.S. delegate, D. King and one member A. Barnes. An increase in the membership during the year, and the annual balance sheet showed that the club was in a sound state. Enquiries for membership are welcomed and full details can be obtained from the secretary.

* * *

THE officers elected at the annual general meeting of the **Bristol Tropical Fish Club** were as follow: Chairman, Mr. L. Nightingale; vice-chairman, Mr. R. Court; hon. secretary, Mr. W. Holland; hon. treasurer, Mr. L. Littleton; reporting secretary, Mr. F. Barry.

The new secretary is Mr. W. Holland whose address is, 424, Whitehall Road, Easton, Bristol, 5. Club meetings are held the third Thursday of every month and new members will be welcomed.

* * *

AT the monthly meeting of the **Belle Vue (M.C.) A.S.** the main item on the agenda was a discussion of the society stand at the 1963 B.A.F., Messrs. Gill and Hickson also received their B.A.F. prize cards. The February meeting will take place on the first Wednesday in the month at the Palm Court Restaurant, Belle Vue Gardens. The main item will be a film show given by two of the members.

* * *

THE **York and District A.S.** held their first annual dinner and social in December, when Cups and Plaques were presented to members who were successful in the monthly table shows for 1963. The results were as follow: 1, Mr. G. Sutton; 2, Mrs. J. Hubble; 3, Mr. D. Gerenwood.

* * *

IN December, 92 members and friends of the **Tipton and District A.S.** attended the first annual dinner and the presentation of awards. The awards were presented by the principal guest Mrs. Evelyn Williams, hostess at the Society's Headquarters at the Leopard Inn. The next meeting which was held at the usual Headquarters on Wednesday, 8th January, and fortnightly on Wednesdays afterwards.

Crossword Solution

T	A	P	E	■	M	A	N	I	A	■	F			
			R	■	T	■	D			L	■	E		
B	L	A	R	E	■	D	I	G	G	E	R			
R	■	I	O	N	S	■	L	E	A	■	N			
I	■	S	E	T	■	A	L	T	E	R	■			
N	E	E	■	H	U	G	■	S	■	■	N			
E	■	■	D	■	R	E	D	■	O	R	E			
■	S	P	A	W	N	■	A	F	T	■	W			
O	■	A	W	E	■	G	N	A	T	■	T			
D	I	P	N	E	T	■	I	D	E	A	S			
D	■	E	■	■	A	■	O	■	R	■	■			
S	■	R	A	S	P	S	■	A	S	K	S			

AT an extraordinary general meeting the name of the Romford A.S. was changed to the **Romford and Becontree A.S.** The rest of the evening was given over to a talk by Messrs. Key and Savoury. The subject was mainly on building a Fish House in which many useful hints and tips were given.

* * *

CHANGES in administration have been made by the **Wakefield and District A.S.** Mr. J. Thompson has been succeeded by Mr. D. English as secretary and Mr. A. Bates has been succeeded by Mr. C. Archer. Other officers are as follow: Vice-chairman, Mr. J. Thompson; treasurer, Mr. R. Fewett; show secretary, Mr. G. Bradley; committee, Mr. R. Proctor, Mrs. M. Turner, Mrs. N. Fawcett.

Meetings are held at Waterloo Hotel, Westgate Wakefield on the second Tuesday of each month. There are speakers every alternate meeting and a table show every meeting.

The society is hoping for more outings this year and all visitors are welcome. The address of the secretary is Mr. D. English, 17, Cypress Road, Normanton, Yorks.

* * *

RECENTLY the **Hendon Aquarist Club** were host to Willesden, Riverside, Hampstead and Independents Clubs in the second last meeting in the North West London Group Shield Competition.

Willesden came away from this meeting having conceded five points to their nearest rivals Riverside, but still in the lead on overall pointing. Willesden members who gained awards were: Mr. R. Porter with a fourth in the Loaches Class, a fourth in the Barbs Class, and third in the Corydoras Class.

Mr. W. Hobbs in the Corydoras Class gained a fourth place. Mr. K. Netsall gained a second in both Loaches and Platy Class. Mr. Creed was the judge for the evening. Latter positions are as follow: Willesden, 126 points; Riverside, 113 points; Hendon, 44 points; Hampstead, 38 points; Independents, 25 points.

* * *

AT the annual general meeting of **Penrice and District A.S.**, the following officers were elected: Chairman, Mr. J. G. Herring; treasurer, Mr. C. Robinson; secretary, Mr. F. Harrison; asst. secretary, Mr. D. Porter; delegate, Mr. W. G. Watson. The retiring secretary Mr. J. Hewitson was thanked sincerely for his services during the past year.

By popular request it was decided to organise meetings for 1964 at fortnightly intervals instead of the present 3 weekly interval. The programme of competitions for 1964 was fixed and a copy will be sent when printed. It was agreed that the third annual open show be held during the summer of 1964, and also to hold a one day open table show at an earlier date.

Earlier in 1963, each member was given two penguin fish and these were on show at this meeting—judged by Mr. J. Hunt. Results: 1 and 3, J. Robinson; 2, D. Robinson. Other awards presented were: Harrison Memorial Trophy (highest points in 1963), Mr. J. G. Herring; runner up trophy, Mr. F. Harrison; Eggtaver Shield (spotted gerdh), Mr. R. Atherton; Livebearer Shield (Lampina Mollie), Mr. F. Harrison; Breeder's Cup (angel fish), Mr. D. Porter; Fighter Cup (blue Siamese fighter), Mr. J. Hunt.

* * *

SECRETARY CHANGES

Bristol Tropical Fish Club (Mr. W. Holland, 416, Whitehall Road, Barton, Bristol 5); Croydon A.S. (A. C. Anderson, 20, Norbury Road, Thornton Heath, Surrey); Erith and District A.S. (A. E. Carter, 10, Lynn Road, Welling, Kent); Wakefield and District A.S. (D. English, 17, Cypress Road, Normanton, Yorks.).

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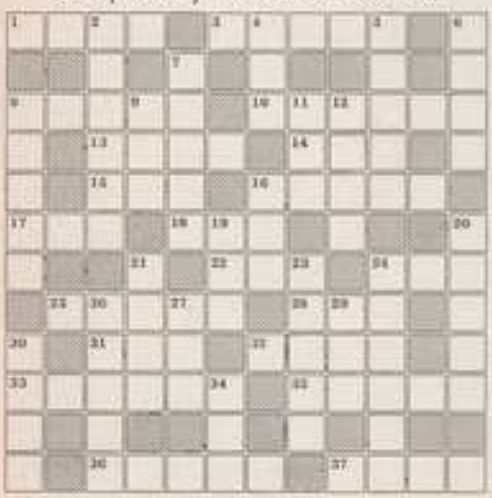
The AQUARIST Crossword

Compiled by M. W. SAUNDERS



Solution on page 191

CLUES ACROSS

1. Type of grass—also known as *Callitrichid* (4)
3. Man I have a cream for (3)
6. Trumpet forth about the bare pound (5)
10. An Australian catfish ? (6)
13. pH is a way of expressing their concentration (4)
14. Sheltered side of a valley (3)
15. If a thermostat is this . . . (3)
16. . . . you won't be able to do this to it (5)
17. Born to be seedy to start with (3)
18. Part of an snakeskid's spawning procedure (3)
22. Colour of an elderly *Rohtee dorsa radicans* (3)
24. Mineral core, mostly (3)
25. Raise a family from the point where you look your possessions (5)
28. Rear end of a raft (3)
31. Hold in dread over 24 across we're told (3)
32. Its larvae is often eaten by tropicals in the wild (4)
33. Useful device for making a catch (3-3)
35. Things on your mind (5)
36. How a snail takes its food (5)
37. Enquiries about some cures (4)

CLUES DOWN

2. Quietly lift up and express approval (6)
4. Say further than you'll find the total (3)
5. Much appreciated by lion-hearers (5)
6. Found in Indian water (4)
7. Not the last man in, but the last man out (5)
8. Salt water home of a certain shrimp (5)
9. Species of deer closely associated with eggs (5)
11. Sick, so takes a pill, almost (5)
12. Receives it and forgets in the end (4)
16. Period of history connected with ice and snow (3)
19. Run around the pitcher (3)
20. Amphibious water-dwellers (5)
21. We see the light and the zebra fish spawns (4)
23. Member of the Cyprinidae family (5)
24. Don't let these animals loose in your goldfish pond (6)
26. Father leads the representative back with the sweetheart (5)
27. Small weed of the tail-less variety (3)
28. Pet idea (3)
30. 66 to one against it being even (4)
34. Strike lightly and it might make the water pour out (3)

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