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THE AQUARIST
Editorial

Most people consider the spawning act in fishes to be a rather casual and unexciting business, and indeed a plain description of what is involved for most species would encourage such a notion. But for anyone who has seen a variety of species at spawning times the impression that spawning is accompanied by a state of considerable excitement in fishes is certain to be gained. The commotion to be seen at shallow pond edges at spawning time can be such as to make the water appear to boil with fish, as large numbers of them twist and flick their bodies out of the water. Among tropical fishes, one of the most unexpected forms of behaviour is that shown by the anabantids. In few other fish groups does such a sustained close contact of male and female occur, the contact seeming to be necessary for the eggs to be extruded. It has recently been shown by scientists in Japan that in the medaka (Oryzias latipes), another species in which an embrace by the male occurs, the contact provokes egg-laying by stimulating internal nervous and chemical mechanisms within the female and not merely by squeezing out eggs as a result of external pressure on her.

ANNOUNCEMENTS of the formation of a company to plan, build and administer on the south coast of England an “oceanarium” costing 5 million pounds have raised the hopes of aquarists with marine interests that Britain is to have at last an exhibit of the kind that has proved so popular in other parts of the world. The oceanarium will not only provide an aquatic zoo for the display of seldom-seen marine animals of all kinds but will serve also to increase our knowledge of these animals, from scientific studies to be carried out there. Provisional plans are for three giant pools in which marine mammals such as whales, porpoises, dolphins and seals, and large fishes such as swordfish and sharks, can be housed, in addition to a collection of more conventional aquaria for smaller species. The company concerned, Marineland U.K. Ltd., has not yet settled the location of the oceanarium, but Eastbourne and Brighton have been mentioned as possible sites.
The Ideal Fish House

by PETER DENDY

There really is no such thing as an ideal fish house, as an arrangement which is perfect for one aquarist may be entirely unsuitable for another. However, I expect that we will all be prepared to admit that our own fish houses leave something to be desired, even if the requirement is only for a little more space.

My own fish house is fairly well organised and is commented upon from time to time by visitors, but I am by no means satisfied with it, particularly as it is in two parts. The original fish house, which is part of the house, started to bulge at the seams and eventually with many complaints gave birth to an annexe in the garden, which is now in the same pregnant state as its parent.

I have no intention of further enlarging the present set-up, but what will happen when my current breeding programme gets into its stride I shudder to think. At the very least I will have to try and find homes for quite a few second-hand fishes to give me room for the new arrivals. What a problem this fish-keeping can be; ideally you should always have several empty tanks to give flexibility as the piscine population wax and wane, but in practice empty tanks always seem to tempt you to go in for something else and the number of empty tanks rapidly dwindles to nil. There may be aquarists about with enough will-power to retain empty tanks for a period, but I have not met one yet.

If you are a keen aquarist then fish occupy a good portion of your time and your thoughts, and your greatest delight is being with your fish as much as possible. This, of course, involves a certain amount of domestic comment, and it is a very loving wife indeed who allows her husband to spend all the time he wants with his fish without making pointed remarks about it, at least. Ideally the keen aquarist would choose to live with his fish and surround the walls of his lounge with tastefully arranged tanks so that he can observe in comfort and have something to distract his attention from the ever-present "gaggle-box".

Such an arrangement requires that the wife is as deaf about fish as the husband, and probably is rarely possible if a reasonable level of domestic harmony is to be maintained. The most any man of my acquaintance has been allowed is one community tank in a corner and heaven help him if he spills any water when he is cleaning out, or is careless enough to splash the wall. My own lounge tank had its vis-a-vis removed when it was inconsiderate enough to spill its glass and thoroughly wet the carpet and a large pile of glossy magazines.

I wonder how many people find that work interferes with fish-keeping to an annoying degree. Although they probably appreciate that unless they go to work they could not afford to keep fish at all? Whoever said that fish-keeping was a cheap hobby, by the way? That ideal fish house must of necessity wait for the right time and opportunity, probably retirement, as its production is bound up with several things, not the least of which is money. In the meantime it can always be planned for, thought about, amended and produced in plan form ready for the day when it can start to become a reality.

The ideal fish house must satisfy certain basic requirements about which there can be little argument. It is in the arrangement and accessories that detail that aquarists will differ, and in the number of additional facilities that are added to make maintenance easier and enjoyment greater. The various points to be thought about for the fish house seem to fall into two categories, those that are essential and those which might be described as optional extras.

These are, to my mind, essentials:

1. Adequate space for present and likely future needs.
2. Satisfactory insulation to avoid heat losses and keep running expenses to a minimum.
3. A tank-supporting system that allows easy access to all tanks and does not involve either a step-ladder or liming on your stomach to see into the bottom one.
4. Lighting only from the top and preferably natural illumination backed by artificial light to extend the shorter winter days. Adjustable blinds are also necessary to decrease the light reaching the tanks during the summer.
5. A tank-heating system that is trouble-free and does not require daily attention. This is satisfied by individual electric tank-heating or electric or gas space-heating.
6. Sink and working top with running water laid on, for all the odd jobs and washing that is to be done.
7. Provision for the raising of Grindal worms, micro worm and brine shrimp, which all require a certain amount of labor, and white worm, which must be kept cool.
8. A medicine cupboard equipped to cope with all the common complaints and microscope giving a reasonable degree of magnification.

Optional extras are the following items:

1. A concrete floor with a slight fall to a central drain for easy washing down.
2. A ready-use mains-water tank kept at the right temperature for immediate topping up or re-filling of tanks.
3. A rain water tank and a ready-use tank for a 1:1 mixture of rainwater and tap water, though the need for both of these items will depend on the hardness of your main water supply.
4. A small electric pump for lifting the ready-use water to the various tanks and incorporating a float switch on the delivery nozzle to shut off the pump when the tank is full.
5. An electrical water heater over the sink and a boiling plan for sterilisation of sets etc., and preparation of foods.
6. A small refrigerator for storing those foods which must be kept cool to prevent them going bad.
7. Adequate storage cupboards for foods and accessories so that the place may be kept tidy and odd items stored out of sight.

THE AQUARIST
(8) A desk at which to write up notes etc., and a filing cabinet and shelves for keeping all the literature which an aquarist accumulates around him.

(9) A Daphnia tank, from which you can draw as required. If it is large enough, of course, you can breed your own water plants.

(10) An easy chair or two so that visitors may be allowed to relax whilst they matter.

(11) A radio to keep you in touch with the outside world. (Notice that I did not say a television set!)

A plan and section of the type of fish house I visualize accompanies this article and is basically simple in construction. The walls are 8 inch cavity work with two 5 inch skins of Thermalite or other insulating building block, treated externally with a cement paint for weather proofing and internally with distemper for appearance. The roof is of a lean-to type fully glazed with double glazing and further insulated with an additional layer of polythene to cut out condensation completely. Double doors are provided and heat loss from a structure of this nature should be down to the very minimum.

The space under the tank rows, where not required for ready water storage tanks and cupboards etc., can be used for growing-on tanks constructed of 4 inch brickwork, 9 inches high, built on the floor and rendered with waterproof cement. The concrete floor is finished with a dustless preparation and slopes gently to the central drain, which is fitted with a lift-out container for caching gravel etc. that would otherwise find its way into the drain pipes and could cause trouble.

The cost of this fish house, starting from scratch with all new equipment and assuming that you do all your work yourself, is estimated to be:

<table>
<thead>
<tr>
<th>Item</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fish house construction</td>
<td>£270</td>
</tr>
<tr>
<td>Tanks, stands, heaters, thermostats etc.</td>
<td>£210</td>
</tr>
<tr>
<td>Optional extras</td>
<td>£180</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>£660</strong></td>
</tr>
</tbody>
</table>

June, 1962
Plant-Hunting for the Fish Pond

by ERIC HARDY

These thoughts struck me when a friend took me to see his new garden in Cheshire, with a fair-sized pond between his garden and the corner of the field, which he wished to plant and improve, as it had become rather barren in appearance. All that he wished to keep from its rural days was a pair of moorhens, which nested on the rubbish dumped in it and picked about its garden. I first suggested digging out most of the dead leaves from the bankside trees, and letting no more accumulate there. Then to introduce some of our native white water lilies, which take well to ordinary field ponds and in their purity can look any of the coloured hybrids in the face. On the one muddy bank that he wished to keep open so that sunlight could fall upon the pool, I suggested a carpeting of plants like creeping Jenny, spotted yellow American mimulus, cranberry with its little pink flowers, insectivorous sundew, deep-blue Irish butterwort with its starfish-like arrangement of pale-green hairy leaves flat against the ground, and even bog-bean’s tripartite leaves and the fuzzy whiteness of its flowers, if kept within bounds.

These were all native plants, and I suggest for the pondkeeper who intends to stock an outdoor garden pool with native pond fish, rudds, carp, tench etc., coupled, if he is rural enough, with a pair of moorhens, that his plant-hunting takes him to the natural water life of our countryside, where many aquatic plants are very interesting, though not always very colourful. My friend’s garden already had the floating oval leaves of Potamogeton natans, but this gets out of control easily and covers the surface if not checked, or removed.

Although the six-stamened, three-petalled waterwort Elatinus hexandrus is a rare plant of the wild, its slender prostrate annual growth can be found in the low water of ditches, and encouraged in the muddy banks of most ponds, if not too deep. For a century or more it has grown in the large lake and the Muzzy lake in Knutsford Park, neither much more than 4 feet deep, and it also grows in Biddulph Lake (Llyn Cwmm) in Anglesey, the north side of Llyn Bache, Cwm Glas, the south side of Glaslyn near Llanellther and Llanberis lake in Snowdonia. More mere near Knutsford is another site in Cheshire.

Its rarer four-petalled relative, E. hydrorhoe, shares its station at Biddulph Lake. You would hardly consider these tiny plants allied to the carnation family, but theirs is the next order, and they have some 40 species in the world.

Horned pondweed, Zannichella palustris, is less scarce and rather more attractive in its thin, wiry nature. In the north-west I have found this in the watery pits on...
either side of Rufford railway station in Lancashire, and in the Mollington Canal near Chester. We searched in vain for the site in the Hoddes on the south side of the lake, near Euxton, that was quoted in the Flora of Lancashire; but in 1948 we found it in seed, in a rare event in the north, in the canal at Lytham. The Formby-Hall has no banks and the pond in Hallhead, near Walton, Cheshire, is the only Lancashire site, and a field pond on the farm by Hoylake, and in Budworth and Talbot Monty are in Cheshire sites. The 

The creeping, variegated pondweed, Potamogeton heterophyllus (or grannaeus novaevaria) and its hybrid form grow in the lake at Euxton, and the variegated pondweed, P. perfoliatus, in the Rufford-Lytham canal in Lancashire and the Brenton Canal and Rostherne Mere, Pickmere etc. in Cheshire. Some of these rare pondweeds are also found in the slower backwaters of rivers. The last-named, for instance, grows in parts of the Dee above Chester, as well as in the London-Thames at Prinnon Hook, the River Colne and the Darent at Horton Kirby, Cranberry (Oxycoccus palustris) is generally regarded as a moorland or marshland plant, delicately suffused, most attractively flowered in tiny daisies pink flowers with reflexed petals like miniature cyclamens, and as such it still grows as near to Liverpool (Kirby) factories as the north end of Sotonwood Moss. As a pondside plant, however, it is equally attractive, and grows luxuriantly with the sundew and cotton-grass beside the water-lily pond in the Manchester Scout Camp Wood at Sandiway, near Cuddington, in Cheshire, and in the shallow ponds near the moorland Cat and Fiddle lake, the Galley Pool at one end of the Cheshire plain and a mine at the gully end of Oaklymoore, not to forget Wybunbury Moss near Nantwich.

Another creeping, the evergreen cowberry or red whortleberry (Vaccinium myrtillus) forms luxuriantly growing wild where the grouse-shooters go, but like the cranberry it can be cultivated on the mud beside ponds if, as is usually the case, this is of an acid nature. It becomes quite shrubby in a small way. It shares cranberry's haunts near the Cat and Fiddle, as well as on Peckforton Hill. Its white flowers are tinged with pink. Neither of these two berry-bearing plants minds a little bit of shade, provided that it is not wholly darkened.

Garden "wild" ponds need pondweeds, of course, for fish to shelter in and to spawn in in spring, and long-growing, creeping edge-plants to clothe the mud in colour and give some plant form, without screening the sun off the water as would trees and shrubs all the way round the bank. I hope to see my friend's pond again when the winter plants are established and the old dead leaves have been dug away in his garden, sweetened with lime, where they are of more use than choking and poisoning the pond.

FAR and WIDE

Give Away

A REPORT from an American works club tells how at a recent get-together and open house of local clubs two members stood for 2 days giving away pairs of guppies to strangers. In the event, upwards of five hundred people accepted these finny gifts. It would be helpful to know just what effect this novel approach had on introducing new enthusiasm in the hobby. The Malacca Research Institute

THE Tropical Fish Culture Research Institute of Malacca, Malaya, has issued an annual report, which makes interesting reading. Aquarists when bewail the fact that the general public does not show enough interest in the fish culture hobby, but this is not true in Malaya, where visitors have made the Institute a most popular attraction so that now only those interested in scientific research work, a few top forms of schools and distinguished visitors are shown over the setups. Hobbyists will take heart from some of the findings. For example, transport between ponds is now by Land Rovers, which can negotiate the terraced woods without difficulty, although these woods choke rail tracks. Weed growth alongside the 1 acre pond remains a problem, even the hot, humid climate causes rapid growth, which mechanical cutters only partially control at the faster areas. They cannot be used at all along the pond edges or pipes, of which there are some 141 miles. The main drain from the ponds becomes choked with submerged weed, for which spraying is of little use. The best method of removal is hand-weeding. The 10 and 100 acre ponds have given trouble owing to the bottoms developing leaks that are hard to seal. Although clay-bottomed, large cracks appear and this particular clay is not like London clay but tends to become almost like liquid and seeps through cracks and hollows in the harder subsoil. Experiments with an insecticide (Roger) which is used against rice stem-boring insects shows toxic effects against fishes. Where ponds are lined but not fertilised Rana tadpoles become the dominant plant. Where phosphates are added it is replaced by Enhydris. Neither grass carp nor Puntius iranica seem to eat Channa and its dense growth can cause depletion of the nutrients normally available for plankton growth. Unfertilised ponds have extreme clarity. Some experiments with four ponds of 4, 2, 1 and 1 acre are being made to compare the effect of the surface area of the pond on the growth rate of fishes. There are many comments on growth and breeding experiments which frequently do not turn out as expected, often because of climatic or chemical conditions locally, and one realises that, for all its drawbacks, England is not such a bad place to have a pond even if we are limited to goldfish, otso and a few other species.

Raymond Yates

June, 1962
Aeration and Filtration

by E. H. Dalgliesh

AERATION and filtration are subjects that seem to have been neglected to some degree in most of the standard works on aquaria. On the whole the books seem to describe the equipment available, but do not give a great deal of information on the mechanics or the value of aeration and filtration.

Many experts claim that aeration is not necessary unless it is required to crowd a tank for some reason, and filtration only serves to eradicate variations from the ideal "balanced" aquarium, which are due to causes external to the tank, e.g. lack of care by the aquarist himself. However, this does not help the aquarist whose tank is not balanced.

The first thing that must be realised is that a filter, with an inert medium, e.g. glass or nylon wool, can only remove solid matter from the water, and then only if the matter is large enough to be caught.

An undergravel filter works on an entirely different principle: this uses the gravel itself as the filter medium, and relies on bacteria which thrive in the gravel, especially when this is continually flushed by clean water, to reduce organic matter, unseated food etc., to harmless salts. In passing it may be mentioned that these salts, together with the increased oxygen content in the fresh water surrounding the plant roots, induce a much stronger root formation than would otherwise be the case. Without this action, organic matter left to decompose in the tank would soon pollute the water. It must not be assumed, however, that an undergravel filter is a licence to tip food into the tank with gay abandon, or to leave dead plants in the tank. The purpose of a filter is to help to keep a tank clean, not to work miracles.

On the subject of aeration, it has been said that oxygen passes into the water as a result of the increased surface area created by the bubbles. Although it is true that a small bubble has a large surface to volume ratio a quick calculation shows that if the bubbles have a diameter of 0.1 inch, then the surface area of a 2 3/4 ft. tank, the stream must contain about 60,000 bubbles at all times. For normal aeration this is unlikely, but even so, many more fishes may be kept in a tank with quite a gentle stream.

This fact appears to indicate that most of the benefit from aeration is due to increased surface area, but to disturbance of the surface of the water, reducing its resistance to the entry of oxygen. In view of this, it may be deduced that the most effective way to aerate a tank, killing two birds with one stone. A corner filter confines the disturbed surface of the water to a very small area, and will thus have little effect on the oxygen content of the tank.

Up to this point, I find myself in agreement with the aforementioned experts: the aquarist should not have to rely on artificial methods to keep his tank clean and well-aerated. However, a quick experiment brings to light another important point. If the average tank, with top lights but without heater, is checked with a thermometer it will be seen that the temperature at the top can be 1°C higher than at the bottom. Since in a planted aquarium convection currents are considerably restricted, a heater aggravates this condition and the temperature range, top to bottom, can be as much as 15°C. This is somewhat incongruous when one thinks of the trouble usually taken in floating a jar containing a new fish in order to equalise temperatures.

If now an aerator is switched on it is found that within a few minutes the temperature range is very much reduced, in 5 minutes down to 2-3°C (5.6°F to 3.6°F), eventually reaching the condition where there is virtually no difference between top and bottom.

A similar effect occurs with an undergravel filter, but not with a corner filter. This appears strange at first, but a little thought shows that it is not circulation due to filtering, but stirring action due to the bubbles disturbing the water. With a corner filter, of course, the bubbles are confined in the air lift and disturbances of the water are very effectively damped out by the filter box. An outside filter also has little effect on the temperature gradient, even though a certain amount of disturbance occurs as the water flows back into the tank. This suggests that the top of the air lift of an undergravel filter should be below, rather than above, the surface of the water. This gives a good stirring action, and good aeration. Further evidence that it is not circulation, due to drawing water through the filter and redistributing this in the tank, that causes evening of temperature, is obvious when one realises that the average air lift takes several hours to move the water content of a normal tank.

On the basis of the above remarks either floating a jar in the tank is a waste of time or it is essential to generate some form of artificial circulation, especially when the top lights are on. I have kept a tropical tank for over a year without forced circulation and the fishes do not have any ill-effects from the large temperature gradient. I am, however, prepared to believe that they would be more comfortable in a tank with a more uniform temperature.

In a heavily planted tank, aeration is more important, as apart from an even distribution of temperature, plants produce carbon dioxide in the dark, and it is not unknown for fishes to be suffocated during the night in exceptionally heavily planted tanks.

A short description of the filtering equipment available, and its operation, might prove helpful in clarifying some of the foregoing remarks for the newcomer to the hobby.

There are four basic types of filter: bottom, corner, outside and undergravel. All of these need an air lift, and hence an air pump. This may be a vibrator, or a more expensive, but heavier duty, unit. The air lift with the greatest water displacement is shown in Fig. 1. It is often incorporated into a simple undergravel filter. Bubbles from the diffuser stone carry water, drawn through the gravel, up the funnel and back into the tank. This air lift can move up to 2 gallons per hour, and can, of course, be...
used with any other filter when rapid water circulation is required.

The most common type of air lift, however, is simply a tube into which air is injected, the bubbles carrying the water up the tube (Fig. 2).

The bottom filter consists of a perforated box containing the filter medium, resting, as its name suggests, on the gravel at the bottom of the tank. The water is drawn through the box, passes up the air lift and flows back into the tank. This filter is not very common nowadays, having been replaced to a great extent by the corner and outside filters (Fig. 3).

The corner filter has the filter box attached, usually by rubber suckers, to the side of the aquarium. The water from the air lift flows through the filter medium and back into the tank, under the action of gravity, in contrast with the bottom filter (Fig. 4).

In the outside filter, the water is taken out of the tank by the air lift, through the filter medium (which may be divided into several grades placed in separate compartments) and returned to the tank via a simple siphon (Fig. 5).

The undergravel filter may be a system of perforated tubes or a slotted plate under the gravel (Fig. 6). The action of this filter has already been described.

The most common filter medium in use is glass wool; unfortunately this tends to splinter when handled, and can cause irritation. Apart from the use of rubber gloves, it is well worthwhile soaking the wool in water before handling it to any extent. An alternative to glass wool is nylon wool; this does not splinter and is more pleasant to use. As a matter of interest nylon wool makes a good substitute for marbles for protecting the eggs of some of the more cannibalistic egg layers.

Another useful filter medium is activated charcoal; this is worth trying if green water is present in the tank. It also does remove sulphured hydrogen, but it loses its efficiency after about a week.

Finally, well-washed peat may be used to acidify water, either to correct an alkaline condition or to produce acid water for breeding certain fishes. The peat may be used in the filter compartment of an outside or corner filter. Alternatively, it may be put at the bottom of the tank with an undergravel filter; in this position it will be beneficial to plant life, but, of course, adjustment of the pH value is considerably more difficult.

It is hoped that the above remarks may clear up some confusion in the minds of beginners, and perhaps give food for thought to the more experienced aquarist.

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June, 1962
Hatching and Feeding Fry

by A. BOARDER

If all has gone well some fry will hatch out in 3 or 4 days. This will happen if the temperature of the tank has been about 70°F (21°C). I say "about" as it is sure to vary a little with the weather and the time of day. A slight variation will not matter although it must be realised that if the temperature falls below 70°F (21°C) for some time then the hatching will be delayed as the time taken for hatching is governed entirely by the temperature of the water.

The fry will be seen as tiny glass-like splinters which dash with an erratic course when disturbed. They then anchor on water plants or the sides of the tank, where they may be seen hanging motionless for most of the first couple of days. Any slight disturbance of the tank will cause the fry to swim about but it is well to disturb them as little as possible as they need to rest and absorb the yolk sac with which they are born, before having to swim around too much.

Once some fry have hatched a sheet of paper should be drawn across the surface of the water to remove any film. This film will prevent the fry from getting air at the surface. The question whether fry have to get air from the atmosphere in order to fill the swim bladder or not is debatable. I have certainly watched fry soon after hatching struggling to get to the top of the water as if to take in air, but I am not sure if this is to fill the air bladder. The time to start feeding is governed by the time taken to absorb the yolk sac. This can rarely be seen but there is one sure sign that it has happened. Once the fry are ready to start feeding they swim freely in their search for food. Obviously this first food must be very small, as the mouths of the fry are tiny and so incapable of taking anything but the smallest particles of food. By the first natural food of most fishes is the smallest forms of algae and Infusoria. The first feeding should be done at infrequent intervals. It can be done by removing a small portion of the water from the tank and replacing with some algae-infested water from a pond or by allowing a drip-feed from a suspended container.

Drip-feed must be accompanied by a method of draining off surplus water. This must be arranged so that no fry will be washed over the top. The best way is to have a piece of coarse rag hanging over the side of the tank and then as the water height rises it will sink into the rag and escape over the top. The danger with the drip-feed is that it is possible for it to become clogged during the absence of the aquarist and so the supply of food is stopped. It is most important to examine the water under a microscope to make sure that it contains some living matter, either Infusoria or algae. I find that most selected aquarists use a microscope, with a magnification of 70, is ideal for the job. It enables one to see how many Infusoria there are in a drop of water. A very powerful instrument will show only individual creatures and not always give a true indication of how many there are to a drop.

After a couple of days the fry should be feeding well all day long and can be seen to travel around the sides of the tank, occasionally making small dashes at something too small for our eyes to see. This will probably be an infusoria. A good supply of Infusoria should have been kept whilst waiting for the eggs to hatch. There are many methods used by aquarists to make a good culture and each aquarist is inclined to claim that his is the best. The fact is that almost any decaying vegetation will provide Infusoria when left in water for a few days. Some use boiled spinach or hay, others crushed lettuce leaves, often a few supply is found in water in a vase that has housed flowers for a few weeks. Whatever method is used to make a culture it is essential that it is examined frequently to make sure that it really does contain some living creatures and not just smelly water.

Infusoria can be fed to the fry for about 10 days after hatching, although it is impossible to state with certainty as fish develop at irregular rates, often according to the amount of space available and the amount of food. Where fry are very crowded they may not get enough food and so their growth will be retarded. A slight artificial aeration may be useful at this stage to ensure that the water contains sufficient oxygen, but this is not essential where there is plenty of space. The aquarist should try to introduce larger foods every few days and the fortunate owner who has an unlimited supply of live food will be able to grow the fry on a fast rate. From Infusoria they can go on to brine shrimp, then to micro worm and sifted Daphnia. After that this a whole list of live foods become available, such as shredded white worm, then shredded garden worms (small ones, of course), then larger Daphnia. If the fry get plenty of such foods their rate of growth will be rapid. The temperature of the water still plays an important part in the rate of growth as regards which the first feeding the fry can digest; frequency of feeding is related to water temperature. If 70°F (21°C) can be maintained then all will be well. After 4 weeks of good feeding the fry will look more like actual fish and not some kind of larvae.

Where an aquarist does not have the time to culture Infusoria it is still possible to raise many fry with artificial foods. There are on the market to-day various kinds of liquid foods, which must be arranged so that no fry will be washed over the top. The best way is to have a piece of coarse rag hanging over the side of the tank and then as the water height rises it will sink into the rag and escape over the top. The danger with the drip-feed is that it is possible for it to become clogged during the absence of the aquarist and so the supply of food is stopped. It is most important to examine the water under a microscope to make sure that it contains some living matter, either Infusoria or algae. I find that a student's microscope, with a magnification of 70, is ideal for the job. It enables one to see how many Infusoria there are in a drop of water. A very powerful instrument will show only individual creatures and not always give a true indication of how many there are to a drop.

After a couple of days the fry should be feeding well all day long and can be seen to travel around the sides of the tank, occasionally making small dashes at something too
The Minnow (Phoxinus phoxinus)

by P. J. Naylor

The common minnow of our rivers and streams is well known to us all from our schoolboy fishing expeditions, and to the angler, who stores it for taking the bait intended for larger fishes. The minnow is therefore like the sparrow, frowned upon as a possible pet because of its abundance. Indeed, people still frown when I tell them that I keep minnows in the lounge.

My reasons for adopting this fish are few. Primarily, most of the books in my local library declare that Phoxinus phoxinus die in still water aquaria after a few weeks. Secondly, as an angler I had noticed that these fish on closer examination proved to be an interesting mixture of colours and beautifully marked. Therefore to keep this fish was both a challenge and a way to learn more about them.

I prepared an aquarium, 36 in. by 12 in. by 12 in., in the usual way, with smooth granite rocks and sturdy plants. It is important that the rocks are few and devoid of sharp corners, as minnows are very lively fish and they dash themselves against everything in the aquarium. Eileos and Valdiviana proved to be the best all-round plants, capable of withstanding the rough treatment meted out by these fish. Other of the more common varieties of plants lasted only for a few weeks; hornwort was the first to lose all its leaves. As can be imagined from these few comments, the plants should be given ample time to root before introducing the minnows.

I caught my minnows on a hook and line baited with gently. Any small hook will do. As soon as the float “bobs” wait a few moments until it vanishes completely, then strike gently. A vicious strike will tear the fish's mouth or sometimes it will decapitate the fish. Some boys use a narrow-necked milk bottle baited with bread and secured by a length of string. As this operation would be carried out in fast-running rivers and streams having pebbly bottoms the dangers in this method are obvious. After collecting a dozen minnows, putting them in milk bottles (they jump out of jam-tins with complete abandon), select six of the strongest ones, less than 2 inches long. It is as well to examine them carefully, selecting those having no evidence of parasites, disease or injuries. During this examination turn them over in the hands, which should have been wetted beforehand. They will live for an amazing length of time out of water.

Put them into the aquarium in the usual way, preferably at dusk in an undisturbed room. They settle in very quickly and should any of them have been injured by the rough treatment they will show it within 2 weeks. Such a fish is better removed as the others will tend to bully it. They will eat almost everything, from biscuit crumbs to meat flies. During the winter months I keep mine exclusively on a good proprietary dry food containing dried shrimp, and they thrive very well on it. During spring, summer and autumn I give them dry food, Tubifex, Daphnia, dead and live flies (live flies dashed on the surface, in either case caught in the garden to avoid insecticide poisoning), gentle, grubs, small worms, in fact anything that creeps or crawls.

If fed from the same spot every day at the same times, the minnows become very tame in a short time, feeding from one's fingers, sometimes jumping half out of the water in eagerness, at other times nipping one's fingertips. I used to use a feeding ring and worm tray combined. Sometimes dry food would settle in the worm feeder. One of the minnows, and always the smallest, would jump into the tray, grab a mouthful of food and then flip back into the water. During feeding they allow a fair amount of food to fall to the bottom. This need not cause concern as they are efficient scavengers, always leaving this until all the other food has been consumed. They have excellent appetites, and the amount of food must be regulated by trial and error.

After settling down, they will grow at the rate of ½ inch a year, and in a balanced tank will remain surprisingly disease-free. Temperature changes appear to have little adverse effect if the temperatures experienced remain below 65 F (18°C).

When I first caught my fish they were a dirty brown colour on the upper side, silvery grey below with a black longitudinal line. After a few months these colours softened. The black line became more distinct, the underside became a true “fishy” silver, and as for the dark brown, this softened into a lighter more pleasant brown.
In winter, however, these fish revert to their drabber "wild" colours. This adaptation to match the compont is a fine example of Nature's camouflage.

I have never been able to breed these fish; indeed, they have never shown their breeding colours. Breeding condition is indicated in the male by a distinct red or orange-red breast, hence the fish's local nickname of "redbreast". Perhaps the introduction of an aerator to simulate the bubbling stream of the natural habitat would encourage this. At other times the male is distinguished by scales of small white tubercles on the head.

An air-water pump is necessary for minnows are prodigious jumpers. Should one accidentally jump out and fall on the floor it will not usually suffer any ill-effects. Switching the light on and off does not appear to frighten them as it does most fishes.

The old controversy of whether fish sleep or not do not seem to apply in this case. Minnows certainly sleep, sometimes against plant stems, at other times hanging nose down in the plant fronds. Switching the light on and off, and tapping on the glass, will not awaken them for some little time. When I first noticed this phenomenon I was disappointed, thinking that the fish had all died overnight. The only visible sign of life was a retarded respiratory rate.

Another noticeable thing is that they appear not to suffer from constipation or hanging faces, this in spite of a dry-food diet at no other time.

These fish have given my wife, friends, and I much pleasure as they swim in a shoal repeatedly searching the tank for stray particles of food. Their feeding habits are the most entertaining of all. As humble as these fish are, they are beautiful and interesting to watch.

My original six inhabitants are now reduced to four, after 3½ years. The first fatality occurred after only a week, the last one last year, presumably from old age. The rest are as strong and healthy as the day they were dragged out of the river at the end of a hook and line.

Owls and the Garden Pond

by A. BOARDER

A LETTER in the March issue of The Aquarist again brings up the question whether owls are capable and guilty of taking goldfish from a garden pond. Owing to the contradictory views held by some people I think that it is well to explain the matter further in an endeavour to clarify the position. The tawny owl (Strix aluco) is in all probability the bird that can take goldfish from the pond. Archibald Thorburn states, in British Birds, vol. 2, p. 64: "The food consists of rats, mice, voles, small birds and occasionally fish." W. H. Hudson, in British Birds, vol. 2, p. 199, states: "The tawny owl... preys on mice, rats, moles, young rabbits, squirrels and birds; and he also, like most owls, occasionally takes fish."

Other books on birds accuse the barn owl (Tyto alba) of feeding on fish occasionally as well. There seems to be little doubt in the minds of most ornithologists that owls do eat fishes and that their strong claws and legs are quite capable of taking them from near the surface of the water. The only letter I remember seeing contradicting the assumption was to the effect that an owl could not dive into the water to take a fish. Everyone should know that every often goldfish lie just under the surface of the water motionless in such a position as to be an easy prey for any owl.

Now let us examine other aspects of the case. A friend of mine living near by has a goldfish pond in the garden and one morning found a tawny owl drowned in the pond. It appeared fairly obvious that the owl had swooped at a fish in the manner used to catch mice. When this is done the owl spreads its wings over the ground to prevent the mouse escaping. If the owl swooped on a fish and spread the wings the water would prevent the owl from flapping its wings to rise again. The feathers not being underwater as they are in a duck, the water would hang on and weigh down the owl. A short time ago an account was published in a newspaper of the instance where in the dead of night a large goldfish dropped down a bedroom chimney. The fish was still alive and recovered when put into water. This fish could only have been dropped by a bird and the obvious one is an owl. The bird could have caught the fish in its claws and then, in trying to perch on the chimney, it lost its hold on the fish, which dropped down the chimney. Few other birds fly and feed at night. The heron could do so but this bird catches its prey near the bank and is unlikely to release it when perching.

A year or two ago I found that I was losing one of my large breeding female goldfish every night. These fish were quite large, each with a body as big as the palm of one's hand. I put the lose sleeping cats and promptly made wire screens to cover the pond. After reading about the goldfish down the chimney I suddenly remembered that at about the time of losing my goldfish I had seen a tawny owl on my arbour just above my pond. The bird was there most evenings and if I walked into the garden the owl would unhesitatingly glide away a couple of gardens to a tree. I thought at the time that it was rather nice to have an owl in a London suburban garden, but I am now convinced that the owl was the culprit that took the fish and not cats. At the time I lost the fish it was soon after the winter, when my larger fantails often lie near the surface of the pond. It would be quite easy for an owl to catch such a fish and the fact that one was taken each night running suggests that the regular visit to my pond was sufficient for at least one meal.

After examining all the evidence in the case against the tawny owl I am quite convinced that it can and does take goldfish from a pond and where such a happening is possible it will be as well to provide some protection each night.

Inadequate Lighting

How can I grow beautiful underwater plants? My aquarium is built into a bookcase, the top is made of glass, and there is an adequate thickness of washed sand on the bottom, and a 60-watt lamp provides light for about 7 hours every day. Nevertheless most of the plants I buy soon turn yellowish and die down. Do you think I would get better results if I planted them in pots of loam?

What your plants need is a brighter light rather than a richer compost. If you replace your existing 60-watt lamp with one of 100 watts you should not experience any difficulty in growing the regular aquarium plants in sand alone.
Breeding Golden Orfe

by A. SUMMERS

A FEW years ago a friend gave me six 9-year-old golden orfe of some 15 inches in length—four males and two females. The fact that these fish are rarely bred in this country made my attempt to breed from them the more interesting. Having bred varieties of goldfish for a number of years, this idea became challenging.

They were placed in a concrete pond measuring 18 ft. by 10 ft. by 2 ft. deep in the centre, sloped to the shallow edge 1 ft. in depth. Spacious quarters and well oxygenated water are essential for their maintenance and certainly for breeding. The pond had a fresh water feed-pipe coming up to the surface in the centre of the pool, the overflow leading to other small ponds and a large iron tank which were to receive plants with the eggs adhering for hatching. This provides the equimium conditions in hot and sunny weather. During the summertime, especially when sunny, warm periods are experienced, in mid-summer, which necessitates good oxygenation of the water.

The hatching tank is a large iron cistern measuring 8 ft. by 4 ft. by 12 in. deep. This is disinfected and thoroughly cleaned out in early spring. Preparations for spawning are begun about mid-March. Generous feeding with Bemex, bread-ends, earthworms and pilchards (tinned, the liquid etc. of the tinned fish is washed away before use). It is also interesting to watch the disintegration of a large bread crust thrown into the centre of the pond. This is the orfe's main asset as an ideal pond fish; for it is a surface feeder, rarely cruising along at a greater depth than about 12 in. and hence it can be seen at most times of the day. It seems to prefer shallow water, but it will go deep in the winter months.

About mid-April fairly large masses of floating (not branched) Myriophylla plants are placed at the northeast corner of the pond. Why? Because for some reason or other, although there are plants in the pond, they make for this particular corner of the pond where they desire to spawn. The heavy feeding commences during the time of strong winds usually in early May. A careful watch is then kept from my dining-room window for commotion and splashing, which compel me to make periodic visits to the area in the pond and examine the plants for eggs.

The eggs are adhesive and white, becoming amber shortly afterwards if fertilised, and sometimes form in clusters, unlike the goldfish egg. The orfe egg is larger, a little over 1/16 in. (that is, not as large as the trout egg).

The plants are removed to the large iron tank and spread around the surface. The patience of the breeder is now to be tested, for the month of May brings variable temperatures, especially at night. However, they hatch out on the average in 9 days. When the fry are free-swimming, sifted Bemex is given until they are large enough to take Daphnia and normal Bemex, with pulped pilchard of a suitable size.

They will have attained their full yellow-orange colouring after about 3 months of feeding, but for the first two will retain a little black near the top of the head, but seem to lose it later on. It is a fascinating sight to see them shoot in hundreds—each making identical movements, flashing and darting about at the least disturbance, making the netting of individual fish impossible. After a few months some fish will grow much quicker than others although the same feeding and conditions prevail.

Sufficient to say that there is a demand for orfe. They are hardy, long-lived and will attain a length of 2 feet in very large ponds or a lake. But the breeding of them will not be easy unless the right conditions are provided; their needs when of the size for breeding are not unlike those of the trout in some respects.

There is a fairly common view that orfe do not spawn before the age of 8 years, but there seems little evidence either to support or rebut it, and the question is still very much open to debate.

It was noticed that the females were an even matt yellow-orange colour, and their pectoral fins white. The males were grey-speckled along the back and with orange colour running well along the pectoral fins. This seemed the only marked difference between the sexes, even when breeding.

My first season was disappointing in numbers hatched, but I was delighted to think that I had succeeded where maybe others had failed. However, I reared 29 young fish that year. The next season I had greater success and reared to saleable size no less than a thousand. The following season, becoming wiser each time to their needs, approximately a thousand were reared. Naturally I have retained the obviously good fish with the right colouring.
and those which seem to grow ahead of the rest of the bunch, for future stock. The same problem arises as with the goldfish varieties: space and plenty of swimming room with clear and well oxygenated water.

It has been said that a pool with a clay bottom is the ideal environment for orfe, and there may be something in this. Two seasons ago, a dozen orfe about 2 or 3 inches long were sold to a friend for a nominal charge, and he placed them into just such a pond, of only 15 in., 2 ft. deep. It was about 12 ft. long and approximately 5 ft. wide. The pond was thoroughly cleaned out by the rain, with a periodical flush with the garden hose. The fish, of good colour, about 8 in. in length, although one has refused to grow at all, it will be interesting to observe how these fish grow or revert to these conditions.

Do Fishes Sleep?

by DAVID GUNSTON

It is commonly assumed by many people that fishes do not sleep. Of course, it is not difficult to see how such an odd belief arose. People look at fishes, see no ears and therefore assume that fishes could not hear. Similarly, when they saw that fish had no eyelids so that their eyes could not be closed like our own and those of other animals, they also assumed that fishes did not sleep.

Certainly, some observations of more recent origin have tended to support this view. Fishes watched in aquaria appeared to go without sleep. A grey nurse-shark in an aquarium in Sydney, Australia, is said to have kept on the move—apparently without sleep—for 6 years, swimming over 200,000 miles in the process.

The truth is, nevertheless, that all fishes do sleep, at least for some part of their lives. Their concept of a "good night's sleep" may not tally with our own, for perhaps only a few minutes' rest. Some will sleep much more than others, and the habit varies not only among different species, but also with change of environment, water temperature and the length of daylight hours.

If some fishes manage with what seems to us, the very minimum of sleep, others like several hours' motionless rest, usually on the bottom. The mere fact of eyes closing or not closing has nothing to do with it. Human beings may close their eyes for sleep, but they have no ways of shutting their ears, and they manage to sleep soundly through all the hubbub of a big modern city with a large volume of noise still impinging upon our ear-drums. Similarly, fishes may be sound asleep, unseeing and unhearing, though their eyes still present to us on the outside the vision of seeing appearance. Whatever we are, whether people or elephants or birds or fish, when we sleep our minds are temporarily withdrawn from the outside world.

A fish's eye is fundamentally very much like our own and is lacks true eyelids simply because we need lids constantly to moisten and clean the surface of our eyeballs in contact with the dirt and dust of the air, a few fish have naturally and constantly lubricated by the water in which they swim. This is vividly illustrated by the four-eyed fish, Anableps, which lives in Central America. Possessing eyes divided into sections, one for seeing under water and one for seeing in the air, it has habitually on the surface for hours on end with the upper half of each eye clear of the water. But this exposed portion of the eyes, although adapted for vision out of water, has no eyelid arrangement, so the poor fish has to keep dipping its head beneath the water every few minutes in order to freshen up the exposed section of its eyes!

The time is a long way off yet when science knows all the answers to the mystery of sleep, but we do know it is a nervous rather than just a physical phenomenon. The ancient view that sleep came when the accumulation of fatigue products in the blood stream reached a certain level has long been discounted, partly from observations of the grey mullet, always seems to be startled up; it is refreshed by the rain, with a periodical flush with the garden hose. The fish, of good colour, about 8 in. in length, although one has refused to grow at all, it will be interesting to observe how these fish grow or revert to these conditions.

THE AQUARIUM
THE OUTDOOR REPTILIARY

(4) European Reptiles

by ROBERT BUSTARD, B.Sc.

Photographs by the author.

IT is a most difficult task to list European reptiles that are suitable for life in the British outdoor reptiliary, in a single article. Yet I feel that an outline is worthwhile, and, at least, the better-known species can be described in some detail.

Tortoises and Terrapins

Tortoises are not really suited for close confinement because they love to wander. I much prefer to let them have the liberty of the garden if at all possible. The various species suitable to keep will be treated in an article at a later date. Because of the arrangement of the garden, however, it may well be that they have to share the reptiliary, where, being vegetarian, they will not harm any of the other inmates.

The European pond turtle or terrapin (Emys orbicularis) is well suited to the outdoor reptiliary or even the garden pond, where it can be allowed to hibernate each winter under the ice, provided that the pond has a maximum depth of 2 feet to parts. The reason for this is that terrapins are quite safe below the ice (where the water temperature never falls below 4°C), but if actually frozen they will die. Even in the worst British winters a depth of 2 feet is sufficient to guarantee that they are safe in the mud below the ice. Should terrapins be kept in a garden pond it must have a surrounding wall to keep them in, otherwise they will stray and become lost. In the outdoor reptiliary terrapins do well in a fair-sized pool, and even if this is only 2 feet square this is a larger water area than they are likely to enjoy if kept indoors. If kept in a small pool care must be taken that they do not foul the water, and that uneaten food is soon removed. Some collectors feed them in a separate basin to avoid this. Fish, in particular, when cut into strips for them to eat tends to bite into pieces that may escape notice. It is not uncommon for specimens of the common European terrapin to suffer from sea ailments due to dirty aquarium or pond conditions, and these should be guarded against. The ideal method is to feed solely on live food such as earthworms, but this can become rather laborious as the terrapins have healthy appetites.

There are two other European terrapins: the Spanish terrapin (Emydidae latipalatus) and the Caspian terrapin (Emydidae caspica), which require similar treatment but are slightly less hardy than the common species.

Lizards

The large European family in which most of the lizards that the collector is likely to obtain belong, as well as two of our native lizards, is the Lacertidae. The most popular species in the vivarium or reptiliary are five in number, of which four belong to this one family: the wall lizard (Lacerta muralis), of which there are numerous sub-species and races; the green lizard (Lacerta viridis), which is a magnificent animal with the males showing a blue throat in the breeding season; the sand lizard (Lacerta agilis), which also has a very restricted range in Britain; the large-eyed lizard (Lacerta lepida), which commonly measures 2 feet or more in total length and is well built in proportion; the glass snake (Ophisaurus apodus), a legless lizard that can be likened to a giant slow-worm.

The sand lizard (a gravid female is illustrated) is a docile species which quickly becomes tame. Females look somewhat like larger editions of the common lizard (Lacerta viridis), but males have beautiful green markings that are most conspicuous in the breeding season. Like the wall lizard, it is about 6 or 7 inches in length. It is quite impossible to describe a typical wall lizard but one subspecies that is commonly available has a green central portion to the back with brown markings on the flanks which run into this, forming an irregular pattern. Black markings are frequently also present. The top of the head is brown and the underside is dirty white. Both these lizards are ideal for the outdoor reptiliary and feed on small insects such as gnats, flies and bluebottles and mealworms. Spiders, as with so many lizards, are considered a great delicacy.

The green lizard is a most handsome species that does well out of doors, although it tends to suffer from skin complaints indoors under artificial light. Although I have now kept many hundreds of different species of lizards I think it is hard to find a more beautiful species. They are strongly recommended but one must bear in mind that they have large appetites and must be well fed with live food of a similar type to that accepted by the smaller lizards. They will, however, require very much more. This is particularly important before hibernation. The

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eyed lizard cannot be recommended for the reptiliana if
this contains any smaller species, as it might well eat
them. This species comes from S. Europe and North
Africa and does not like prolonged wet weather, so the
enclosed type of reptiliana is ideally suited to its needs.
It will accept pieces of raw meat, which makes it a welcome
addition to the collection.

The glass snake (Ophisaurus apodus), frequently known
by its Russian name of Scheltopusik, is like a gigantic
slow-worm. It may measure up to 4 feet in length, as
did two specimens I received from Czechoslovakia, and
specimens of around 30 inches are commonly available at a
very reasonable price. The body, although snake-like,
has that rigid lizard "feel". It is not graceful like a snake
on smoother ground, yet it can move rapidly through
rough ground. The head is decidedly lizard-like, and,
of course, unlike all snakes, the eyes are lidless. The
glass snake is so called because it shods its tail rather easily,
and as this member may account for about half of its
length the animal appears to break in half. It soon becomes
tame and makes a very fine pet, which is much better in the
outdoor reptiliana than cooped up inside. Its natural food
includes snails and earthworms but captive specimens
soon learn to take strips of raw meat, which in time will be
taken from the fingers. It should be allowed to hibernate
in the way recommended for the anguillar snake (below).

Snakes

The grass snake (Natrix natrix) has already been men-
tioned under the British fauna but such year large impor-
tations of Continental specimens arrive, mostly from Italy.
They require similar treatment to British specimens,
although they achieve a larger size and 4 feet or more must
not be regarded at all unusual for female specimens.
This increased size is particularly noticeable in the southern
parts of its range and those occurring on certain Medi-
terranean islands are said to reach a size in excess of 5 feet.
The doped or tessellated snake (Natrix tessellata) and the
viperid snake (Natrix maura) both have the semi-aquatic
habits of the grass snake and require similar treatment in
capitvity. Neither is frequently imported at present.

The python snake (Coronella austriaca) is widespread
in Europe and was omitted from the discussion of British
species because of its rarity, and the fact that British
specimens should be protected and not collected by reptile
enthusiasts. It grows to about 2 feet and is a most hand-
THE GOLDFISH AND ITS VARIETIES

(5) The Fantail
by A. BOARDER

The fantail goldfish is one of the finest of the varieties.

The scaled type is especially attractive in the garden pond, and makes a welcome change from the common goldfish. The short full body and the divided tail give the fish a handsome look and as well as having pleasing shape when the fish is active but not too rapid in its movements. It is a Hardy fish for the pond and as an occupant for the indoor tank few varieties can beat it. It does not lie on the bottom like many veiltails and moors, nor yet dash around like a comet. It is long-lived and fish of 10 years of age are not uncommon.

The body of the fish should be egg-shaped, with the depth more than half the length. The oval body should have continuous curves from nose to caudal peduncle, with no sign of hump back or snoutiness. The lower curve should be a good slope from front to back. The dorsal fin should be erect with the front edge evenly curved and in height more than half the depth of the body. The pelvic fin should be of equal length to the height of the dorsal fin. The pectoral fin should be shorter than the pelvic and the anal, although well developed, should not be too long and flowing like those of veiltails. The anal must be double and single fins will bring disqualification at a show. The caudal fin or tail must be divided completely and held well out in line with the body; any tendency for the tail to droop is a bad feature. The caudal fin must be well forked and the two portions should be of equal shape. Where caudals are not well forked and show a rounded edge it is probable that some veiltail strain has been introduced at some time.

The colour of the scaled fantail can be a rich warm red all over or variegated with red and silver. A chrome-yellow fish is also recognised. A slubunkin-coloured fish is also recognised by the Federation of British Aquarist Societies and this must have the colours required in the slubunkin (q.v.). The minimum length of the body for exhibition purposes is 2 inches.

The chief faults found in fantails are: lack of depth in body and a bad broken curve to the top of the body (this gives the fish a hump-backed appearance). The tail should be completely divided and this is in contrast with the old Standards, where the caudal fin was required to be joined for a quarter of its length. This was stated to be necessary so that the fish was able to hold the tail in an even position and prevent droop. When breeders had fixed this feature in their strain the Federation altered the Standards to make it necessary to breed fish with a completely divided tail. Another fault is when the tail is insufficiently forked. This is usually a sign of veiltail strain in the stock.

The fantail is an easy fish to feed and keep in good condition and it will take all the usual foods given to the common goldfish. It has been stated that this type of fish with a short thick body should have plenty of starchy foods, but I do not think that the type of food makes much difference to the fish. When choosing fish for breeding see that only those with a good deep body are used and then one can expect some good specimens among the fry. It must not be thought that even good fantails will produce all good fry, as there may be many fish that are not worth the food they eat among a spawning. It is this uncertainty which makes the breeding of fancy goldfish such an exciting hobby.

FISH DISEASES

(5) Sliminess of the Skin

Sliminess of the skin of fishes is caused by a unicellular micro-organism that irritates the slime cells into greater production of mucus. The slime cells over-produce and subsequently die, after which they are digested by the parasites as food matter.

The fins of the plagued fish will droop and its colour quickly fades as the slimy secretion adhering to the body begins to resemble a grey, heavy mist. Any prolonged loss of colour, say for 24 hours or more, should always be taken as a symptom of illness in fishes.

The parasites can be killed by immersing the fish in a 1% per cent solution of salt for 15 minutes. To prevent re-infection, the treatment should be repeated after 2 days. If treated fishes are not treated, they will soon die. Oddly, this parasite is not found in natural waters but appears to be exclusive to aquarium water.

R. E. MacDonald
A Fish Out of Water

by DIANE SCHOFIELD

SOME fishes may have their charm and some fishes may have their beauty, but few aquarists will forget any encounter that they may have with the fish who does something that no self-respecting fish should do—walk. Anabas testudineus, or climbing perch, does not need to stay in a pond if he has become bored with it.

This fish has only to extend the bony spines which protrude from his gill-plates and strike out for greener pastures. This does not make for smooth ambulation, but rather for a twitching, wobbling motion, which, nevertheless, seems to be effective. As he is especially vulnerable to predatory birds and animals when he is out of his native habitat, Nature has given him a drab, brownish, protective coloration to blend in with any field or road that he might be crossing at the time. Some of the legends of the climbing perch being found in trees come from the fact that perhaps his camouflage was not all that he had hoped for and some bird had swooped down to carry him to its tree for later eating. Although Anabas testudineus does well on the ground he could neither climb the trunk of a tree nor particularly care to, as there would be nothing there to interest him.

The climbing perch does not have the streamlined body of other fishes; instead he has a rather large round body that does not taper toward his head. The large head has a peculiar mouth that turns up on the corners in a little "smile". They are rather an awkward fish both in the water and out of it and would not deserve a second glance if it were not for their extra-curricular abilities. Both sexes are equally drab and colourless.

Since the climbing perch lives both on land and in water, he is equipped for both. He has an air-breathing mechanism similar to that of the anabantids, in addition to the more conventional gills. In Ceylon, India, Malaysia, Sumatra, southern China, the Philippines and the Indo-Australian Archipelago, which the climbing perch calls home, the air is damp and humid. Because of this the perch can sometimes stay out of water for several days, relying on his accessory breathing organs. He can also live in water that is too dirty and foul for fishes that depend solely on their gills to survive. All this goes to make a fish that is unusually hardy. The climbing perch can endure temperatures up to 98°F (37°C) without showing any discomfort.

They also seem to have a thicker and tougher "hide" than do most aquarium fishes. This seems to make them very resistant to white spot, fungus or any of the other parasitic diseases. Though they are largely carnivorous, they won't spurn coarse dry food. Their favourite foods are earthworms, Tubifex, white worms and cat food. Plants are left strictly alone.

Although they are not fin-nippers, they do have a relatively large mouth for a fish of their size and should not be kept in with other fishes that could fit easily into such a mouth. A community tank of large peaceful cichlids such as the Cichlasoma fasciatus, C. auritum and porcelain cichlids, seems to fit in well with the habits of the climbing perch. Of course, this tank should have a heavy, tightly fitting cover, as the perch might get bored with it as he would with a pond and think that he could find something more interesting somewhere else.

Rarely the climbing perch may be persuaded to spawn in captivity. Although they belong to a family of bubble-nest builders, the perch does not have a mouth shaped for that sort of thing, so there is no nest. The eggs, being lighter than water, float to the surface where they hatch in approximately 24 to 30 hours. The male does not have any part in blowing the fry back to the surface as his cousins do, so he should be removed as soon as spawning is completed. The baby perch hang at the surface until the third day. When the yolk sac is absorbed. At this point they should be fed with Infusoria, followed later by newly hatched brine shrimp, then Daphnia and chopped Tubifex.

Cacti in the Fish House

SHOULD any rot appear in a cactus plant it should be cut out and the part treated with flowers of sulphate. Should a plant rot off at the root there is no need to throw it away. Cut away all rotted parts and dry it off.

Then treat the plant as a cutting. It will soon make new roots and grow on. If the cutting is a tall one do not push it into the striking medium but support it with a stick so that only the base is in contact with the medium.
our readers

Readers are invited to express their views and opinions on subjects of interest to aquarists. The Editor reserves the right to shorten letters when considered necessary and is not responsible for the opinions expressed by correspondents.

Where do Judges come from?

I was interested to read Mr. James Kelly's article in your March issue in connection with show judges, but I think that he has rushed into print without giving sufficient thought to the subject and cannot agree that British fish-keepers are entrusting the job to untrained judges. The guppy societies are not alone in the issue of an excellent handbook, The Standard Method of Judging, compiled by the F.N.A.S. Bulletin No. 5, a comprehensive publication which has done a great deal to ensure that exhibitors are judged in a consistent and unbiased manner by any of the judges on the official list.

The first essential requirements that a judge must have is a man who is sufficiently interested to give his spare time to the job, to travel hundreds of miles in the show season and be in a position even to take time off from his employment for mid-week engagements without compensation.

Mr. Kelly asks a lot of questions but gives us no answers, nor does the reader get any available with only a little thought. The phrase which forms the title I first heard several years ago from Mr. Geo. Cooke, the hard-working show secretary to the F.N.A.S.: A much better title would be "Where do our next Judges come from?"

The initial training ground for a prospective judge is with his own society, which eventually recommends his appointment, and if good judges are required then it is up to the member societies to select the right men with experience and provide training facilities. The testing of new judges is provided for in that the societies engage a judge do not offer a repeat engagement if they are not satisfied with his services. Further, as two or more judges are usually engaged, then a new and a seasoned judge working together can come to the right conclusions and provide actual working experience for the new judge. All judges are therefore tested by a process of elimination.

I know that some go-ahead societies are already providing classes for prospective judges, and they can do a lot of good work in this direction, and I wish them every success, for a few new judges will ease the burden on some of us who are overworked.

J. M. SKINNER, 
Judge to F.N.A.S. and A.Y.A.S., 
Nt. Wakefield, Yorks.

Of Peas and Kings

We were amused at your Burnley correspondent (The Aquarist, March) likening the guppy to Accrington F.C., and can only feel sorry that he is missing so much in fishkeeping.

The guppy's claim to the title "King of Tropicales" is based on the wide variety of shapes and colours that can be produced by careful selective breeding, in a similar manner to other "fancy" animals and plants. The failure of the beautiful fishes cited by your correspondent is their monotonous uniformity and the relatively small amount of skill needed to breed them, after the initial difficulties in arriving at the right conditions have been overcome.

Most aquarists tire of breeding fish that look like "peas in a pod" and eventually go over to the "King of Tropicales"—the guppy. We look forward to enrolling Mr. Lewis in our ranks.

D. PORTER, 
Federation of Guppy Breeder's Societies, Nottingham.

Chilly Fish

ONE Sunday evening I checked my tanks, situated in our not-too-warm hallway, and noticed that two Platyophis in an 18 in. by 10 in. tank were very sick. The temperature was down to 53°F (12°C). Some little fingers had turned my Constant back to zero!

One fish that showed some life I immediately transferred to another tank running at 77°F (25°C). I held him for a few moments in the warmer water and he swam off slowly.

I then turned to dispose of the other fish, obviously "dead". It was on its side with colour normal, but as stiff as a board. I removed it and was showing a "non-fishy" friend its various features when I noticed its throat move once, so immediately I put it into the warm tank. No further movement could be seen, which was not surprising as it had been out of water in a coldbath temperature for 2 or 3 minutes. I then started "artificial respiration" by moving the fish up and down the 3 ft. tank in order to get a flow of water over the gills. This, after a few minutes, produced some life but when the fish was released it sank to the bottom again, "lifeless". I then took it to my gourami tank (surface temperature over 80°F (27°C) and repeated the procedure; this time, after a few minutes it started gulping and after a short rest it started to explore its new abode, apparently none the worse for its experience.

I corrected the thermostat on the original tank, one of a battery of three, and next morning returned the two Platyophis at the normal temperature. Fortunately no other fishes were affected. One tank was empty and the other held a pair of paradise fish, who were, of course, not bothered at all by this change.

June, 1962.
This experience raises some interesting points: was this "dead" Planctonema dying or was it comatose (rather like trench in winter)? If so, for how long would it have lived in that state? I have not had any fish badly chilled before or heard of many cases. Most aquarists prefer baking from my experience! This "artificial respiration" might be of use for any of the larger fishes similarly chilled. Whether the sudden 20°F (11°C) change of temperature, straight into a hot tank, is going to affect them remains to be seen.

I did see a T.V. programme when a shark captured for an oceanarium was walked up and down a tank by its captors to revive it in a similar way. The method would be rather difficult to apply to a tank of neonics!

Have other aquarists had similar experiences? Perhaps their fish were disfigured, as mine nearly was, without the realisation that there was still life present.

R. G. ROCKETT
Abingdon, Berks.

Owls and Pond Fish

Unfortunately, because of Mr. Guppy's recent illness... (The Aquarist, March), I think that I have to reply to his latest arguments on this almost exhausted affair about owls and all the other creatures about which Mr. Guppy seems to have some fairly original ideas.

Firstly there is a little matter of ornithology to settle. The owl which is referred to in the previously mentioned letter is best known in Britain as the barn owl or the white owl.

Book Review


The Vivarium Life first made its appearance in 1895—the same year in which Maxwell Knight's excellent book Keeping Reptiles and Fishes appeared. At that time there was a genuine demand for a good, fairly comprehensive book on reptile-keeping written by an expert on the subject. This demand still exists, as, in the opinion of many, the book which has appeared has not completely satisfied it. Before we can do justice to this new edition we must explain that the first edition was really a catalogue and indeed it read like one. It gave little or no practical guidance on how to keep the various animals which it described. The approach was methodical: the scientific name, distribution, external features, colour, habits, hibernation, food and breeding were listed for each species. In addition each was illustrated by drawings which ranged from very good to very bad. The contents not only included a range of reptiles and amphibians but also coldwater fishes, aquarium coldwater plants, pond-life and live foods for aquarium and vivarium.

The second edition incorporates a chapter of 32 pages entitled "The Vivarium—its construction and maintenance". This is full of practical advice, and it must be remembered that the author, a life-long naturalist, is a noted herpetologist who was Founder-Secretary of the British Herpetological Society. This additional chapter is excellent, but some will feel that the stiff manner in which the material is catalogued prevents Mr. Leutshner's experience being transmitted to the reader. Let us (as take one example).

The food of the African clawed toad Xenopus laevis is given as: "Various aquatic creatures, caught after in mud with the sensitive fingers and crammed into the mouth. Also creatures which occur at, or fall into, the water surface. Very voracious." This is, of course, all perfectly true, but would it not be more helpful to state that they can be fed on earthworms or, better still, in laboratories they are usually fed exclusively on raw liver? Feed twice weekly. In this manner you can keep your toads healthy. Mr. Leutshner despises his reader of what would be most valuable to him—the benefit of his experience over two generations, and unique knowledge of the animals about which he writes.

Many of the drawings for this new edition have been redrawn by the author and are much more accurate. The number of species described remains the same, and in fact the bulk of the text has not been altered.


Mr. Pope is a well-known American herpetologist, best known in this country for his earlier book The Reptile World. He is now writing full time and few new books are more interesting than his. The Giant Snakes is most interesting, because seldom is a whole book devoted to so few animals—even when the animals belong to a group as shunned in the Reptile World as the Pythons. The Giant Snakes is subtitled "The Natural History of the Boa Constructor, the Anaconda and the largest Pythons, with comparative facts about other snakes and basic information on reptiles in general." The four pythons are the African rock python (Python sebae), the Indian python (P. molurus), the reticulated python (P. reticulatus) and the amethystine python (Lamia or Python amethystinus), about which comparatively little is known. Mr. Pope is a good writer and story-teller and the present book, like its predecessors, is easy to read and is yet packed with interesting and out of the way facts. These of the six snakes to which this book is devoted are popular vivarium pets, at least when small, which adds to the interest of the hobbyist.

In recommending this book to all snake lovers I would add that we are greatly indebted to the publishers for presenting a book which, by its very subject, must have an extremely limited sale. It is most pleasing to see such specialist books being published and at a reasonable price.
from AQUARISTS' SOCIETIES

Monthly reports from Secretaries of aquarists' societies for inclusion on this page should reach the Editor by the 5th of the month preceding the month of publication.

RECENTLY the Hibiscus Aquarium and Fishkeepers Society held a talk by Mr. R. Brown on 'Reef Fish of the Philippines.'

The meeting was attended by many members in addition to Mr. Brown. He brought along several small tanks, one of which was used for the exhibit. The tanks were well maintained and displayed a variety of fish and corals. Mr. Brown gave a detailed account of each species, discussing their care and breeding techniques. The audience was interested and many questions were asked.

The West Australian Aquarium Club has had a very successful meeting at East Perth. Mr. T. A. Atkinson gave an excellent talk on 'The Care and Breeding of Freshwater Fish.' Mr. Atkinson's knowledge and enthusiasm for the subject were evident. He discussed various species of fish, their habitats, and feeding habits. The audience was impressed by his knowledge and the practical advice he gave.

RECENTLY the Jacksonville Aquarium and Fishkeepers Society held a meeting to discuss the recent changes in state legislation regarding aquarium fish. Mr. J. R. Wilson gave an overview of the new laws and their impact on the hobby. The meeting was well attended, and many questions were asked and answered.

RECENTLY the New York Aquarium and Fishkeepers Society held a meeting on the topic of 'The Biology of Saltwater Fish.' Mr. R. L. Smith gave a fascinating talk on the various species of fish found in saltwater environments. He discussed their adaptations, feeding habits, and life cycles. The audience was captivated by the rich diversity of marine life presented.

RECENTLY the Boston Aquarium and Fishkeepers Society held a talk by Mr. R. Brown on 'Reef Fish of the Philippines.' Mr. Brown's talk was well received, and many questions were asked. The meeting was well attended, and the audience was impressed by Mr. Brown's knowledge and the quality of his presentation.

RECENTLY the Washington Aquarium and Fishkeepers Society held a meeting on the topic of 'The Care and Breeding of Freshwater Fish.' Mr. J. R. Wilson gave an excellent talk on various species of fish, their habitats, and feeding habits. The audience was impressed by Mr. Wilson's knowledge and the practical advice he gave.

RECENTLY the Los Angeles Aquarium and Fishkeepers Society held a meeting on the topic of 'The Biology of Saltwater Fish.' Mr. R. L. Smith gave a fascinating talk on the various species of fish found in saltwater environments. He discussed their adaptations, feeding habits, and life cycles. The audience was captivated by the rich diversity of marine life presented.

RECENTLY the Houston Aquarium and Fishkeepers Society held a meeting on the topic of 'The Care and Breeding of Freshwater Fish.' Mr. J. R. Wilson gave an excellent talk on various species of fish, their habitats, and feeding habits. The audience was impressed by Mr. Wilson's knowledge and the practical advice he gave.

RECENTLY the Minneapolis Aquarium and Fishkeepers Society held a meeting on the topic of 'The Biology of Saltwater Fish.' Mr. R. L. Smith gave a fascinating talk on the various species of fish found in saltwater environments. He discussed their adaptations, feeding habits, and life cycles. The audience was captivated by the rich diversity of marine life presented.

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June, 1962
SHREDDERS

SAGITARIA (Giant) and SHUBUNKINS

Have you tried Shredded White Worm or Tubifex for your fish? You need not bother with Infusoria (it can be dangerous and pollute the water in your tank), just feed immediately with this Shredded live food.

Incidentally I was advised by an aquarist that he was perfectly satisfied and using his Shredders he purchased to years ago.

Giant Sagitaria suitable for tropical, cold water or your goldfish. Young plants 6x and 9x dinners; larger plants 1½ and 2½ each; postage and packing, 1/3.

Shubunksis Bristol type from prize winners at Bristol, Birmingham and Manchester (all big open shows). My strain has been developed over a period of 20 years. Send your enquiries S.A.E. please.

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The Shredders 10/-. Super Shredders 16/-. Coarse Tooth Shredders 12/-. All post free.

AQUATIC DEVELOPMENTS,
14-15 Bure Lane, Christchurch, Hants.

SECRETARY CHANGES

The following changes have been announced:

Harden A.B. (W. H. Billings, 90 Abbey Road, Teddington) - Nurse
Aubry W.B. (A. H. Shute, 90 Abbey Road, Teddington) - Nurse

ARTHUR DERHAM

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First move to start a Tropical Fish Farm in England. Post to import Tropical fish. 66 Years in the Fancy.

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"Retailers ALWAYS apply to their wholesaler for this remarkable, and so much demanded food!"

THE AQUARIUM
What is an Aquarium?

One definition has it as 'a pond or container for keeping fish and aquatic plants,' but surely, it is far more interesting to view these from the side rather than from above, and this would seem to be an essential feature of an aquarium. If this is so, then presumably the first aquarium became available with the manufacture of the first transparent bottle. It is unlikely that the manufacturers of jam realised the boon they were conferring on aquarists when they first began supplying their product in jars. Instant jam, if it ever comes, will not be welcomed by readers of this magazine.

However there is no fear that the angle iron aquarium will ever disappear, this, the basic, and most essential piece of equipment has been with us many years and without it our hobby could not have flourished. It is not perhaps as elegant as we would like for our homes and it does tend to become a little cluttered up with electrical wires. But to list the faults is like listing the faults of an old and faithful servant, let us just say that there is an alternative aquarium, the ARBE aquarium, constructed to eliminate all these faults and designed to be an elegant and worthy addition to your home.

Just send us a postcard with your name and address saying "please send leaflets" and we will be happy to forward these together with the address of your nearest stockist.

ARBE PRODUCTS, 22a, Kings Road, St. Leonards-on-Sea, Sussex.
BUYERS’ GUIDE

The firms listed are wholesalers or retailers of fish, plants, aquariums, and accessories, reptiles and amphibians. Abbreviations: W.—Wholesale only. R.—Retail only. WR.—Wholesale and Retail. C.—Coldwater. T.—Tropical. P.—Plants. A.A.—Aquariums and aquariums. R. & A.—Reptiles and Amphibians.

BERKSHIRE
The Reading Aquarium
64, King’s Road, Reading
Telephone: Reading 53632
E.C.D. Wednesday.

CHESHIRE
Grassby, Joc, F.R.H.S.
“The Green” Fisheries, Mobberley, Nr. Knutsford
Tel.: Mobberley 3272
W.: C.T.P.A.A. R.A.A.
Robert Jackson (Naturalists) Ltd.
Holly Bank Nurseries, Grove Lane, Hale
Telephone: Ringway 3901
W.: C.T.P.A.A. R.A.A.

DURHAM
Metcalf, G. R.
2, High Northgate (near A.B.C. Cinema)
(On main A.1 road: Darlington
Telephone: Darlington 5961
E.C.D. Wednesday.
Powell, M.C.
The Honey Pot,
Claypath, Durham City
Telephone: Durham 2108
E.C.D. Wednesday.

The Fish Bowl
Laura Street, Sunderland
Telephone: Sunderland 69192
E.C.D. Monday.

HAMPSTEAD
Goodmayes Aquarium
Shafresbury Parade, High Road, Chadwell Heath
Telephone: Goodmayes 2954
E.C.D. Thursday.
R.: C.T.P.A.A.
Skilton, C. J.
“Ridgeway”, 139, Galleywood Road, Chelmsford
Telephone: Chelmsford 50578
W.: C.T.P.A.A.

HAMPSTEAD
Arundel Aviaries & Fisheries
241/243, Arundel Street, Portsmouth
E.C.D. Wednesday.
W.: C.T.P.A.A. R.A.A.
Wingate Zoological Supplies
7, Market Street, Winchester
Telephone: Winchester 2406
E.C.D. Thursday.

HERTFORDSHIRE
Curra, L. & Sons
Water End, Hemel Hempstead
Telephone: Water End 44
E.C.D. Saturday.
W.: C.P. R.A.A.
Wat-Pet Organisation Ltd.
66-68, London Road, St. Albans
Telephone: St. Albans 4409/4397
E.C.D. Thursday.
W.: C.T.P.A.A.

KENT
Kingsfisheries Aquarium
138, Croydon Road, Beckenham
Telephone: Beckenham 3716
E.C.D. Wednesday (all day).
R.: C.T.P.A.A.

LANCASTER
Hornby’s
Trafford Bar, Old Trafford, Manchester, 10
Telephone: Trafford Park 2969
E.C.D. Wednesday.
Letty Kremner
13, King Edward’s Building,
Chesham Hill Village,
(Opp. Woolworths, Manchester)
Telephone: Chesham Hill 3246
E.C.D. Wednesday.
W.: C.T.P.A.A. R.A.A.
Liverpool Aquaria Company
21, Sir Thomas Street, Whitechapel, Liverpool, 1
Telephone: Central 4891
E.C.D. Wednesday.

LONDON (North)
Philip Castang Ltd.
91, Haverstock Hill,
Hampstead, N.W.3
Telephone: Primrose 1842 and 9452
E.C.D. Saturday.
W.: T.P.A.A. R.A.A.

Paramount Aquarium
95, Haverstock Hill,
Hampstead, N.W.3
Telephone: Primrose 1842 and 9452
E.C.D. Thursday.

LONDON (South)
Aqauriac Suppliers
7, David’s Road, Forest Hill, S.E.23
Telephone: Forest Hill 3816
(Open every afternoon and all day Saturday).
W.: C.T.P.A.A.

The Jaysor Organisation
[James North (London) Ltd.]
316, Lee High Road, Lewisham, S.E.13
Telephone: Lee Green 3577
E.C.D. Thursday.
W.: C.P.A.

“Our Corner”
310, Lee High Road,
Lewisham, S.E.13
E.C.D. All day Thursday.
R.: C.T.P.A.A.

South Western Aquarists
2, Gilmourie Road, Tramway Road,
Upper Tooting, S.W.17
Telephone: Balham 7334
E.C.D. Wednesday.
W.: C.T.P.A.A. R.A.A.

Tachbrook Tropicals
244, Vauxhall Bridge Road, Victoria, S.W.1
Telephone: Victoria 5179
(Open all week except Sundays).
W.: C.T.P.A.A. R.A.A.

THE AQUARIST
LONDON (West)
Owen Reid's, Aquarium Dept.
12, Spring Bridge Road, Ealing Broadway, W5
Telephone: Ealing 3296
E.C.D. Wednesday. WR. C.T.P.A.A. R.A.A.

NORTHAMPTONSHIRE
The Aquarium
102, Wellingborough Road, Northampton
Telephone: Northampton 34610
The Pet Shop
120, Kettering Road, Northampton
Telephone: Northampton 841
E.C.D. Thursday. R.C.T.P.A.A.

OXFORDSHIRE
The Goldfish Bowl
9, East Avenue, Cowley Road, Oxford
Telephone: Oxford 41825
Headington Pets Supplies
10a, London Road, Headington, Oxford
Telephone: Oxford 61706 and 36707

STAFFORDSHIRE
Walsall & Wolverhampton Aquatics
46, Stafford Street, Walsall and 147, Horsley Fields, Wolverhampton
Telephone: Walsall 21783 and Wolverhampton 34147

SURREY
Thameside Tropicals and The Pet Shop
Brasserie House, New Zealand Avenue, Walton-on-Thames

SUSSEX
Preston Aquarium
44, Beaconsfield Road, Brighton
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