

# The AQUARIST AND PONDKEEPER

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Photo:

Laurence E. Perkins

Tropical catfishes, including the bronze catfish discussed on page 206, are often thought of merely as scavenging partners for the community tank, but are really worthy of special attention to study their interesting habits

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## Editorial

IF it is true to say that one of the chief reasons for the popularity of the tropical aquarium is that a fish community of mixed species is more readily assembled from the numerous small exotic types than from the few communal coldwater fishes, it is also worth emphasising that tropical community-making is not without its difficulties. For the beginner, with his desire to keep every species which attracts him in the dealers' stock, the difficulties form a common source of early disappointments. Troubles arise even for the more cautious aquarist who tries perhaps a recommended "safe" community or who copies the stocking of a community aquarium he has seen to be successful with a brother aquarist.

At first sight it seems a simple task to make an elimination list of undesirable fishes for community life, and indeed, in broad outline it is perfectly feasible to do so. On the other hand, some species which theoretically are quite safe will in some unlucky aquarist's experience earn themselves a bad name as community fishes and be the origin of strong dissension concerning their nature at society discussions. In the light of such experiences the list one obtains by cataloguing all the fishes which can be suspects when torn fins and damaged scales are seen in a community then makes hay of an attempt to separate "blacks" and "whites." In most species "rogue" individuals will be found occasionally, just as in those types which seem "certs" for the black list the odd single fish will be found which appears benevolently disposed to all its brethren. As a contributor points out in an article in this issue, changes of behaviour when the breeding urge is roused can make bullies of some of the normally most peaceful species.

Add to these individual behaviour differences and periodic variations the effects of possible influencing factors on fish behaviour such as nature of the diet—amount of live food provided, for example, then the size of the problem concerned with recommending a peaceful community—including (as is often asked for) the maximum variety of types—begins to be appreciated. Trial and error is probably the way by which most good communities arise.

## Book Reviews

*Tropical Aquariums, Plants and Fishes*, by Laurence Wells. Frederick Warne & Co. Ltd., London. 10s. 6d.

THIS book was originally published in 1937 but was completely revised and reprinted in 1954. It is very much improved with its "new look," and very few aquarium books have such excellent coloured plates of tropical fish. All too frequently the printer depicts the fish in far brighter hues than nature bestowed, but in this instance no such fault occurs. Altogether there are 12 coloured plates by Ernest Mansell showing some 43 different tropicals, as well as line drawings of 46 others. There are also 34 other illustrations scattered throughout the 230 pages. One good idea is a line under each fish drawing which represents one inch, thereby enabling the reader to judge the exact size of an adult specimen.

The book is well written, with an interesting style, and it is a pity that in one or two sections, notably the one on fish ailments, the advice given seems to be rather doubtful. As an example, the author recommends mercurochrome for gill-worm and dropsy whilst for white spot he suggests six drops of 2 per cent. mercurochrome to the pint, leaving the fish in this for fifteen minutes and repeating the performance for four days. Few experienced aquarists will agree with this or where the author suggests the addition of a pinch of sea salt and a pinch of Epsom salt every month. These distractions apart, the book makes good reading and caters

for the beginner and the more advanced fishkeeper, and the detailed descriptions of the coloration, habits, temperature range and breeding requirements of some 127 tropicals are more than useful.

*Pond Life*, by R. L. E. Ford. A. & C. Black, Ltd., London. 6s. 6d.

A BOOK mainly for the young naturalist who is interested in the inhabitants of a pond. In the course of his 96 pages the author introduces us to waterside birds, reptiles and amphibians, water voles, fish, waterside trees and plants, pond insects, water spiders, crustaceans, water snails, microscopic life, leeches and worms, each in turn. There are also two chapters dealing with "The Pond Month by Month" and "Making your own Pond." There are six delightful colour plates but the main charm of the book must surely be the 27 photographs by Lionel E. Day, an expert at aquatic photography. His underwater shots include newts, young rudd, bladderwort, *Chara*, water violet, curled pondweed, willow moss, water beetles and their larvae, dragon-fly larva, water boatman, *Caddis* cases, water stick-insect and water scorpion, water spider and nest. In addition there are five other photographs and a colourful illustrated jacket which makes one impatient to browse through the book. The publishers have issued some highly technical but very interesting books on pond life; this book is neither technical nor advanced but a fascinating introduction to the mysteries of life at the edge and below the surface of a pond.

R. YATES.

### FRIENDS & FOES No. 32

#### Anophelines

PHYLUM:—Arthropoda, from Greek *arthron*—joint, and *podos*—foot.

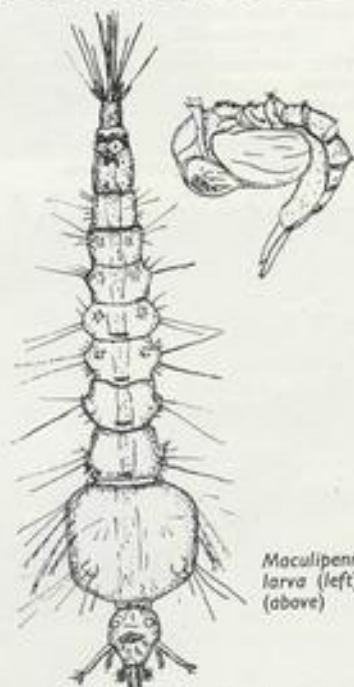
CLASS:—Hexapoda, from Greek *hex*—six, and *podos*—foot.

THE anophelines belong to the family *Culicidae*, and are thus closely related to the common gnat (see July, 1954 issue of *The Aquarist*). There are only four British species, and aquarists are unlikely to come into contact with the larvae and pupae of the species, which breeds in water found in tree holes.

One variety of another species, *Maculipennis atroparvus*, lays eggs in brackish or salt water. The imago of this variety is believed to be the malaria carrier, but only by feasting upon the blood of a sufferer from malaria can the female of the species transmit it to others.

*Maculipennis messeae* is the variety found near fresh water. It lays single eggs equipped with floats to keep them right way up on top of the water surface. These hatch into larvae which closely resemble those of the common gnat. Instead of hanging head downward from the meniscus of the water, however, they remain in a horizontal position, and move round and round or backwards and forwards in circles, their breathing spiracles (on the eighth abdominal segment) being the centre of the circle of movement. Two brushes in the vicinity of the mouth sweep minute particles of organic and vegetable matter into it.

The pupa can most easily be distinguished from the common gnat by the position of the breathing "ears," which are much further forward in *Maculi-*



*Maculipennis messeae* larva (left) and pupa (above)

*pennis*. Both are appreciated as titbits by all fishes, and may be given whenever found. The eggs are extremely difficult to find, unfortunately, so there is no possibility of collecting them to obtain newly hatched larvae.

C. E. C. Cole

# Making a Large Breeding Aquarium

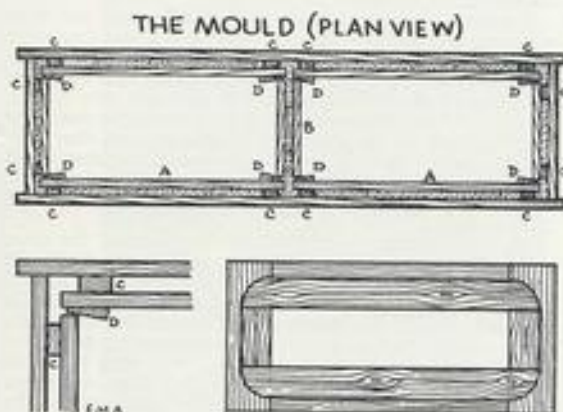
by W. H. MACEY

**M**OST aquarists, especially fancy goldfish keepers, have been longing for larger and larger aquaria at a moderate price. In fact this difficulty has been one of the greatest obstacles preventing this section of the hobby becoming far more popular. The aquarium to be described is inexpensive, will accommodate several fish, and is ideal for breeding, even with the largest types of fancy goldfish. As shown in the photograph it is in no way flattered, as its walls are damp with rain; when its outside is dry, or colour-washed to suit the surroundings, its appearance is greatly improved.

The cost for material to make a large portable concrete aquarium, similar to the one shown, is less than eight shillings, and this includes the two glass panels and the present high price for sand and cement. Timber to make the mould should not cost more than ten shillings if an old wooden crate is obtainable, nor more than 15 shillings if second-hand flooring boards are used. Each mould can be used for making several dozen tanks, and when the task is completed, the value of the timber as chop-wood will not only pay for itself, but may assist in paying for the first aquarium.

With a concrete aquarium there is of course, never any rust, and it needs little or no renovation. It can be emptied for long periods, or transported from place to place, and will be perfectly watertight when refilled. There is little or no condensation, and it is most suitable as a marine aquarium. Having three sides blank it is more natural for the inmates, and this also tends to control the temperature better, thus saving on any heating costs. It will last several decades, and will never leak as it is made in one solid block.

Its construction is quite simple as there are so few important points to remember, but to avoid any disappointments these are as follows: (1) Those parts of the mould



A CORNER OF THE MOULD

THE WOODEN PANEL (A)

B-ROUND WOOD PLUG C- SPACERS  
D- WEDGES

Finished concrete aquarium showing the central partition with communicating hole between the two compartments



Photo:

W. H. Macey

that will come in contact with the mixture should be given a liberal coat of old used car engine oil, obtainable at most garages free of charge, and it is advisable to put this on with a paint brush within 24 hours of filling the mould. (2) The mould should be dismantled within 16 to 24 hours, preferably about 16 hours, to allow: (a) the two mixtures to knit together well should any defects appear; (b) the mixture-wash to knit with the soft concrete and fill all the air-pots until the surface is quite smooth; (c) the mixture-wash to harden the surface of the concrete and make the aquarium perfectly watertight, and (d) to enable the edges and corners to be easily rounded off while the concrete is in such a soft state. (3) The wooden panels should remain in their position for at least 40 hours to allow the bars over them to become rigid. (4) Few reinforcing wires are required, but those suggested appear to be absolutely essential or the top corners of the aquarium will crack; not when the aquarium is first filled, nor perhaps within 12 months, but usually sooner or later, and it is a defect that cannot be permanently repaired.

## The Central Partition

The design of a central partition with connecting hole has several interesting advantages. (1) The weakest part of any aquarium is its lower centre, so in this case the partition acts as reinforcement. (2) It enables 32-ounce glass to be used for the panels in lieu of the heavy and expensive plate glass. (3) By placing a sheet of glass over the hole and keeping it in position with two half-inch wide strips of sheet lead bent over the partition, the breeder can bring his fish into breeding condition with the males in one compartment and the females in the other, and then, without handling or netting—a very important point when fish are in spawning condition—he can make them spawn at his convenience, simply by removing the glass. (4) By placing the spawning medium in one compartment only, the fish can be confined to the other immediately after spawning, where they will create an abundance of Infusoria which will pass to the other compartment between the glass and partition, ready for the fry as soon as they are able to take them. (5) Later, the adult fish can be removed to allow the fry to occupy the whole of the aquarium, where they should grow quite large enough to be able to distinguish and remove all the misfits until only the very best fry are being reared.

The following dimensions are given—assuming the outside measurements of the aquarium, or a number of them, are to be 60 ins. by 15 ins. by 15 ins., similar to the one shown, with the walls and bottom an inch in thickness. The mould consists of an outer and two inner collapsible wooden frames. The inside measurements of the outer frame are 60 ins. by 15 ins. by 15 ins., and it is held together with screws, or a long bolt through two eyebolts at each end can be used for this (if a large number of tanks

are to be made). The outside measurements of each inner frame are 28½ ins. by 10½ ins. by 14 ins. deep. This is slightly smaller than the actual size required in length and breadth, to allow the face of each end board to protrude a little beyond the ends of the front and back boards, and also to enable small wedges to be inserted between the side edges of the end boards and the front and back boards to keep the inner frames rigid while the mould is being filled. To strengthen and round off all the inside corners of the aquarium, all the outer lower edges of each board, and the outer side edges and lower corners of the front and back boards, are well rounded off.

The outside measurements of the two wooden panels required to form the side that will receive the glass are 26 ins. by 11 ins., while the glass panels are one-eighth of an inch smaller. A simple way to make the wooden panel is to nail together battens half an inch thick in picture frame style so that they form a rabbet all around half-an-inch wide and deep, with the inner corners of the rabbet well rounded off as shown in the sketch. The panels are secured with the rabbet facing outwards to the outside of the front boards of the inner frame with two screws having their heads on the inside of the boards so that they can be removed before dismantling the mould. Their position on the boards is central lengthways, half-an-inch from the bottom, leaving 2½ ins. clear at the top. The outer edge of each panel is tapered slightly towards the front for easy removal.

A round piece of inch-thick wood is used to form a six-inch hole in the partition, and this also has its edge tapered slightly towards one side, and that side should be well marked to ensure the wood being removed the correct way later. It is held centrally between the two end boards of the inner frames with a bolt which should pass quite freely through the holes in the wood, again for easy removal later. Eight battens an inch in thickness, and about 12 ins. long, with a nail inserted into one end for hanging to the back and end boards of the outer frame are required as spacers: two to each end board, spaced, and four to the back board so that they hang near the end boards of the inner frames. Eight spring clothes pegs are dismantled, and the 16 legs used as wedges, while eight small blocks of wood an inch in thickness are required for the ends of the boards of the inner frames to rest on.

#### Assembling the Mould

The aquarium is made on a piece of wet sacking laid on a flat wooden or concrete floor, and then flattened out with the hands to remove all creases. Having oiled over those parts that will come in contact with the mixture, the outer frame is assembled and squared using one of the glass panels as a square, and the spacers hung in their positions. The inner frames are then assembled with the end of each board resting on the blocks of wood, and each board is placed and kept in its correct position with a weight or brick until the wedges are inserted: one wedge at or near the top, and the other near the bottom, of each board.

The concrete mixture consists of one part of Portland cement to three parts of sand that has been passed through a sixteenth-inch sieve, and made up in small lots in a bucket. The first few lots are made on the stiff side and dropped between the boards at the back, ends, and centre partition to a depth of about six inches. This is lightly rammed down until a layer of mixture is seen protruding under the boards of the inner frame an inch or more wide. The remaining lots to complete the walls to within an inch of the top, including that over the panels, is made up much softer, and the only ramming required is with a view to filling the rabbets of the panels and under the block of wood in the partition. The spacers are raised and eventually removed as the mould is filled.

For reinforcement, lengths of old fencing wire (rusty

wire will do) are straightened out and then bent at right angles with each arm about nine inches long. These are laid centrally in the mixture, one at each corner, eight all told, and two 59-inch lengths, or several shorter straight lengths to double-bank are laid over the panels. The walls are then completed, leaving a ridge of mixture above the top of the boards about half an inch high to allow for any shrinkage. A little mixture will pass through the gap near the wedges, but this is immaterial as it is easily removed later. To lay the bottom the first lots of mixture are again made up on the stiff side and forced up under the front boards of the inner frame with a view to filling the rabbets. The remaining lots to complete the bottom are made much softer, and the blocks of wood are removed as convenient and used as guides for the thickness of the bottom. The mould is now covered with damp sacks for 16 to 24 hours.

#### Dismantling the Mould

Uncover the mould, and scrape off all surplus concrete on the walls with the trowel until they are level with the top of the boards, and then run the point of the trowel, or a sharp instrument around each side of the wall to a depth of roughly an eighth of an inch to free them from the boards. Remove the screws holding panels, bolt holding block of wood in partition, all wedges and any concrete that may be in the way of removing the end boards of the inner frame. Dismantle the inner frames first, starting with the end boards, and if stubborn, place the point of a screwdriver on the top of the board and tap it lightly with a hammer.

Now remove the back and front boards and dismantle the outer frame. Any defects that appear, and they are usually at the lower rabbet of the panel, can now be invisibly and permanently repaired with a fresh lot of mixture, still one in three. Remove all surplus concrete inside and out, and round off all the outside edges and corners with a rough rasp, or wire brush, including the bottom edge and corners, as well as possible. Now make up a fresh lot of mixture, still one in three, in a very soft or sloppy state, and keeping it well stirred, splash it on to the surface inside and out with a large paint brush until all the airpots are closed and the surface quite smooth. Finally, give the bottom inside two or three coats of this mixture-wash, and then cover the aquarium for 24 hours.

Uncover, and give the outside surface a good rub over with coarse sandpaper, or a fine wire brush, and then with assistance carefully cant the aquarium backwards and forwards to remove the sacking, and at the same time complete rounding off the lower edges and corners and give them a good coat of mixture-wash. Remove the wooden panels by tapping them on the outside all round and see that they give first at their lower corners. Remove the block of wood in the partition by tapping on its correct side, and pare off any surplus concrete around the hole and the rabbets of the panels.

To glaze, paint the rabbet and the edges of the glass with a light colour paint, and fill the rabbet with fresh soft putty. Rest the panel in its position and press it well home with the fingers. Pare off all surplus putty, inside and out, and fill the aquarium with water for seasoning. The aquarium will be perfectly watertight when first filled if all the air-pots have been closed. Otherwise the walls may seep a little in patches, but this will close up within a few days without any further attention. If however, the seeping should be very bad, the aquarium should be emptied immediately and the surface inside and out given a few more coats of mixture-wash. This should be left for 24 hours to harden before the aquarium is refilled.

It is suggested that the aquarium should not be lifted for at least a week, although it can be pushed, or slid about after 48 hours (handling it always at its lower ends).

## AQUARIST AT HOME:

# Mr. H. North

(LEEDS)

*Interviewed and photographed  
by JAS. STOTT*

**I**N addition to being well-known in the trade, Mr. H. North is also a noted breeder and exhibitor of the fancy goldfish varieties. His orandas and veiltails have been seen regularly at the B.A.F. shows, where they have won him several awards. I think it is true to say that his deep interest in the coldwater side of the fancy has made his name known to many aquarists throughout the country who are goldfish enthusiasts, irrespective of his other activities in the hobby.

He first became interested in fish keeping some 20 years ago when living in Blackpool. Later he moved to Leeds, where his interest deepened, and he became connected with the trade—eventually to open an aquarists' business on his own account in the centre of the city. Throughout these years, however, he has maintained the deeper interest and enthusiasm of the fancier and exhibitor, and now we find him keener than ever and, as a breeder and exhibitor, fitting up another establishment at his new home in Kearsby near Harewood, Yorkshire. Formerly he lived in Leeds but with his son-in-law and daughter now firmly established in the running of the business he found that he could devote more time to his interest in breeding the goldfish varieties. So when the opportunity occurred to obtain his present house at Kearsby he moved there, in September 1953, where, although within reasonable car distance from the business he is actually residing in the centre of some delightful countryside with ground to the bungalow ideally suited for his purpose.

Mr. North and his wife, during the last twelve months,



*Through the doorway of Mr. North's fish house a glimpse of large breeding aquaria is obtained*



*Mr. H. North (left) in the garden of his home talking to Halifax A.S. coldwater fish enthusiast, Mr. J. A. Holloway*

have been busy people re-designing the garden layout to suit their own ideas and requirements, and I was particularly charmed with those parts of the ground which have so far received their attention. They are still busy and likely to be for another twelve months or more before they have achieved what they have in mind. When I visited Mr. and Mrs. North last year one fish house was completed and in full working order. It is a lean-to structure 14 feet long by eight feet wide, with a glazed roof. The sides consist of a three feet brick wall glazed above this up to the roof. It is built up to the side of the garage where the height is nine feet sloping to a height of six feet at the front, and the entrance door is in one end. Containing some 17 tanks ranging in size from 24 ins. by 12 ins. by 12 ins. up to 3 ft. by 2 ft. by 2 ft., this house forms the breeding department where could be seen many really healthy youngsters from last year's breeding and, of course, the adult breeding pairs of veiltails, orandas and lionheads. This fish house faces due south, and is protected from the north by the somewhat large garage, while the sides are screened to quite an extent by conifers in the garden. The position is ideal for the work, and Mr. North finds that, even in the winter, no heating was necessary in the building and the average temperature drop seemed just about right for the particular varieties of goldfish.

Although not yet quite complete, as far as the installation is concerned, an extension to the other side of the garage permits the housing of some really large tanks which are used for growing stock and as a rearing department. In here were to be seen 11 tanks from 36 ins. by 15 ins. by 15 ins. up to 6 ft. by 15 ins. by 15 ins., providing plenty of swimming space for the development of selected youngsters. Plans for the future include the building of a conservatory type fish house on to the bungalow, with the entrance from the lounge, and part of this, when completed, will be given over to the propagation and growing of tropical aquatic plants and certain species of tropical fish, a side of the hobby which Mrs. North is interested in. Mr. North also intends to build one or two ponds in the garden because, as he said, they are always useful to the coldwater fishkeeper.

# Bronze Catfish

(*Corydoras aeneus*)

ORDER:—Ostariophysi, from Greek *ostarion*—a little bone, and Greek *physa*—a bladder.

FAMILY:—Callichthyidae, from Latin *callosus*—hard skin, and *ichthys*—a fish.

SPECIES:—*Corydoras aeneus*, from Greek *Korys*—a helmet, Greek *dora*—a hide or skin, and Latin *aeneus*—bronzy.

**CORYDORAS AENEUS** is one of the best of our scavenging fishes, and deserves a place in any community tank if only for this reason. It has, however, other qualities which endear it to most aquarists. It is peaceable, amusing, long lived, and unaffected by most complaints which attack its less hardy brethren from time to time. Indeed it appears to have no enemies. From the breeders' point of view, demand is constant, and although obtainable for the last seven years in this country, the price has not dropped anything like so much as many other "rarer" species of fishes.

It is another member of the South American catfishes, growing to a maximum of three inches. Back and sides are of a bronze hue, but the abdomen is pale. Behind the opercula is a small area which is darkly pigmented. Sexing, provided the fish have been adequately fed, is fairly simple, for the female grows larger and much plumper than her mate.

The question of feeding is all important if specimen fish are desired. It is still the custom of most aquarists to expect the scavengers to scavenge only—to pick up a meagre subsistence on "left-overs." This is all right as far as it goes—they will live for a number of years under such conditions, but unless the amount of scrapings is more than it should be in a normal well-organised aquarium, then the cats will remain lean and undersized. Often, particularly after introduction into a freshly set-up aquarium, catfishes will hide behind rocks or plants day after day. The surest way of luring them into view is to add a quantity of live *Daphnia*. A day or two of this treatment and they will become active immediately you approach the aquarium, waiting expectantly for their treat.

### Catfish Breeding

Temperature tolerance is good, and they appear to breed in the range from 70° to 80° F. Some breeders use two or three male fishes to each female, but this, to my mind, is just wasteful and unnecessary. Each male, if normal and ripe, is quite capable of fertilising every egg of a dozen or more females. Spawning procedure is interesting, and unlikely to be forgotten if once witnessed. Incidentally, some breeders have spawned catfishes in newly set-up aquaria, and others in old-established ones, so it seems that if the fishes are ready, nothing will stop them from going right ahead with the business of life. The female lies quiescent while the male, or males, swim repeatedly over her back, lightly touching or stroking her with their barbels. Nothing else seems to occur, but soon after this performance the female climbs up a broad-leaved plant, or the glass sides of the aquarium, and presses a number of eggs (held between her ventral fins) on to a spot which has previously been cleaned. It has been claimed that the male does the cleaning and that he leaves sperms upon the glass, but I cannot vouch for the truth of this. Certain it is that the



Female bronze catfish

eggs are fertilised, and the male must be responsible somehow, for no female has yet spawned without a male being present. A vigorous chase has been described by one breeder.

The eggs hatch in two to four days. At first helpless and heavy, the fry wriggle about on the aquarium compost, and if in the process of wriggling they find food it will help them no end. Powdered fish food, forced beneath the surface of the water, will sink to the bottom and lie just where it is needed. The provision of mild aeration will help to maintain the oxygen supply while the youngsters are forced to lie in what would normally be the foulest part of the tank. It is true that catfishes are provided with an auxiliary organ for utilising atmospheric air to supplement what oxygen is in the water, but this does not develop until the babies are at least five weeks old. After a day or two of feeding powdered fish food, add a quantity of micro-worm. This will be greatly appreciated and readily eaten.

The youngsters will very soon become stronger, more active, swarming over the plants, and more hungry. Slow-moving live foods, like white worms, micro worms, Grindal worms, *Tubifex*, chopped earth worms, etc., will be easily consumed, but fast moving *Cyclops* will evade destruction, as will *Gammarus*, and even *Daphnia*, until the babies are much larger and swifter. When three weeks old you may begin to doubt whether your young fishes are in fact *aeneus* or a hybrid, because they show dappled markings which their parents have not got, but don't worry—this is a normal proceeding, and the dappling will fade as the babies get larger and older.

If you raise specimen fishes from your spawnings and intend to exhibit them, please, please put compost on the bottom of your show tanks. Nothing is more annoying than the average row of catfish exhibits, with every one in the corner below the angle iron, showing perhaps the tip of a dorsal fin, and little else. Judges waste a lot of time trying to persuade these fishes to display their good points, and the average member of the public, for whom these shows are arranged, passes them by without a second glance.

### Post-Mortem Examination of Fishes :

W. Harold Cotton, F.R.M.S., F.Z.S., 39, Brook Lane, King's Heath, Birmingham, 14. (Phone: Highbury 1693)

Specimens should be sent direct to Mr. Cotton with full particulars of circumstances, and a fee of 3s.

It is important that the following method of packing fish be adopted:—Wrap fish, very wet, and loosely in grease proof paper and then in wet cloth. Re-wrap in grease proof or wax paper and pack around with cotton wool in tin box. Despatch as soon as possible after death, with brief history of aquarium or pond conditions.

# Salamanders Without Lungs

by Dr. EDWARD ELKAN

A LUNGLESS salamander is not a freak or a poor salamander which has lost its lungs through a dreadful disease. Salamanders represent a large group (the urodeles) among the amphibians. In the evolutionary scale they stand between the fish and the reptiles. The fish, in so far as they obtain their oxygen from the water, breathe through gills. Most of the amphibians, in so far as they have gills when young, lose these in the course of their metamorphosis. They then spend their time on land and breathe, like all the higher vertebrates, with the aid of lungs. Yet, of a large group of the salamanders, this is not true. They live on land, they never return permanently to the water; they are true vertebrates and yet they have neither gills nor lungs.

## Habitat

Why is it, you may ask, that we have never met such an animal? Our British newts and the well-known spotted salamander certainly have lungs. Where are these lungless creatures to be found? Alas, dear reader, not in this country. The nearest place where some of the lungless forms occur—largely unknown, I am sure, by the local population—is in the Maritime Alps, which extend from Southern France into Northern Italy. There, and on the island of Sardinia, we have the Italian cave salamanders *Hydromantes genei* and *Hydromantes italicus*, two closely allied forms which have no lungs at all. And in the same region occurs an extremely pretty little salamander, the "conspicuous" *S. perspicillata* (because of two bright patches on its head) which has hardly any lungs either. The same can be said of the Corsican *Euproctus montanus* and its near relation in the Pyrenees, *E. asper*. These are the only European forms.



Photo: Edward Elkan  
American worm salamander *Batrachoseps attenuatus*—so small it can take shelter in the burrow of an earthworm



Oregon salamander *Ensatina escholtzii*. This specimen travelled to Britain from Oregon in wet moss within a plastic bag

Why, you might say, should we bother about such comparatively rare animals which we might never see in the flesh? The reason is, first of all, that these European lungless forms represent only a small outpost of a large lungless salamander population in the New World and that it is very fashionable to take an interest in things American. The second reason is that these salamanders could easily be imported and kept in a terrarium here and that they present us with more than one biological riddle.

There are about 170 species and sub-species in North and South America and yet, not one in a thousand Americans will ever have heard of them. All these salamanders are small creatures which live far from the centres of human habitation and are strictly nocturnal in their habits. They can be found in the neighbourhood of water under rotten logs or leaves, sometimes many of them clumped together. When undisturbed they walk leisurely but when disturbed they can run quite fast. In captivity they can be fed on white worms and green fly. Out of doors they eat what small animal they can capture with their tongues. These tongues work, on a small scale, like the tongues of chameleons, and it is a surprising sight to watch a tiny salamander catch its prey at several centimetres distance. Not that they always hit the victim; they miss just as often, and their eyesight seems to be poor in spite of their large, protruding eyes.

## Biological Riddle

But the biological riddle they represent is connected with their state of lunglessness. Why, among the other "normal" salamanders, have these forms no lungs and how do they get along without them? As usual in biology no cast-iron answer can be given to either of these questions; the best that we can put forward are the most likely theories to explain the facts. It seems that even those salamanders which have lungs do not need these organs very urgently for breathing, but use them more as a kind of float, blowing them up or releasing air from them according to the depth to which they want to descend. Salamanders living in shallow, fast-running mountain brooks would have little

(Continued overpage)

# Microscopy for the Aquarist ————— 4

**I**N my concluding paragraph last month I said that this month we would start operating a microscope. I have decided to defer articles on this until after I have given some guidance upon the choice of an instrument. Therefore this month we will pay our first visit to a dealer. There are a number of these who send out lists of instruments in stock, but to the novice these lists convey little except to emphasise the great variation in price of the goods offered.

If you know what you are doing you can order through the post "On approval"—no instrument should ever be purchased without the understanding that if latent faults develop they must be remedied or cash refunded. The dealer can tell whether the faults are the result of your mishandling, and you must be prepared to pay if they are. It is far better to visit the dealer of your choice, even if it entails a journey, and there, armed with a knowledge of what to look for, you can usually make a satisfactory purchase.

You will, no doubt, be confronted by a bewildering display of microscopes and accessories, some of ancient vintage, and some of comparatively modern manufacture. Brand new instruments are costly, and, unless money is no object, you will try to find a good second-hand instrument. This may often be obtained for a matter of £10 or thereabouts. Money well spent, for there is nothing which can last so long and give enjoyment so consistently as a microscope. There is one thing you must bear constantly in the forefront of your mind—a microscope is for looking through, not at. Do not allow yourself to be hypnotised by highly polished instruments of no known name, offered cheaply with a considerable array of accessories—imposing, fascinating, but frequently useless *impedimenta*.

Ignore too, the binocular models. Until some experience has been obtained, the special technique required to manipulate one of these satisfactorily—especially an old model—will add to your difficulties. Do not bother with long-tubed models—the ten-inch body tube has long been discarded,

and objectives made for a modern length of 160 mm. (approx. six and a half inches) will never give of their best when used with 250 mm. tubes. Many 160 mm. tubes however, are provided with an inner, sliding tube which enables the length to be increased so that the old objectives can be used with them. This gives you a greater choice of objectives.

Ask the dealer if the threads and diameters of the instruments are standard. There are still in existence many models of no fixed standard, equipped with lenses which cannot be used on any other instruments. I once possessed a microscope of this class, and was perfectly happy with it until an accident deprived me of an essential, but irreplaceable, part. The man from whom I purchased it—a thoroughly reliable chap, took it back for "spares", so that it was not a complete loss, but I had learnt my lesson.

The following firms enjoy a well-deserved, world-wide reputation for first-class craftsmanship and reliable service. Should your dealer possess any models by these firms, make your choice from them, and you will not be disappointed. Any second-hand model, however, needs careful examination, whatever its maker's reputation, for there is no way of telling what misfortune may have befallen it during its life. Between 1939 and 1945, many a microscope lay buried for months—sometimes years—beneath the debris of a bombed hospital, factory, or laboratory. Others were brought home as loot, or "gifts" for cigarettes, from abroad, by people who did not know how to treat them.

I will tell you more of what to look for next month. In the meantime search for models by any of these firms: Baker (British); Bausch and Lomb (American); Beck (British); Cooke (British); Leitz (German) 170 mm. tube-length; Prior (British); Reichert (Austrian); Spencer (American); Swift (British); Troughton and Sims (British); Watson (British); Zeiss (German).

C. E. C. Cole

## Salamanders Without Lungs

(Continued from preceding page)

use for such a float. It might, on the contrary, make them too light in the water and increase the danger of being swept away. Having no lungs or reduced lungs might in such circumstances have a survival value. The fact is that many families of New World salamanders eventually left the water altogether and found it quite possible to survive on land with no lungs at all.

Now the readers of this paper are too well trained in physiology and too familiar with oxygenating plants and aerators to imagine that a lungless salamander had perhaps given up the habit of breathing altogether. Breathing means taking in oxygen and getting rid of carbon dioxide. These are two essentials of basic metabolism and without this gas exchange life is impossible. The salamander, however small and insignificant and however sluggish in its habits, is yet alive and consumes oxygen. How does it enter its body? We are so used to see every animal breathe by its mouth (not every animal; what about the insects?) that on observing a lungless salamander making rapid movements with its throat we are only too ready to jump to the conclusion: it breathes through its mouth and absorbs oxygen from the lining of the oral cavity. But, does it? There are serious objections to this assumption.

These animals are small and have, relative to their size, a large surface. They are sluggish in their habits and live in cold, moist places. Why should they make the relatively enormous effort to execute 100-200 vibrations with their throat per minute? And on the other hand they do not always do it. An undisturbed animal often makes no movement at all with the throat but as soon as it is disturbed it starts again. The animal's sight is poor but it has a large organ of smell and a large corresponding olfactory lobe of the brain. How could the organ of smell function if it were not well ventilated? The undisturbed animal might take no interest in its surroundings for the time being; the disturbed animal would be only too interested to smell out the danger. Feeding, it must be remembered, takes place at night, when eyes are in any case useless and only the sense of smell guarantees success.

It seems therefore that the throat vibrations should not be interpreted as breathing, the more so since, in most species, the mouth seems no better adapted for the absorption of oxygen than any other part of the animal's skin. It is the skin which, being very thin and always moist, absorbs the oxygen needed and gets rid of the superfluous carbon dioxide. And so we have here a large group of small vertebrates, smelling their way through life with throat movements so fast that it is hard to count them, but without any active efforts at maintaining the necessary gas exchange to balance their metabolism. A very remarkable group of creatures, well worthy of our notice.



# AQUARIST'S Notebook



by  
RAYMOND YATES

**D**URING 1953 some 39 autopsies were made of fish at the London Zoo Aquarium, where death could be ascribed to animal parasitic infection and the results have been reported in the *Proceedings of the Zoological Society of London*. In some instances organic conditions in certain fish contributed to the deaths. In no two instances were the post mortem findings identical. Six salmon smolts were examined in which there were four instances of fungus, four of white spot, three of *Dactylogyrus* and one of *Diplostomulum* (causing blindness), apart from other parasites. In most instances death was due to asphyxiation by hypersecretion of mucus by the gills, frequently octobothriid flukes. Sea fish showed considerable parasitic infection, most deaths being due to asphyxiation (*Dactylogyrus*, *Lamellodiscus*, *Trichodina*, etc.) and also to fungus and *Cylochoaeta*. *Argulus* was found in three cases. Only about five sea fish died as a result of parasitism in their internal organs. One large fish had dropsy, three-quarters of a pint of ascitic fluid being collected on making an incision into the body cavity; its pericardium was greatly thickened and kidneys senile; the gall bladder was distended with yellowish bile, discoloration being due to many trophozoites and some spores of a myxosporidian.

About 14 tropical fishes were dealt with. Tuberculosis was found in two coral fish whilst an albino swordtail had abscesses on the liver due to tubercle bacilli (quite harmless to the aquarist himself). A nigger barb died of asphyxiation due to *Myxosporidia* in the gills and every organ of this fish was embedded in fat. The intestine of an old mud-skipper contained *Nyctotherus* and *Balantidium*, some of which had been aspirated into the gall bladder. A scat died of asphyxiation due to hypersecretion of mucus caused by reinfection with a form of *Oodinium* from newly arrived fish. Methylene blue treatment had been used on this fish in 1952 and it was feeding well. In September 1953 fresh infection was obtained from newly arrived fish; no immunity had been obtained by the previous treatment as the fish died 14 months after the original infection. A specimen of *Danycellus trimaculatus* was found to be infected with *Amyloodinium*, *Costia* and *Diplostomulum*, the latter causing blindness in both eyes. A harlequin was found to have infested gills, the flukes being still alive although the fish had died overnight in a warm tank. A *Therapon farbus* which died overnight in a warm salt-water tank was found with flukes too decomposed for identification.

A Japanese giant salamander died in October 1953. Slightly earlier it had developed discoloured patches and pustules on its skin. Examination showed heavy infestation with the destructive flagellate *Costia necatrix*. Success was achieved by swabbing the salamander with slightly diluted sea water but this removed some mucus and some sloughing skin as well. The dermatitis improved considerably and the salamander showed no discomfort. No further treatment was given. Organic trouble later caused its death, in particular, severe coronary thrombosis.

A recent film of the adventures-in-space type made use of salamanders and geckoes to give the effect of something in the nature of prehistoric animals. These were shown as of giant size as against the people in the film. I do not know what the reaction of the audience was to this but to me it seemed laughable. However magnified they were still salamanders and geckoes and simply did not look at all frightening. Several efforts have been made in the past to give effect to underwater scenes by filming aquarium fish in tanks as if they were wild denizens of the sea. Perhaps in time we shall see a new name added to the

already long list of people who have assisted in the production of a film . . . "Aquatic adviser".

When visiting a dealer's shop it is a wise policy to scrutinise every tank for signs of white spot. If any is present in any tank the more prudent aquarist will defer purchase until he finds the shop is once again in the clear. One can never be sure of the nets used by dealers and safety first maxims warn us to take no chances. It is true that certain chemicals are effective against this pest but at best the tank water is ruined, particularly if it happened to be old, matured water, the pride of the fish house. It is remarkable how many dealers will refer to their competitors with faint praise, and follow this up with dark suggestions of white spot trouble emanating from there in the recent past. In the shop the dealer usually puts affected tanks in darkness or covers the top with a dark coloured glass, and this is a sure sign of trouble. A number of fish in a tank will often be seen to be near the surface with fins folded and a dejected appearance. Look closer and you will see at once that white spot is obviously present. It is never wise to buy fish from a tank where any of the fish present are in poor condition, emaciated or in poor colour. Wait until you see first-class fish in first-class condition.

Festive cichlids are generally rather shy and retiring but on occasion can be very much to the front. Some time ago I was feeding a crane fly ("daddy long legs") to some *Panichax* and I noticed they held back as if unsure, quite unlike the way they usually snap up tasty morsels. However, whilst they were making up their minds the *G. festivum* came from nowhere with a rush and got in first. Now I find it their most popular food although one in very short supply, unfortunately.

Fungus on the eye is sometimes treated by swabbing with glycerine and iodine, according to instructions in some aquatic books. I have never found this successful whereas swabbing with ordinary castor oil produces a favourable result in about half the cases treated. At least three applications are needed at 24 hour intervals. The white tumours which are found on mollies are nothing to worry about if the fish is not a show specimen. I think it is asking for trouble to attempt treatment when all that is needed is to leave things as they are. I find that these clear up on their own and do not appear on other mollies or other types of fish in the same tank. It is true that the affected fish will often break out elsewhere but it is usually a purely local effect and nothing to worry about. The tails of *Corydoras* catfishes tend to rot very slightly with age, and particularly when they are kept in soft water with a low pH. They remain quite lively, however, and can safely be left in their scavenging job in spite of the unsuitable surroundings. They are very active at night but, like pussy, cannot really see in the dark. Their sensitive taste buds introduce them to food and no doubt they would not be inconvenienced at all by blindness. Pencil fish will give their owner little trouble, although *trifasciatus* suffers from a form of tail rot which can run through a whole batch. This does not affect other fins or kill the fish but the whole tail can be lost. *Anostomus anostomus* do a bit of fin nipping and when a shipment arrives most will be found

to have damaged tails. It is annoying but nothing can be done.

There is nowadays quite a lot of artificial rockery on sale, and much of it looks very attractive, although it is rather dear for what it is. It is common sense to soak it very thoroughly before use and even boil it if possible. However, I have not heard of any ill effects from the use of these commercial rockworks. There will be some effect on the tank water, however, and it is safe to say that tanks containing this type of decoration will have hard water and a high pH. This is probably a point overlooked by the purchaser who considers only effect. Algae can, and does, take a liking to this set up and it is very hard to remove from such a rough surface.

The *Toronto Weekend Magazine* has reported some interesting details of a man who doesn't have to go out looking for fish—they come looking for him. This is Mr. Bill Kerr of Marlborough Sounds, New Zealand, whose unique hobby for the last four years has been the taming of schnapper and blue cod. Every evening about one hundred fish come into the bay near his home and wait for their dinner. He now recognises many by their distinguishing marks, especially the schnapper, which vary in size from a six-pounder he calls "Little Bella" to a 24-pound "Hector," the possessor of a rakish spot over the left eye. He began by tossing shellfish into the water to attract them and blue cod began to arrive. The cod always arrive first but are less tame than the schnapper. The fish soon became used to his presence and, before long, he was putting his hand in the water to feed them and even lift them out. Once he had introduced meat into their diet some fish refused to go back to ordinary shellfish. The local butchers now save scraps for him and he finds it rather like having a hundred pet dogs, except that bones are not wanted. Some excellent photographs accompanied this report.

The hobbyist spends the long winter evenings browsing through numerous aquatic books and magazines and it is in this period of the year that he begins to amass considerable book-learning on certain kinds of fish in which he is interested. At last the chance comes to purchase one or more of the long anticipated specimens but, all too often, comes disillusion. There are so many ways fish can fall short of expectation. Some just fail to grow and remain stunted, others defy all efforts to spawn them as hoped. Some lack all colour, never having seen the illustrations in books, and look very dull and insipid. Others immediately hide away and week follows week without the owner seeing more than a momentary glimpse of them. Some fish just mope at the surface, waste away and die, others flatly refuse to eat, whilst a few take a great delight in chasing all and sundry and causing as much havoc in your community tank as possible. It is, of course, all part of the game. Before buying fish of a kind unfamiliar to you, it is a wise plan to ask the opinions of experienced aquarists, who can often tell you the good and bad points far better than ever appeared in cold print. The dealer is not always the best person to ask; after all he wants to make a sale and his views, of necessity, are biased.

In the June 1954 issue I mentioned the excellent tropical fish transfers issued by the Kaylee Transfers Ltd., of Long Eaton, Notts. (also of Dublin, Paris and Johannesburg). These are real paint and coated with a special heat and water-resisting varnish. If prolonged immersion is required the transfer should be coated over with artists' mastic picture varnish, particularly the edges. Some new issues have appeared recently. One is of eight tropical fish including two angels and two red fighters, whilst others

depict mermaid and fishes, pair of kingfishers, pair of fish-bowl scenes (tropical) and seven assorted flying ducks. The reference numbers for these are P.3, P.1, P.4, P.5 and P.6 respectively. The size of each sheet is 10 ins. by 7½ ins., price 2s. 6d.

Mr. S. A. Stretch is a dealer in Chester who does not believe in allowing beginners to lack advice on the hobby. He furnishes all newcomers with a small neat card which contains a great deal of useful advice and suggests they get in touch with the local aquarist society (through him) who will readily furnish any advice, information or assistance necessary. Far too much is written nowadays for the established aquarist and too little for the beginner, so I give below a summary of some of the major points in Mr. Stretch's excellent advice card.

The last part of the card reads as follows:—"Exotic fish do not live in hot water. They are happiest in a water temperature of 75° F. Changing of water is unnecessary and inadvisable. Green algae is usually the product of excessive light. One gallon of water weighs 10 lbs. One cubic foot of water is equal to about 6½ gallons. Ten watts per gallon provides sufficient heating for the average tank. Tanks can be all glass, pressed steel frame spot welded, or angle-iron mitred and welded. All-glass tanks are seldom free from distortion, faults and flaws. Pressed steel is not advisable for larger tanks. Angle iron is preferable for its rigidity. Thirty ounce glass is usual for tanks up to 10 gallons, quarter-plate glass is usually for larger sizes. Metal other than iron or lead should not come into contact with water. Special aquarium glazing compounds have many advantages over ordinary putty. Locally made tank frames must be exactly true because glass will not bend to counteract any discrepancies. Aeration is not essential but more fish can be kept in a given sized tank, and it can be used in conjunction with filtration and sediment removal. A tank 18 ins. by 12 ins. by 12 ins. would contain about eight gallons of water. A thermostat will control heating with a latitude plus or minus 2 or 3 degrees (varying between 72 and 78 degrees with an average temperature of 75° F.). Allow time between the initial setting-up of tank and introduction of heater and thermostat, also a further time lapse between heating of tank and introduction of plants and fish. Do not purchase all your plants or fish at once. Find out plants most suitable for your particular tank and start with a couple of the hardier tropical fish. You will quickly develop fish-knowledge to increase your fish and decorations."

Mr. Stretch has a large number of tanks and each one is marked with a number. At the back of the shop is a long blackboard which contains the number of each tank, and written alongside the names of the occupants and their prices. Rather a neat method which some other dealers could do well to copy.

Blind cave fish are quite uncanny in many ways, and it is remarkable how they seem to recognise a newcomer to the tank. They will take no notice usually of the other occupants but when a new fish is introduced, particularly if a large specimen, they will immediately chase him round the tank and swim round and over and under the newcomer in a most embarrassing manner. After a few minutes, however, they lose all interest.

Kuhli loach are easy to keep and are very long lived but are rather fond of hiding most of the time under stones or behind rockery. When they are getting old, however, they tend to come out of this seclusion and spend most of their time resting on the water plants or the tank thermometer but not on the gravel. When death overtakes them they generally die in full view (not hidden away as might be expected), lying on their backs in the form of a semi-circle.



*A page for  
the beginner  
contributed  
by  
A. BOARDER*

**A**T the commencement of yet another year we are all inclined to make new year resolutions, but I am sure that many of these are likely to be broken before long. We all start off well but other factors impose their complications upon us so that the good resolutions are either forgotten or crowded out by more urgent matters. After each season one is sure to have found some point where one has gone wrong and an endeavour is made to see that this mistake is not repeated. Where fish-keeping is concerned there are so many points where it is possible to go wrong and although we may know them it is not always easy to see that these mistakes are not repeated. It may be easy to plan out a course of procedure during the winter months, but when the spring comes with its added work in garden etc., these ideas are not carried out and trouble arises again.

Even so early in the year the enthusiastic pond keeper will be looking forward to breeding his fish once again and now is the time to start making preparations. As I have repeated so often before it is essential to have plenty of space for rearing the fry and so fresh tanks can be made now to be ready in good time. I have given directions before as to the making of concrete tanks for hatching purposes, and a good supply of these will mean that more fish can be raised. All tanks which have been used before must be thoroughly sterilised so that they are quite safe for use again. This task is most important. No-one knows how many thousands of fry are lost each year through the attacks of flukes, and possibly many of these could have been saved if the tanks had been cleansed before use. Never use any tanks for hatching which have been kept filled with water throughout the winter without seeing that they have been made safe. I prefer to empty a number of tanks and then well sterilise them with a disinfectant such as Dettol. They are then kept empty until needed.

It is difficult to know where these flukes come from, as even with great care on the part of the fishkeeper they may be introduced into the fry tank. It is possible that some kinds of fluke can encyst through the winter and come active again when the warmer weather arrives, and so it is well to do all possible to ensure that the tanks are as clean as possible in good time. It is my opinion that for every young fish lost through other diseases or pests at least a hundred are lost through flukes. Often the aquarist is unaware of the cause of the loss of hundreds of fry. They may have been placed into large tanks or even a small pond in the garden, and there may have been two or three thousand fry introduced. After a month not a single fish may be seen. No dead ones have been noticed and yet the fry have disappeared. I have known many people who have had this happen and they have been at a loss to account for it. When the fry are not more than a week old I think that some may have been lost through *Hydra*, which may not be easy to see in a pond, but after this age I feel sure that flukes are the cause of many deaths. The fry are so small that when they die they soon disintegrate and are seen no more. If any trouble has been experienced with flukes I consider that it is better to keep the fry in glass-sided tanks so that they

may be watched when they are small; once they are a month old is plenty of time to place them into larger quarters.

In preparing the treatment for fluke infestation the amount of Dettol to water varies according to the length of time it is safe to keep the fry under treatment. Whereas in a solution of a quarter teaspoonful of Dettol to a gallon of water the fry may be kept in safely for fifteen minutes, when the strength is increased to a teaspoonful to a quart the limit of time for immersion is only fifteen seconds. When using the immersion method for any small fry, it is better to keep them in a small net, so that they can be removed immediately they show signs of distress by turning over. A clean tank must be ready to place the treated fry in, as they must not be returned to the affected tank. Even if they look groggy for a time, they soon recover when in the fresh water. The flukes increase in numbers and spread right through a tank in a short space of time if treatment is not given early enough. I am sure that crowded and unhygienic conditions encourage the spread of the trouble, and lack of space is one of the most certain reasons why so many fry are lost at an early age. Plenty of the right kinds of food can do a great deal towards the keeping of the young fish in a healthy condition. I know that this matter is not of immediate concern but later on in the breeding season there will be so many other things to think about that I am sure a study of the problem now will mean that you are better able to cope with the trouble if and when it appears.

One way to assist the check of these pests is to give all breeding fish a good bath in Dettol before actually using them for breeding purposes. Another plan which I consider is well worth adopting is to have a spare tank ready with matured clean water so that as soon as the fry are free-swimming in the hatching tank they are caught and transferred into the new tank. This will mean that many pests which may have been on the spawning medium are prevented from attacking the fry. The chances of keeping the flukes at bay will also be better. There is no need to have anything at all in the tank in the form of water plants for some time and then when they are introduced try to make sure that they do not contain any pests which might cause fresh trouble. When catching small fry for moving into the fresh tank it is a good plan to use a small milk saucer to catch them with. The fry can then be seen, also any pests in the form of the small larvae of dragon flies or water beetles. Do not think I am over-stressing the importance of care when dealing with young fry, as I know how many pondkeepers and breeders have been disheartened by the losses among fry. To those aquarists I say try again and keep these notes by you for reference if any troubles arise later on.

During any mild spell one or two small pieces of earth worm can be offered to the breeding fishes. If they are able to feed a little when conditions are mild they are more likely to come through the winter in good condition. Give no dried foods to fishes in ponds at this time of the year and greatly reduce the amounts of food given to coldwater fishes in tanks, in the house.

# Culturing INF

by Dr. F. N.

*Photographs accompanying this article on micro worms in the October*



A lettuce is broken into small pieces with screwing and crushing movements to bruise the leaves, over an enamel bowl



One kettle of boiling water is poured on the crushed lettuce pieces and allowed to infuse for about half an hour



The bowl is three-quarters filled with cold tap water and placed in a warm situation for 24 hours before the Infusoria are added to start the culture off

**T**HERE are numerous ways of making an Infusoria culture, but the underlying principles are the same in every case. Once these are understood there should be no difficulty in making good cultures as a routine procedure. Though there are numerous Infusoria substitutes now available which are handy to have around in an emergency, nothing grows fry faster than a really good Infusoria culture.

Infusorians are unicellular animals which live in water, feed mainly on bacteria, utilise oxygen and have an optimum temperature at which they thrive best. If all these factors are to their liking they multiply at a tremendous rate; if not they breed very slowly or die off and the aquarist is left with some dirty water and a not too pleasant smell.

Let us consider the first important factor, their food. As we have seen already, a large number of bacteria are needed for the Infusoria to feed on, so our first job is to provide a culture of bacteria. This we can do by allowing some dead organic matter to rot in a quantity of water. Up to a point it does not really matter what we use as dead organic matter, and different aquarists have different ideas on what is the best in this direction. Here are a few of the materials commonly employed: potato peelings, pieces of potato, cooked cereals, flour, Bernax, hay, dead fish, cucumber, lettuce and banana skins. No doubt you can produce some Infusoria with any of these, but some give better results than others and also tend to give "cleaner" cultures more suited to the needs of the aquarist. I have on occasions tried most of the above-mentioned materials but I now use lettuce exclusively.

Besides the dead organic matter we need, of course, water for the culture medium. In the picture you will see that we pour a kettle of boiling water on the lettuce leaves and allow it to stand. The reason for that is quite simple; all we are trying to do is to partially cook the leaves. This breaks up the cellulose walls of the vegetable cells in the lettuce and liberates the food material contained within. Thus this step makes the food more readily available to the bacteria. You may, of course, omit this stage; if you do all that will happen is that your Infusoria culture will take a little longer (about three to four days longer usually) to mature than otherwise.

After the boiling water we add tap water and allow this to stand for 24 hours. This gives the bacteria a chance to get going before the Infusoria are introduced. Another thing which Infusoria need is oxygen, hence it is desirable to provide a fairly large water surface by using a shallow wide receptacle rather than a deep narrow one. Under such conditions not only will the Infusoria fare better but there will be less likelihood of smells developing (as anaerobic bacterial activity will be kept down to a minimum) and the large surface not only helps the uptake of oxygen but also the elimination of foul-smelling gases. Aeration is employed by some aquarists to obtain a really odourless culture: it is a refinement that certainly works but I do not use it as a routine measure.

Probably more Infusoria cultures fail due to keeping them too cold than to any other single reason. Though satisfactory cultures can be obtained at about 50° to 55°F.

# INFUSORIA for Fry

## ESSENTIALLY

of those which appeared with the  
specimens were taken by the author.

anything much lower than that usually fails to produce a culture rich enough for the aquarist's needs. The rate at which Infusoria multiply is notably influenced by temperature. The higher the temperature (up to a point) the faster they multiply. As a matter of fact at a temperature around 70°-75°F. a really thick culture can be produced in three to four days.

The spores of many Infusorians are airborne, hence it is not absolutely necessary to seed the culture from a previous culture or water from an aquarium. However, it is better to do this than to rely on chance arrival of spores of the correct type. The only snag about using aquarium water is that creatures such as *Cyclops*, *Daphnia*, etc., may be introduced. These feed on Infusoria, so obviously they should not be allowed to get into the culture.

Many aquarists harbour the fallacious impression that any sample of turbid coloured smelly water is full of Infusoria. Nothing can be further from the truth. All the above indicate a polluted sample of water, that is to say one containing a lot of bacteria. As a matter of fact since the Infusoria really get going they devour almost all the bacteria available, and hence a really ripe Infusoria culture is almost colourless (when made with lettuce—hay cultures have a yellowish colour even when ripe, due to the colouring matter in the hay), and the water is clear enough to allow newsprint to be read through a culture thickness of at least two inches, often much more. The unaided eye can now easily detect shimmering clouds of

Infusoria when a jar full of the culture is held up to the light. In any case an expensive microscope is not essential to see these creatures; a pocket loop magnifying about ten times is ideal. Actually a microscope magnifying more than about 20 to 30 times may give a very fallacious idea to a novice of the true value of the culture, for it brings into view lots of smaller creatures which are not of much value to the fry after the first day or two.

No rule of thumb should be adopted when feeding Infusoria to fry. The principle employed should be to see to it that there are always a fair number of Infusoria available to the fry. Before adding any more just examine a drop of water from a lighted portion of the tank. If you can detect five to ten organisms per drop there is no need to add any more. If you can only see an odd one or none it is high time some more is added. With experience even this is not necessary—a careful naked-eye inspection of the surface of the water in the tank can tell you all you want to know. Do not, however, add too much at a time; remember that Infusoria use oxygen and large numbers may produce the same result on the fry as crowding too many fish in too small a tank.

When Infusoria are fed intelligently to the fry and if other conditions are right they grow at a phenomenal rate. Most of the fry of egg-layers are ready to take newly hatched brine shrimp in just under a week, often earlier, if plenty of a good culture is available. There is no need to fear pollution when the culture is really ripe and clear.

The actual method of adding the culture to the water has also received considerable attention. Many like to introduce the culture by arranging some sort of drip feed; others take the trouble to see that the culture temperature is the same as the tank temperature before the former is added to the latter. On theoretical grounds there is much to commend in both these ideas. I have passed through these phases myself but seeing no actual advantage in practice I have now abandoned these refinements. My present method is both simple and fool-proof—I just unceremoniously pour in about a jam jar full of Infusoria into the fry tank, as and when required.

## Killers at Large in the Community

MANY fishes which are normally seen in the community aquarium are not ideally suited to living with other species, that is, in a restricted space; for their habits and behaviour are at variance with what we like to call a peaceful existence.

Angel fish, for instance, have erratic tempers, and are often the cause of smaller fishes being found dead on the bottom—the result of persistent bullying, or outright attack. Tiger barbs, which look so pretty darting in and out of the greenery, delight in fin-nipping, and soon ruin the appearance, and often the health, of less-robust companions. Male swordtails, as they reach full size, often become most aggressive towards other males of their own species, and if there are not sufficient females of their own kind to distract their attention, will worry the aquarist with their everlasting skirmishes in the plant life.

Among the most cunning killers sometimes placed in the community tank are the fighting fish and two-spot gouramis. A solitary male fighting fish does most of his damage at night, when the light is out. For then it is an easy matter for a fighter male to sneak up on an unsuspecting zebra fish or guppy, and tear its life out—a quick lunge at the gills or soft throat and all is over. The two-spot gourami cannot inflict much, if any damage with its small, soft mouth, but when it attains full-size it can become a great nuisance at feeding time, for it bangs against other

fishes in its mad rushes to get food; and a bang from a hefty gourami is no light matter for a frail-bodied flame fish or similar species.

All gouramis, even the dwarf species, become a positive danger to other fishes at breeding time, for they have a highly-developed sense of parental responsibility, and go berserk if other members of the community venture too near the zone marked down for raising a family.

The following fishes, however, are absolutely trustworthy in a happy family tank, and if several of each species are included, the aquarist can be assured of plenty of colour and no tragedies from an excess of high spirits or vicious temper: *Barbus semifasciatus*, *B. schubertii*, *B. gelius*, *B. cuningii*, *B. oligolepis*, *Pristella riddlei* (and its golden form), *Hyphessobrycon innesii*, *H. gracilis*, *H. flammus*, *Rasbora heteromorpha*, *R. maculata*, *R. pauciperforata*, *Acanthopthalmus semicinctus*, *A. kuhlii*, *Corydoras* catfish. These last are charming little creatures, which one must resist collecting; for too many of them will cloud the water by stirring up the bottom in their everlasting search for morsels of food. Four of these little catfish is about enough for a 24 in. by 12 in. by 12 in. tank. I suggest two *C. aeneus* and two *C. melanistius* (or *C. julii*).

Jack Hems

# Journal of a Marine Aquarist

I APOLOGISE for some doubt as to the identity of the "king rag" mentioned in a previous article, but this has now been established as *Nereis virens sars*. Its second specific name refers of course to Michel Sars, the famous Danish marine biologist. *N. virens* is certainly a most formidable beast, reaching a length of two feet. The director of Port Erin Station informed me recently that one had a bit out of his thumb—and thumb skin is, next to the sole of one's foot, about the thickest cuticle *Homo sapiens* produces. This handsome and pugnacious worm is local. Reported rare in the Plymouth area, it abounds in mud at Southampton and is sold at about twopence, i.e., about four inches a penny, and worth it! The giants seem to be centred in the North West, from Peel, Port Erin, and the Clyde area. English Channel examples that have come my way rarely exceed a foot in length.

Despite its great size and powerful toothed jaws, (I always decapitate before threading on a hook) most sea beasts on fins or armoured legs will tackle it with zest. To put one in an average home tank is asking for a riot. Hermits seize the monster, clip it in two, daintily taste the bitten ends and then settle down to enjoy one, as a child might tackle a stick of animated rock. A hungry trio of blennies enjoying a king rag remind one of the famous Laocoon group, save that their catlike faces register a tigerish enjoyment, and at this moment a little finger-nail sized shore-crab is travelling round a tank with one end of a six-inch fragment, cannoning off the glass and rocks, apparently in a gastronomic ecstasy the while. One can only wonder what some sentimental bull-fight fan or cruelty-prevention society subscriber would make of it all.

It is curious to think how even *The Aquarist* in its early days regarded the home sea-water tank as an ideal most difficult to realise, and anticipated a very long and uphill struggle for its votaries. Even with money relatively no object it must ever be uphill, for if the known life histories and requirements of a few thousand sea beasts are fairly



Photo:

J. Francis

Aquarium of the Marine Biological Station at Plymouth. At the end of last year the Rockefeller Foundation announced a grant of 30,000 dollars to the Aquarium's laboratories to support research on the biology of the sea. About a hundred marine biologists from all over the world visit and work at the Plymouth laboratories each year investigating numerous problems connected with sea water and the physiology of marine organisms.

by L. R. BRIGHTWELL

pegged down, they dwindle to the merest handful beside the great unknown.

Yet the British Marine Aquarists' Society, founded only a few years ago, has made astonishing strides, and in August last year produced its fifth Bulletin in such a well-duplicated effort of six pages that one feels it is not far off real print. May that day soon come. As an example of fast-growing interest, new members hail from places as far apart as Wallington (Surrey), Newport (I.O.W.) and Liverpool. The slowly but steadily growing library now includes a book of abstracts from the Society's memoirs by Mr. J. P. Browne, and a fauna list of the Port Erin area. Fauna lists, by the way, are much too scanty. One of the Brighton (i.e. Southampton to Bexhill) Channel is only now in gradual preparation but is not likely to see print for some years. The B.M.A.'s animal supply scheme can now guarantee beadlet anemones and sand-gobies (*Gobis minutus*) to all who want them, and also shrimps and mussels for food.

Here a digression, apropos of aquarium foods. Some months ago there was much newspaper talk about the annihilation of the Worthing and Brighton beach flies by spraying (at goodness knows what outlay) with a guaranteed-to-kill insecticide. At the Centenary Celebration Luncheon of the Brighton Natural History Society, a guest of honour (Dr. A. E. Swinton, O.C. Dinosaurs, South Kensington, and a man who knows his onions, to boot) grimly reminded us, in an admirable speech, that the killing of the beach flies, tireless destroyers of rotting weed, must inevitably have far-reaching repercussions—not to be appreciated fully perhaps for some years hence. Most of the well-fed gathering (it was an after-lunch speech and a warm, languorous day) took it calmly enough. But it was the writing on the wall!

Within a week of the spraying not a sand-hopper—a finer beach-cleaner even than the flies—was in existence between Seaford and as far west as Angmering, nearing the Hampshire border. A certain professional trapper of *Gammarus marinus* had to cancel his orders from the London Zoo Aquarium and other valued clients. Just a queer trade hard hit, and so hard luck? Not quite. Mrs. E. Sexton of the Plymouth laboratory, and an internationally recognised authority on the Gammarids, has recorded how 20,000 hoppers have been found cleaning up that most malodorous beach poisoner, a dead sea-urchin. But, nature luckily outwitted the too clever business men. A few inaccessible pockets on the wonderfully varied hundred miles of Sussex coast escaped the poison people. Just where those pockets are, wild sand-hoppers in any quantity, nothing will persuade me to disclose. But nature's wheels are slowly beginning to rotate once more, and the London Zoo marine fishes are getting just what the doctor ordered.

Today we stand impressed by Florida's "Aqualand," a veritable inland sea, viewed from galleries so that the paying public may see this captive ocean from sea-bed level, mid-water and the surfaces. One can only wonder what P. H. Gosse would make of the aqualung and the under-sea camera, both at the moment admittedly in their infancy.

## OUR EXPERTS' ANSWERS TO READERS' QUERIES

Just before one of my female mollies had her young, her sides bulged so much I thought she would burst. After the babies were dropped, her sides returned to normal. Now another one of my female mollies is showing the same bulging sides. Is it right for gravid mollies to bulge to such a great extent, or have they contracted some disease?

When a female molly is carrying a large number of young, her sides will look as though they will burst under the load. But do not worry. The mother fish should drop her babies without any complications. We would warn you, however, not to move a gravid female from one tank to another, for a shock at this time is likely to kill her. And make sure that the temperature of the aquarium is kept near enough constant. Gravid female mollies should not be subjected to any change in temperature.

I should be pleased if you would tell me how to induce white worms to congregate in one spot so that I can remove them from their original box to a fresh one I have rigged up for them. The soil in the old box has become very smelly.

Do not feed the worms in the old box for several days, and allow the soil in it to become rather dry. Then place a small piece of bread soaked in milk on the surface of the soil, and cover over as usual with glass and sacking or brown paper to exclude all light. If you lift the glass top in about three days time, you will find most of the worms in the box congregated around the food. Lift the food, worms and some of the soil from the old box in a tablespoon, and transfer to the fresh culture medium.

Can you suggest a good sub-soil to place under ordinary aquarium compost to encourage a luxuriant growth of plant life?

A thin layer of peat or peat moss is the best to use. Peat keeps the water on the acid side, which suits the majority of tropical fishes, and most aquarium plants root very well in it. The plants which grow better in peat than in sand alone include *Cryptocoryne*, *Sagittaria* and *Ludwigia*. We advise you to pour a kettle of boiling water over the peat before you place it in the aquarium. This will get rid of a lot of the fine, dusty particles, and sterilise it.

I am not having any success as a fish-keeper. Although I change the water in the aquarium every other week, I keep finding a dead fish on the bottom. In the last two months, I have lost about eight fishes, mostly angel fish and black widows. The water used in the aquarium is drawn straight from the tap, then heated up to the required temperature. When it flows from the tap into a glass, the water always shows a slightly milky discoloration. A friend has told me the water is too hard, and this is killing the fish. Do you think my friend is correct?

Hard water does not suit many species of fish, but we do not think that your fishes have died because of it. We would say that changing the water too often has led to the trouble you have had in your aquarium. Fishes do not like to be disturbed just when they are getting used to their environment; then again, sudden changes of water always result in a certain amount of shock, for to change a fish from one sort of water to another in a matter of an hour or two is like whisking a man who has lived all his life in Wigan to a mountain top somewhere in Peru, and expecting him to show no change in his physical condition. We advise you to let your aquarium water stand and mature. With increasing age it will tend to become softer. If you wish to hasten the softening of the water, dip a few jugfuls of it out of the aquarium and pour them through a flower-pot filled with peat. Then return this peat water through muslin into the aquarium.

The compost of my tropical aquarium has become coated with what appears to be a dark green cobweb. The fishes are perfectly healthy, and the aquarium is kept well-aerated and

Many queries from readers of "The Aquarist" are answered by post each month, all aspects of fish-keeping 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.

filtered by a small air-pump. Can you please tell me the cause of the green growth, and will it harm the fishes?

The "green cobweb" which has coated the compost in your aquarium is a lowly form of submerged vegetation known as algae. It may be caused by alkaline conditions—say, a calcareous compost, or naturally hard water; by too much starchy dried food being left uneaten on the bottom; or by too much strong side light. Algae does not harm fishes; in fact, many species like to eat it. We suggest that you remove as much of the growth as you can by raking over the surface of the compost with a pointed stick, and siphoning the loosened green patches into a large jar, after which they can be thrown down a drain or on to the garden. If the side light is too strong, cut down the intensity by judicious screening, and do not feed the fish more food than they can eat in a matter of a few moments.

My tropical aquarium is situated in an alcove on one side of a bay-window facing due west. It gets plenty of light from the window, and we also give it a few hours every day of electric light. Just lately I have noticed that the plants and sides of the tank are becoming coated with a thick growth of algae. Please can you tell me what I should do to get rid of the green pest?

Your aquarium has been getting too much light, but now that the days are darker, the growth should die down. The best thing you can do is to scrape it off the sides of the tank with a razor blade inserted in a special holder sold by dealers in aquarium requisites, and when the longer, brighter days come round again, try and shade the aquarium from too much sun or bright light by judicious arrangement of the curtains, or by placing a few potted plants between the aquarium and the source of the light.

I am interested in breeding zebra fish. Can you please tell me when I should transfer the fry to another tank for "growing on"?

Directly the adult fish have finished spawning they should be removed to fresh quarters. The eggs should be left in the spawning tank. The fry should develop very well in any aquarium larger than 18 ins. by 12 ins. by 12 ins. In smaller tanks, you should be able to raise about 15 to 20 fish to a good size. But we must emphasise the fact that the more room the fry have to swim around in, the better it is for their proper development.

Some time ago I read that marine aquaria are almost as easy to maintain as freshwater tropical aquaria. I should very much like to keep a salt water aquarium, but wonder whether it is as easy as the author of the article would have his readers believe. For instance, could I make my own sea water from chemicals? Would seaweed grow in a marine tank? And does one have to keep changing the water, or can it be left in the tank for months or years without a change?

Marine tanks are not so easy to keep in the home as some writers would have us believe. In the first place, you need to fill your aquarium with genuine sea water obtained from a clean part of the coast. Many seaweeds soon die in an aquarium, and pollute the water. The water is best filtered and aerated, though anemones will often survive for years in a balanced tank, placed out of a bright light, and kept scrupulously clean. Of course, certain tropicals which inhabit brackish waters will do well in a tank filled with a 50-50 mixture of sea water and fresh water. These

tropicals include scats, puffer fish, *Psetta* and the like. You will find several pages devoted to the marine aquarium in Hervey & Hems' *Freshwater Tropical Aquarium Fishes*.

I recently bought a black mollie. She was gravid when I placed her in my aquarium, but instead of dropping baby fish, she deposited several clear eggs. Can you tell me whether female mollies normally jettison unfertilised eggs?

We have not come across an experience like this before. But it is not uncommon for a gravid molly to give birth before her normal time, in which case she will drop undeveloped fry with the yolk-sac still attached to their bodies. It would be easy to mistake this yolk-sac for an egg. Such premature babies do not live.

Some of my guppies and platys seem to be wasting away. Their heads look too large for their "caved-in" bodies. Can you please tell me the cause of this trouble?

The condition you described in your letter may be due to old age. Most livebearers do not live much longer than two years, and a sign of old age and approaching death is wasting away. On the other hand, female livebearers do become very hollow-looking after dropping a large batch of young; and if a female is past her prime, a batch of young may hasten her decline. Hollowness is sometimes a sign of malnutrition, that is, in young fish. Better food, say, a course of Bemax and finely chopped "lights" or liver will often work wonders in emaciated-looking fish.

At a recent meeting of our local aquarists' society, we were advised by an electrician to earth our tanks by fixing a brass screw through the top angle bar of the aquarium and allowing it to make contact with the water. Since taking this person's advice, my fishes have been dying off in ever-increasing numbers. Do you think the brass screw in contact with the water is the cause of the trouble?

Brass in contact with water is highly poisonous to fish life. If you wish to earth your aquarium, the best thing to do is to solder a wire to the outside of the frame and connect the other end to the earth-pin of a three-pin socket, or to a copper pipe buried in the ground.

My plants do not grow at all well in my aquarium. I cannot understand this, for the aquarium is not a very large one and it gets plenty of artificial light from two 40-watt bulbs fixed immediately above the surface of the water. Some of the plants become yellowish; others become scraggy. I cannot keep spatterdock alive for more than a month or so.

Plants can be very temperamental. Some will settle down in an aquarium; others will not. Some plants need acid water; others flourish best in alkaline water. Too much light will harm some; too little light will kill others. We suspect that you have been placing the wrong sorts together. *Cryptocoryne* do not like too much light; they do best in a subdued light. A bright overhead light will tend to stunt, but not kill *Sagittaria*. For a position in a bright light, place *Vallisneria*, *Apogoneton crispum*, *Myriophyllum* or *Ludwigia*. For partial-shady places plant fine-

leaved willow moss, *Cryptocoryne*, *Sagittaria natans*, or hornwort which has been grown in warm water. With a little experiment, the aquarist can usually discover the sort of plants which will flourish in his special conditions.

I have some *Cryptocoryne willisii* plants in my tropical aquarium. When I bought these plants they were a nice shade of green, but now they have turned reddish-brown. Can you tell me why the plants have changed colour?

Young *Cryptocoryne willisii* are grass-green, but as they mature the leaves turn a sort of beech colour; that is, a lovely reddish-brown, richer and more red on the undersides. This plant flourishes best in a partial shady position.

Is it advisable, when lighting an aquarium, to use low wattage bulbs over a long period of time, or high wattage bulbs over a shorter period, say, a 40-watt bulb for eight hours at a time, or a 100-watt bulb for five hours?

The best results are always obtained when an aquarium is lit by a really bright light for a short period every day rather than when it is illuminated hour after hour by a poor light. For instance, many light-loving plants would soon die down if kept in a 24 ins. by 12 ins. by 12 ins. aquarium illuminated by a single 40-watt bulb for about eight hours every day. But the plants should thrive if given at least two hours light at 100-watts, and four or five hours at 40-watts. Of course, the plants should be directly underneath the source of the light, and the bulbs should be fixed not more than six inches above the surface of the water. It is impossible, however, to lay down strict rules for lighting the tropical aquarium. It is all a matter of personal experiment, for a great deal depends on the amount of natural light reaching the aquarium, and whether the natural light entering a window comes from the east, the south, the north or the west.

My fish keep rubbing themselves against fixed objects in the aquarium, and their gills look very inflamed. What sort of treatment should I give to clear up this condition?

Diseases of the gills are often very difficult to eradicate, and fishes which are badly infected are best destroyed for their own sake, and for the sake of other fishes in the aquarium. Mild infections of the gills can be cleared up by keeping the aquarium scrupulously clean and introducing methylene blue into the water. Get a chemist to dissolve fifteen grains of methylene blue in three-and-a-half fluid ounces of water. Add drops of this solution to the water until it assumes a distinctly blue colour. Keep the temperature a few degrees above normal while treatment is in progress, and siphon about a pint of water from the bottom of the aquarium every day, and top up with fresh, heated to the same temperature as the aquarium. Sometimes the gills of a fish become inflamed when they are living in overcrowded conditions. Fresh water and artificial aeration will usually put things right; that is, if taken in time.

## COLDWATER FISHKEEPING QUERIES answered by A. BOARDER

I have made a concrete stone or "rock" for my tank and although it has been soaking in water since last November the water is very alkaline, on test about pH 7.5. Will fish live in this and what can I do to improve conditions?

I can hardly see why you have gone to such trouble to make artificial rockwork for your tank when it is quite easy to obtain suitable stone from any nurseryman quite cheaply. Well-weathered Westmorland stone as used for rockeries is ideal for the purpose and this can be broken down to any size or shape required as long as all sharp points or edges are rubbed down afterwards. After all that soaking and washing I should expect the rockwork to be safe by now. Perhaps the water itself is limy and your rock is not the only

fault. Goldfish do not appear to mind a slightly alkaline water. Some peat in the tank may help matters, but it must be in an enclosed bag or it can make rather a mess.

About two months ago I set up a fountain in my pond and have since lost a dozen fish. To operate the pump I use a strainer which has a brass connection and the water is pumped up into a copper tank. Do you think the copper tank is causing the fish to die?

The copper tank can certainly be a cause of the death of your fish. We have repeatedly warned readers of the danger of copper and brass for piping or containers where fish are concerned: that some aquarists appear to get by



without trouble does not mean to say that many others have not had trouble in plenty. I have had many experiences of copper harming fish, so many that I certainly would not think of using it myself. Less than one part of copper to a million parts of water can be fatal to goldfish, but I realize that a good deal may depend on the type of water used. For instance if a hard water is used this can so cover the piping with lime that its deadly effects may not be enough to harm fish, especially when there is a large amount of water in the pond, since this means a smaller concentration of copper to the water.

I have a small tank of goldfish and as fast as I buy fresh water plants and set them in the sea coral at the bottom so they die. What can I do to grow these plants?

In the first place I do not think the sea coral is suitable as a compost for your plants. Get rid of this. The salt may be too strong. Try a clean coarse sand and well root your cuttings before planting them in the tank.

Our next door neighbours intend to keep pigeons. Will their droppings foul the water in my pond and harm my fish? I have heard of birds carrying types of worms in their intestines. Is this so?

Certain flukes, etc., do have some of their life cycle stages carried by birds but usually, I believe, by water birds. You need have no fear that the pigeons will do your fish any harm. An old friend of mine near here used to breed many goldfish in a pond where his pigeons regularly bathed, and no ill-effects were ever noticed, in fact, he appeared to think that the oil from the feathers was beneficial in that it encouraged Infusoria to form, giving food for the fry.

There a female goldfish which has spawned this year. It looks quite healthy and eats all right but most of the time it lies on its side on the bottom. What is the trouble?

The fish has evidently a deranged swim bladder. This may have been caused by some damage such as rough treatment from the males when spawning. See that the fish has shallow water and if you are able to warm it up slightly it may improve the condition of the fish. It is quite possible that the fish will soon recover and have no further ill-effects. If any fish shows any sign of weakness the breeding period usually aggravates it. One often sees many dead fish in natural waters after spawning, and so one must expect something of the same sort of thing to happen when fishes are kept in unnatural conditions.

A month ago I made myself a two and a half gallon tank and installed in it four one inch goldfish. My intention was to establish a natural home for the fish, but I now have my doubts as to its success. One of the fish has small white spots on its fins and body and I have isolated it. Is this sufficient? Also would paraffin fumes harm the fish and does altering temperatures harm goldfish?

Your tank is too small to be of value. The smaller it is the harder will it be for you to keep the fish healthy. The fish appears to be suffering from white spot disease. Can you get an aquarist friend to confirm this? If so the mere isolation of the fish may not bring a cure. The water needs to be warmed up considerably to hasten the development of the parasite. When it leaves the fish it, or the resultant small parasites, may be killed by several disinfectants. Paraffin fumes need not do any harm to your fish. I know many aquarists who heat their tropical tanks with the aid of paraffin and find it safe. Changing temperatures will do no harm to the fish. It is a different matter if you take a fish from warm water and plunge it into very cold water. The temperature of the water in a tank would change gradually as the general temperature of the room altered and this would not have any harmful effects on the fish. In many ways fish which are subjected to gradual changes of temperature are more hardy than those which are kept at a steady temperature thermostatically controlled.

I wish to make two small cement pools for breeding *Daphnia*. Will you please tell me the best depth and position? Shall I have plants in one end to oxygenate them?

I advise you to make the ponds a good size as the *Daphnia* will require plenty of oxygen. They should be in a sunny position. You could have a few plants in the pond but these are not essential. If the ponds are about a foot deep the water will keep fairly well oxygenated without plants, and too many plants would mean that the ponds could remain too clear. *Daphnia* only thrive well in water where there is a large amount of Infusoria and algae. Once the ponds are made and well scrubbed out, you must fill with pond water if possible, otherwise well-cleared rain water will do. If pond water is used it must be thoroughly strained to see that you do not introduce any pests which would eat the Infusoria needed by the *Daphnia*. You would then need to get a good culture of Infusoria and rotifers breeding in the pond. Only when there is plenty of food in the pond should *Daphnia* be introduced. When they are breeding well you must see that the water has a part changed for fresh now and again, and keep up the supply of Infusoria.

I have bred some paradise fish but find that after a time they disappear. I see no traces of dead fish; what do you think happens to them?

I have heard of many aquarists with the same trouble and I feel sure that few breeders have not experienced the same thing at some time or other. There are several reasons for the disappearance of the young fish. I believe many are eaten by *Hydra* when tiny, and planarians can also do a lot of harm. Also the fact that some fish will eat their kindred is also a well-known fact. Only the other day I saw a small fantail not more than three weeks old with another smaller one in its mouth. The imprisoned fry was wriggling its head and body but the larger fish had it by the tail and there was no escape for it. I have for many years wondered if the water louse or *Asellus* was in any way to blame. I had seen them eating a dead fish but had no actual proof that they would attack living fish. However, just recently an aquarist friend had been losing fantail fry from his tank and with a torch examined the tank at night expecting to see planarians. Instead, he saw a water louse on the bottom of the tank and suddenly it sprang forward and seized a young fish which had been feeding on the bottom nearly three inches from it. In a matter of seconds there was nothing left of the fry. If a number of these creatures are in a fry tank it can be realised how soon most of the fry would disappear. I have often recommended the inclusion of these creatures in a tank as they are such good scavengers but they must from now on be excluded from the fry tank. As they feed mostly at night they are likely to be overlooked and so should be searched for at night.

I have bred some shubunkins and have the fry in a tank 24 ins. by 12 ins. by 12 ins., at present at 68° F. My problem is that I am shortly going away on holiday for a fortnight. Can I leave the fry to themselves or shall I try to fix up a drip feed for them?

The leaving of such small fry alone without feed will present a problem. Normally fish may be left for this period and longer without coming to any harm, but with fry it is more difficult as they need to be feeding almost all day long. If you could place them in a large container such as a bath with plenty of green water and some water plants it is quite possible that they would be quite all right when you returned. The smaller the container the less food will there be for the fishes. I do not see how you could arrange for a drip feed to last that time. Even a drip every two seconds or so would need a lot of water and an overflow would have to be arranged. I have often left young fry for long periods on their own but usually in larger, well-planted tanks. A lot will depend on the number of fry in your tank. If you could get someone to drop in a small quantity of dried egg powder each day from a small packet previously prepared by you it would be safer.

## In the Water Garden in JANUARY *by Astilbes*

**Y**OUR pond may be in good condition and needing little attention at this time of year but the surrounds may be worthy of improvement. If the layout of your garden allows it why not build a rockery with a small waterfall to give an added attraction? The accompanying photograph shows how a small pond has been greatly improved by the addition of some rockwork and miniature waterfalls. This idea not only enhances the beauty of the pond but can make for a more healthy state in the water to the benefit of all the inhabitants. A small trickle of water also looks well, sounds charming and gives added interest to the pond-keeper. A small electric pump can be so introduced that it is out of sight, with a switch in a concealed position, so that when necessary the water pump can be started to give a gradual flow of water over the rocks through small pools into the pond.

To build up the necessary rock-work great care is needed. Lack of care in the first place can easily ruin the whole task and give endless trouble later on. The main point to be watched when constructing the falls is to see that the rocks are firmly bedded so that there is no possibility of any movement as soil subsides. Should this happen the concrete seals will be broken and the line of levels altered. Some spare soil may be available from excavations of the pond which will do well for a base. Before placing any rocks in position it is essential that the soil is thoroughly rammed, and to prevent any sinking, long pieces of gas piping can be driven into the earth so that they form a prop for the large pieces of rock. Only when the rocks are quite firm should the joining concrete be added. The pipe from the pump can be hidden in the soil so that the water can run out on to a shelf from under a small piece of rock. This pipe should not be seen at all if the task is carried out properly. The look of the falls will be greatly improved if there are small pools allowed to form at intervals. Not only will these add to the beauty of the finished waterfall but the pools will form drinking fountains for birds.

When making the concrete mixture for filling in between the rocks and forming pools it will be a good plan to mix some colouring with the compost so that the colour of the rocks can be imitated. Builders' merchants can supply the necessary tints. A mixture of one part fresh cement to three parts sharp sand will do for the concrete. When making the waterfall be careful to see that no actual concreting is done when there is a threat of severe frost at night. The building can be carried on during quite cold weather but choose a fairly open time for the concreting. Also it is a good plan to cover the freshly laid compost at night time in case there is a sudden change of temperature. Actually the concrete will set better when cool than if done in hot weather, as although it will take longer to dry out it will be a better job when finished.

The supply of water is best taken from the pond, for if a pipe is laid on from the house supply then there is the problem of supplying an overflow to the pond to get rid of the surplus water. This is not always an easy problem, and I do think that it is better to use the pond water and pump it up to the top of the falls. Small electric water pumps are available for this purpose, and it is well to let the dealer know for what purpose the pump is needed when ordering. A water-proof box for the pump should be made at the rear of the rockery, where it can be hidden by a flat piece of rock. It should be made water-proof but so that it can be reached for service if necessary. The pump should be fitted with a feed pipe together with a foot valve. This lies in the water free from water plants, and the pipe can be hidden from view by small rocks. A small flow of water down the rocks will not harm water lilies but if too



Photo: Laurence E. Perkins  
Rockwork has been built up at one side of this pool to form a water course with small "falls" fed from a concealed pump

much water were allowed to run through the pond some kinds of lilies might not be too happy.

When the concrete has set it will be possible to scrub it well so that any free lime is washed away before it has a chance to enter the pond and poison the water. When the rockwork is all completed some fresh soil must be added to hide any ugly parts. Planting must not be done until all the soil has settled down firmly and then only in suitable weather. If small rock plants are obtained in pots there is no reason why the plants should not be set in position even in the winter, as long as the plants are hardy and have not come straight from an indoor nursery.

### Cacti in the Fish House

**M**ANY cacti can be increased by the taking of cuttings. In fact any part of most cacti could be encouraged to make roots and subsequently make a new plant. If cuttings are required it is always better to do this when there is plenty of daylight and warmth. The cutting should be dried in a sunny position so that a seal is made. This can then form a callous for the formation of roots. If the cutting is placed on some vermiculite or sharp sand and occasionally sprayed, roots will soon form. Once a good set of roots has grown the cutting can be planted into the ordinary potting mixture for cacti but care must be taken to see that the newly formed roots are not broken. Too much water must not be given until new growth can be seen on the cutting. Some of the more fleshy types of the genus *Mammillaria* can be increased by striking the small tubercles which have been removed from the plant and allowed to dry at the point of division. It is very interesting to watch how the new plantlets burst from the tubercles, sometimes at the tip and at others at the base. When any fresh cacti are purchased in pots it is advisable to remove them carefully to see if they are well rooted and that the soil is in a healthy state. Some so-called plants sold are just unrooted cuttings which may die on you if you commence to treat them as growing specimens. If any plant is found with no roots it should not be planted into the ordinary soil but must be treated as a cutting until fresh roots have formed.

# 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.

## Dog and Fish Showing

LOOKING through your October, 1954 issue, I read your Editorial concerning judges at dog shows and fish shows. This interested me very much as I am a dog breeder and exhibitor and have judged dogs, and my husband is a tropical fish breeder, exhibitor and judge. We both take an interest in each other's hobby and sometimes attend shows for fish or dogs together, and I feel I can see both sides of the picture.

Please don't think that dog showing is a prize-money grabbing side-show—far from it. Let us take a championship show: 90 per cent. of exhibitors live away from the town where the show is held. Cost of an entry per class is 12s. 6d., benching costs 2s. 6d. or more, so that in my own case, added to the cost of railway travel to London or Birmingham for self and dogs, the total cost is about £3 10s. At the show the prize money is 1st, £2; 2nd, £1; 3rd, 10s.-12s. 6d., and the most I can win is £4, i.e. a first in each class (if I am lucky!) To make a dog a champion one must attend championship shows, and these are spread from Edinburgh and Glasgow in the north to Paignton in the south, and from Brighton to Belfast. Any dog exhibitor counts himself lucky if in any year his entry costs are covered by his wins, and if he also covers expenses above that amount he is in his seventh heaven!

On the whole I think the dog show judge has a worse time than the fish judge, for paid or unpaid, he will have to "go over" anything from 20 to 300 dogs, risking a bite or two, judging from 10 to 30 classes with anything from 7 to 25 dogs in a class. Judging is done in front of spectators and exhibitors and in a continual noise. The fish judge may judge the same number of classes and fishes but in perfect quiet and he does not have to remember his placing of different fish in each class and keep judging fish of different kinds against one another in the same class. A good well-known championship judge may be paid 15 guineas, but many dog judges receive expenses only like the fish show judge. In the end I am sure neither of the judges makes anything out of the shows—it is just a pleasure and hard work too, and done in most cases because of the interest in each hobby and a desire to see the best in each of their interests.

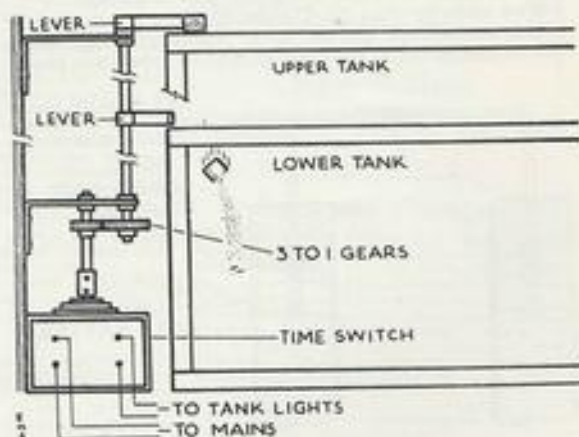
(MRS.) MURIEL WOOD,  
Taunton, Somerset.



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

## Automatic Feeder

IN order to provide light and food for my tropical fishes I have devised the following automatic system. A "Venner" time switch is the basis of the apparatus. Using "Meccano" parts I fitted a vertical spindle to the centre knob of the time switch, which revolves once every 24 hours. I then included a 3 to 1 set of gears and longer spindles to reach the top aquarium on my stand. By attaching a lever to the top of the spindle, which now revolved once every three days, it was possible to arrange a



small cup of food on the tank edge so that this was knocked into the aquarium three days later. Other gears and separate levers would, of course, provide for feeding at different times, and a tank could be left for a fortnight with this scheme and the fishes would still be getting their correct rations. The time switch itself controls the lights and can be set to switch on or off at any time.

E. G. HUSBAND,  
Stourbridge.

### Light Direction

I HAVE often observed, but never seen a reference to it in print, that fish swim at an angle in a tank when all the lighting is coming from the side and not overhead (as on a bright day when the aquarium lights are off). It appears that they are accustomed to light penetrating vertically on to their backs, and when it arrives horizontally (an event which never takes place under natural circumstances), they try somewhat unsuccessfully to swim on their side.

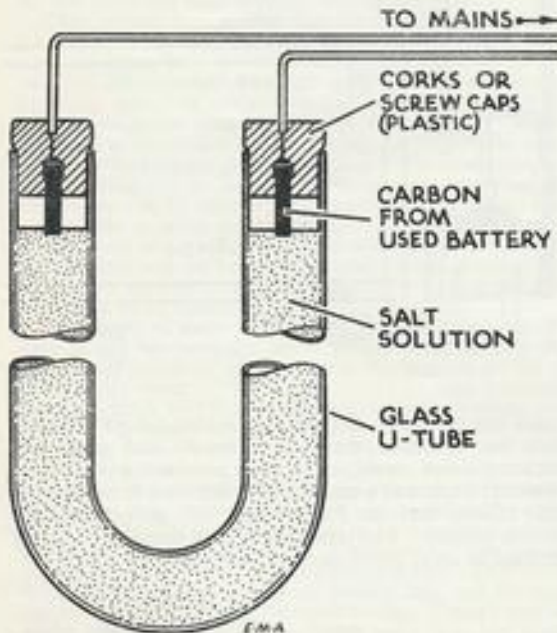
I wonder to what extent a fish knows it's the "right way up" by the source of light, and how far it is determined by balance organs, or some kind of gauge in buoyancy, or is it a mixture of the three? Presumably it doesn't lose its sense of the vertical in the dark, nor in deep water where (according to divers' accounts) the light seems to come from all directions. I wonder too if it is a deliberate attempt on the part of the fish to reconcile horizontal light with an upright floating position or if they are all reflex actions. Perhaps we cannot know the answers to these questions. But should we not hesitate when claiming that we keep fish under "natural" conditions, remembering that they do not normally view light which shines horizontally, nor for that matter look out into living rooms?

THE REV. A. B. DE T. ANDREWS,  
London, W.1.

### Brine Heater

I WOULD like to describe a heater which I am using and which I find very good, since the idea may be new to some readers. The heater is a U-shaped glass tube about three-quarters of an inch in diameter; the length of the U-tube depends on the aquarium depth, but the tops of the limbs must be about an inch above the water. The tube contains a solution of salt—pure sodium chloride from the chemist, dissolved in distilled water. Five grams of salt to each ounce of water gives a heater developing up to 150 watts, and more salt will give a greater wattage.

Two corks to close the U-tube openings are needed, or plastic screw caps can be used. Insulated wires which will be connected to the main electricity supply are passed



through these and attached to two carbon rods from an old dry battery. The amount of salt solution is adjusted so that when the corks are in position the carbon rod in each limb of the U-tube just touches the fluid; both carbon rods need, of course, to be the same size and length. The components of this heater cost less than four shillings, and it never fails to work. What is more, it is self-regulating if the thermostat should stick.

After thermostat failure the heater will heat the water to about 95° F. before disconnecting itself—the fluid rises in one limb and falls in the other, thus breaking the circuit. When the temperature drops again the circuit is re-made. Water has to be added to the tube to make up for evaporation losses about once in two weeks—it can readily be seen when this is necessary. The carbons last about six months and replacement is made when they are seen to begin to flake. The salt solution needs renewing after about a year, for after this time the tank temperature will be found to drop slowly, about 2° F. a day, but serious cooling does not occur before action can be taken.

A. KROLIK,  
Kingswood, Bristol.

### Protein Food

MY article on "Colour and Sex Change" (*The Aquarist*, October, 1954) has caused readers to ask for information about the manufacture of the food.

(1) First put through a rotary shredder ("The Moulinette"), 1½ oz. of red meat, from pet stores. It will come through in a worm-like structure.

(2) In a mortar rub down six tablets of "Vetzyme" to a fine powder. Next add gradually 2 ozs. of "Bemax" until the whole is well mixed. Empty out and place on one side. Put all the shredded meat in the mortar, and add small quantities of the mixed "Vetzyme/Bemax," pressing and rubbing it into the meat until all are mixed well together.

(3) Now put "Vetzyme," "Bemax" and meat through the shredder, and all is ready for drying.

Place the product thinly on metal cake baking pans in the domestic oven, set at the lowest possible heat, until the food is absolutely dry. It can now be stored in dry screw-top jars and will keep perfectly.

By passing through a smaller mesh shredder or rubbing in the mortar, the food can be made to different degrees of fineness.

If any other substance is required to be added, hormone, etc., do this when rubbing down the "Vetzyme." To the quantities above two tablets of "Mixogen" are required for quick colour and sex-changing results. The standard food (without hormone) has been tested against live food feeding, and more than holds its own in the size and well-being of the fish.

A. VERNON ASHFORD,  
Northampton.

### PICK YOUR ANSWER

1. *Batis batis* was named by: (a) Day. (b) Gunther. (c) Hamilton-Buchanan. (d) Regan.
2. The slender barb is the popular name of: (a) *Barbus calliensis*. (b) *Barbus setirostris*. (c) *Barbus unicolor*. (d) *Barbus vittatus*.
3. *Pseudorasbora daniconius* (the golden killie) is native to North America from: (a) Alabama to Louisiana. (b) Georgia to Mississippi. (c) South Carolina to Florida. (d) Virginia to Georgia.
4. The oranda goldfish was first bred in Japan about: (a) 1820. (b) 1840. (c) 1860. (d) 1880.
5. The optimum temperature for *Heliconia palustris* (the water violet) is: (a) 50 degrees. (b) 55 degrees. (c) 60 degrees. (d) 65 degrees.
6. The cat, drowned in a tub of goldfishes, commemorated by Thomas Gray, was called: (a) Jeremy. (b) Selima. (c) Strawberry. (d) Willow.

G.F.H.

(Solutions on page 221)

**AMALGAMATION** of the Hornchurch and Dagenham Aquarium Societies has taken place to form the new **Thameside Aquatic Society**. Chairman of the new society is Mr. L. Lamb.

**RESULTS** of the home aquarium competition of the **West Middlesex Aquarists' Society** were announced at a recent meeting. Members entering had to stock and furnish a tank at home and keep it in perfect condition for a stated time up to 12 months. The tanks were judged in the home. Silver cups and diplomas were awarded to Mr. C. Blagrove (tropical) and Mr. W. T. Harding (coldwater). Information regarding the activities of the society can be obtained from the secretary, Mrs. J. Shelton, 99, Snow Park Gardens, Isleworth, Middlesex.

**PICTURE** programmes at meetings of **Worthing and District Aquarists' Society** include *Diadromis* 1, Recognition and sexing of fishes (21st January 1955) and *Lipidiscopus* 2, Breeding and plants (22nd February 1955). Meetings are held on the second and fourth Tuesdays of each month, 8 p.m., at the Adult Education Centre, Union Place, Worthing.

At the first annual general meeting of the **South and District Aquarists' Society** good progress was reported, including the increase of membership to 60. Furnished aquaria have been displayed in local cinemas, and a three-day exhibition was staged in an empty cafe. This display was opened by Miss Binnie Hale, and over two dozen aquaria were on view. It is intended to place a 48 in. tropical aquarium in the foyer of the Princess Theatre, Yeovil.

At the December meeting of the **Croydon Aquarists' Society** all members expressed the interest and warm affection which they felt for their president Mrs. M. Wood-Roberts, retiring after nearly nine years of continuously outstanding, keen and practical interest in the affairs of the society. As a small token of their high esteem, a specially hand-inscribed life membership card in a leather folder was prepared for presentation at the society's annual Christmas social. The secretary is now Mr. E. T. Bennett, 12, Burgoyne Road, South Norwood, S.W.16 (Livingstone 1284) who will be happy to hear from previous and prospective members and assumes them of interesting meetings following the re-organisation of what is one of the oldest societies in the country.

**MEETINGS** of the **Doncaster and District Aquarists' Society** are now held at 7.30 p.m. on the first Thursday of each month in the Art Gallery and Museum, Waterdale. Recent activities of the members have included the



## 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.

A copy of *The Aquarist's Directory of Aquarium Societies* will be sent free to any reader on receipt of a stamped, self-addressed envelope.

installation and setting up of 13 tropical and two coldwater tanks in the Aquarium—an exhibition which the Director hopes to make a permanent feature in the Doncaster Museum.

**ANNUAL** general meeting of the **British Herpetological Society**, London Group, was held last month and the following committee members were elected: chairman, Mr. B. M. Smith; secretary, Mrs. M. Green (49, The Grosvenor, Colindale, London, N.W.9); treasurer, Dr. J. R. D. Frazer; Mr. J. D. Thompson; Mr. R. L. Johnson.

TO accompany a film programme showing the documentary "Killers of the Sea" members of the **Hampstead Aquatic Society** set up a furnished tropical aquarium in the foyer of the Hampstead Playhouse last month. Annual general meeting of the society will take place on 1st February.

**PLANS** for this year's National Aquarium Exhibition in London are under review by the **National Aquarists' Society**. It is likely that the show's layout will be materially altered and there is to be a revised show schedule (available shortly). At the society's annual general meeting Mr. F. G. Odams was re-elected treasurer for a further two-year period.

A **DRIVE** for new members from any district is being made by the **Hendon and District Aquatic Society**, one of the few clubs holding weekly meetings (every Thursday, 7.45 p.m. at the Brotherhood Hall, Edgware Road, West Hendon). Fish houses within the club open to be visited by any member now total 18. The society, which has an impressive fish breeding file, plans to be represented at every main show again this year, and already 15 "teams" of members for tank furnishing have been recruited.

**MR. A. Fraser-Brunner** gave a talk on the hobby to **Lambeth Aquarist Society** last month at a meeting also attended by other clubs in the area. In early December a table show of fighting fishes was held, judged by Mr. J. Vosper, at which Mr. J. Bunge was awarded first prize for his exhibit.

**WHEN** breeding egg-layers it is advisable to black out the aquarium glass so that light only enters from above when fry hatch. This, said Mr. W. L. Mandeville, during a lecture to **Coventry Pond and Aquarium Society** members, attracts the small fry to the surface where they are enabled to fill and develop their swim bladders.

**REVIEWING** the year's activities of the **Bristol Tropical Fish Club** at its first annual general meeting the secretary, Mr. W. E. Ridler said that the club had well over 50 members, and he spoke of the valuable social events and outings which helped members to know one another better. The club gained first award at last year's fish show and was placed fourth at the Oxford Three Counties Show.

**WINNER** of the Richardson cup awarded within the **Southern Amateur Aquarists** for the best bred fish of the year was Mr. J. H. Wilson. Three members tied for first place with their exhibits in the breeding competition (egg-layers).

### Free Posters

**PAPER** posters suitable for carrying details of shows and other functions for publicity purposes are being offered free of charge to aquarium societies by Spratt's Patent, Ltd. The posters, colour printed with advertising matter at top and bottom, are approximately 22 in. by 17 in. and will be supplied in lots of up to 100 on quoting reference PB/450F to Advertising Department, Spratt's Patent, Ltd., 41-47, Bow Road, London, E.3.

### Journal of Herpetology

**IN** the December, 1954 issue of the **British Journal of Herpetology** (journal of the British Herpetological Society) is printed an interesting and detailed account of observations of the local migrations of common toads in one region of Dorset. Observations made at breeding times covering four seasons reveal the slow rate of progress made towards the water by the toads, their behaviour *en route*, and their directions of approach to the water, but, unfortunately, no clear indications as yet can be given to the stimuli causing toads to migrate or to their reasons for selecting certain waters.

### New Society

**Thurrock Aquarist Club** Secretary: Mr. E. Couchman, 134, Palmerston Road, South Stifford, Grays, Essex.

### Secretary Changes

**CHANGES** of secretaries and addresses have been reported from the following societies: **Bath Aquarists' Society** (Mrs. M. I. Crisp, 34, Bartlett Street, Bath, Somerset); **Bridlington and District Aquarist Society** (Mr. J. H. Bulmer, 20, Clarence Road, Bridlington, Yorks.); **Corby and District Aquarists' Society** (Mr. D. E. Jones, 58, Chestnut Avenue, Corby, Northants); **Doncaster and District Aquarist Society** (Mr. C. Dinsdale, 10, West Grove, Doncaster, Yorks.).

### Aquarist's Calendar

Lectures have been arranged to take place at London Aquarium, South Bank, London, S.E.1 on the following dates:

12th January—"Natural Breeding Requirements of Tropical Fishes" by A. Fraser-Brunner, 7.30 p.m.  
26th January—"The Cichlid Fishes of Africa" by Dr. Ethelwynn Trewavas, 7.30 p.m.  
15th February—"Marine Aquarium Keeping" by L. R. Brightwell, 7.30 p.m.  
23rd February—"Aquarium Plants" by P. C. Katritzky, 7.30 p.m.

### PICK YOUR ANSWER (Solution)

1 (c). 2 (c). 3 (c). 4 (b). 5 (c). 6 (b).



### The Aquarist's Badge

**PRODUCED** in response to numerous requests from readers, this attractive silver, red and blue substantial metal emblem for the aquarist can now be obtained at cost price by all readers of *The Aquarist*. The design is pictured above (actual size). Two forms of the badge, one fitting the lapel button-hole and the other having a brooch-type fastening, are available.

To obtain your badge send a postal order for 1s. 9d. together with the *Aquarist's Badge Token* cut from page 8, to *Aquarist's Badge, The Aquarist, The Butts, Half Acre, Brentford, Middlesex*, and please specify which type of fitting you require.

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