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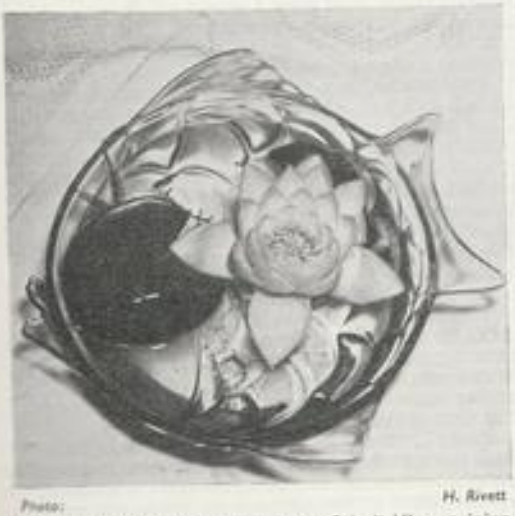

Photo: H. Rivett

Unusual entry at a flower show—a "fish dish" containing small goldfishes and a flowering water lily. An exhibit by "Aquarist" reader, Mr. L. T. Trussler

Editorial

POPULAR allocation of pronouns in the English language is a peculiar business. The rules, if there be rules in the matter, governing what is "he," "she" or "it" are obscure. Ships are always "shes," for example, yet in legal circles day-old chicks and horses have been classified as "its," or to be more exact, they have been declared to be articles; the Duke of Wellington is reported to have said of the British soldier at the time of Waterloo: "This is the article which will finish the fight." But what of fish—are they articles too?

This tricky point had to be decided by the Magistrate of West Ham Court last month when a rag merchant was before him on a charge of giving goldfishes to children under 14 years of age in exchange for rags. Section 154 of the Public Health Act, 1936, says that articles may not be delivered in exchange for old clothes or rags to young children, so the question was—is a goldfish an article? The original summons was adjourned for seven days for more thought to be given to the matter. At the second hearing it was announced that the word "article" in the enactment was intended to mean an inanimate object and that in the opinion of the Magistrate a goldfish escapes this statutory qualification. Accordingly the summons was dismissed.

So goldfishes can be given away to children who offer rags for them without offence to Public Health Act Section 154. Aquarists will no doubt look at this from another angle: is not this practice likely to be a source of cruelty to the fish? In our opinion it is, and for such offences the Pet Animals Act, 1951 was instituted. But its provisions apparently do not meet the case of exchanges, and neither do they prevent goldfishes being given to children as prizes from stalls at fun-fairs. In view of this Act's other excellent controls it seems not unreasonable to ask that these two apparent defects be quickly remedied.

Breeding the Flame Fish *(Hyphessobrycon flammeus)*

by R. H. GIBBINS

ABOUT three years ago I became very interested in that popular little characin the flame fish (*Hyphessobrycon flammeus*). My interest was first aroused by a friend who had several pairs of what appeared to me to be excellent specimens, and my friend's only regret regarding them was the fact that he found them very difficult to spawn. This seemed strange to me, for several of the females were plump, and obviously in condition for breeding.

I managed to obtain a pair of these fish myself, and I suffered the same fate, managing to get a spawning only after a very prolonged period of driving by the male, which reduced his partner to but a shadow of the once trim little fish that she had been. She took quite a long time to recover her former fitness. My method of spawning had been the usual orthodox method, a 24 ins. by 12 ins. tank, clean, new water—pH.7. The tank was filled to a depth of seven inches, with just a very thin layer of new fine gravel, illuminated by a 60-watt bulb, and planted with a good bunch of *Myriophyllum*. The temperature was brought up to 75° F., and after allowing to stand for 24 hours the female was introduced, followed a few hours later by the male.

First Attempts

The temperature was then slowly raised to 78° F. By mid-day the next day the male was attempting to drive, but the female was obviously not in the mood, her nose being pressed into the corner joint of the tank, flashing up and down the glass whenever the male approached, and sometimes dashing across the tank with the male in pursuit. It was not very long before the pair seemed to lose all interest in each other, each following their separate paths, the female hiding as much as possible whenever the male strayed her way.

After about three or four days my own interest started to wane, and judging by the look of the female, which was by now a sorry looking specimen, refusing all food, I came to the conclusion that very soon the pair would have to be returned to the community tank. I mentioned my difficulty to several friends, and it appeared that they too had had very little success with them themselves, complaining about the same difficulties.

I decided to concentrate my attentions on the species, and it was a few months later that I had my first brood of over 150 fish, which I raised to full maturity, spawning them easily within a few hours of introduction to the breeding tank. My clue that bore fruit was the observation that when the female was being driven by the male, she tended to rise to the surface of the water, not swimming only in the planted spawning medium (*Myriophyllum* and artificial fern).

Bearing this point in mind I set up a 24 ins. by 12 ins. tank as before, first ensuring that everything was quite clean, no water snails or Infusoria in the water. Instead of planting the bottom of the tank as before, I covered the surface of the six inches deep water with floating ferns, having some good bushy roots with plenty of very fine hairy fronds. Beneath these roots was a clear space about three inches deep for driving the female in. After standing, the parents to be were introduced in the same manner as before at the same temperature and water pH. Spawning took place within a few hours, and this proved to be a most interesting spectacle to watch.

The male drove the female across the clear space under the roots of the floating ferns, and at frequent intervals the female rose up into the fern roots with the male in close attendance dancing around her, fins fluttering but held erect and fully displayed. They reminded me strongly of butterflies at play; at the same time batches of eggs were released into the fern. The male ate a few, but in general left them unmolested. Spawning ceased in about two hours, and I then removed the parent fish.

Hatching and Rearing

This took place on the 9th March last year, and just over 24 hours later several young were hatching; they could be observed rising to the surface in a spiral fashion. The next job was to inspect my Infusoria culture under the microscope to see if it was sufficiently active to support the fry. This being so, a system of drip feed was brought into operation in the morning of 11th March. (The culture, by the way, was made by drawing off about 10 pints of old aquarium water to which was added several crushed lettuce leaves and a spoonful of top soil from the garden, the whole being kept at 75° F. for about three or four days.) By the evening of 12th March, plenty of fry could be seen hanging from the sides of the glass and from the roots of the floating fern. They were not easily seen, being very tiny and transparent, save for the smallest black speck of an eye, and one could only really spot them when any moved or wriggled for a moment.

On the 14th most of them seemed to be free swimming and they could be more easily seen, moving about pecking at invisible tasty Infusorians, which were entering at a rate of one drip every four seconds. At the end of the second week of their life the fry were easily recognisable as strong youngsters and I started to feed a little micro worm. By the middle of the third week I turned off all Infusoria, and continued to feed micro worm and brine shrimp. This food supported them very well until about the end of the fourth week when I started to add very finely ground earthworm.

At two months they were rapidly colouring, and were about half inch long, the complete brood numbering about 150, one being a runt. Males predominated over females, although sexing at this stage was a little chancy, but first impressions were later confirmed in the majority of cases. Some were much larger than others, seeming to grow apace, others growing more slowly. At four months old they were being separated into those for retention and those for friends who wanted them.

Breeding Conclusions

By November the remainder of the brood that I am retaining for future breeding were well over one inch long, some as big as one and a quarter inches, and many were ready to spawn. This good growth I have always attributed to feeding shredded earthworm, *Daphnia* being dispensed with in view of the risk of infection.

In conclusion the chief observations appear to be:—

1. Each time a tank was set up in the orthodox manner with rooted plants on the bottom of the tank, a spawning did not take place except after a most prolonged period of driving, much to the distress of the female.
2. The considerable length of time spent in the tank prior

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Artificial Rockwork for Aquaria

One of the author's attractive artificial rockwork aquarium lay-outs

by H. CHARLES

IT appears that the arrangement of "artificial rocks" in some of the aquaria at the recent British Aquarists' Festival at Manchester has caused enquiry as to "how this is done," and the Editor of *The Aquarist* has asked me to write an article on the subject—presumably as I have the doubtful distinction of starting the vogue in the North of England. In the past I have given talks to many Yorkshire societies in this connection, but unfortunately, I have had to discontinue this pleasure owing to ill health.

Shortly after my innoculation with the aquaria "bug" the family went to Filey for a holiday, and immediately "Filey Brig" fired me with a desire to imitate the effect in aquaria, and caused me to say, "If only I could reproduce those rocks in my furnished aquaria I would be satisfied." All readers will know the symptoms of our particular hobby fever, and will not be surprised to learn that although I was on holiday I could not restrain my imagination (much to the disgust of my wife, who said such things should be forgotten at the seaside) and, by the time we arrived back home, I had already figured out how I was to proceed.

Briefly, my plan was to make concrete imitation rocks to be arranged so as to give a natural effect, and details of subsequent happenings are given below. First, I should emphasise that, in my opinion, the layout should be properly planned on paper so as to ensure that you achieve a balanced effect—not too much rockwork and yet not too little so as to make the rocks insignificant. At the same time, however, it should be borne in mind that adequate room for plants, and swimming space for fish, should be allowed. At each of our "annual shows" I have staged a different layout of artificial rockwork, but in each case I have drawn my plan on paper to scale, and have shown by plan and elevation the maximum intrusion which could be allowed for the rocks. Plan around a certain idea of arrangement of plants and rocks and carry out the work accordingly.

There are very many types of rock formation which can be copied, but in any case the aim should be to achieve a natural effect, either in "miniature" or "in section." Personally I favour the miniature effect, but I have seen other exhibits which have achieved very good results by portraying an underwater scene as though it was a section of an actual aquatic location. All rock gardeners know that to build a realistic rockery there has to be a resemblance to natural strata, and the same applies to our subject. The strata can run horizontally, at an angle, or can stand on end, which ever you prefer, but again my own preference is the "angle effect" which I feel creates the impression that the rocks are actually protruding through the base of the tank or through the gravel. The main point, however, is to keep the line of strata the same throughout the whole scheme. (I know some people make the point that volcanic eruption causes "faults" but it takes a very good piece of "fault formation" to look really natural.)

After one or two efforts I realised there were greater possibilities if I could create a flat piece of rock at the back of the tank which would give the impression of bulk without actually taking up a lot of space in the tank, and, with this in mind, I designed what theatricals would call "a back cloth," the bulk of this only projecting about half an inch into the tank with protruding layers of rock superimposed thereon. The same kind of thing can be done at the ends of the tank, the end and back pieces being made to dovetail together at the corners. Subsidiary rocks, small in size, placed at advantageous points just to peep through the gravel, will complete the picture.

The usual proportions for making concrete were used (three of washed sand and one of cement) this being thoroughly mixed when dry, and mixed with sufficient water to a thin or thick consistency, according to the method adopted—see below. I have used two methods of construction but, as I am not conversant with the niceties of concrete construction, I do not doubt that there are many other ways than those described.

Method 1. At first I made wooden patterns, roughly the

size and shape desired for the finished rockwork, and these were depressed into soil which was just moist. After easing out the pattern very gingerly, I filled the resulting hole with a rather wet mixture, gently tapping the mixture to ensure the concrete filled the various cavities. The concrete was allowed to set in the soil for about three days, after which the soil around it was carefully dug away and the concrete cast was put under a tap, or *gently* washed to remove the unwanted soil.

Method 2. Later I found that by mixing less water with the sand and cement the result gave a stiff mixture of concrete, and with this I could build up from a level base (a sheet of glass covered with thick brown paper), this method giving the equivalent of a rough cast.

In both cases the cast was "shaped" whilst the concrete was "green," this being done with an old table knife or similar instrument, the crevices being scraped out to a good depth, which emphasises the projecting strata. The secret of the whole business is in this operation, because it is the "shaping" which turns the rough cast into the finished article. Imagination, patience, and a not too heavy touch are needed for this part of the work. If considerable adjustment of the rough cast is necessary, care should be taken not to attempt too big an alteration in one operation, but the adjustment should be carefully proceeded with by piecemeal wearing away of the unwanted part until the desired result is attained. It is not possible for me to give precise details of what to do in this shaping process as experience alone will show what you can and what you cannot attempt.

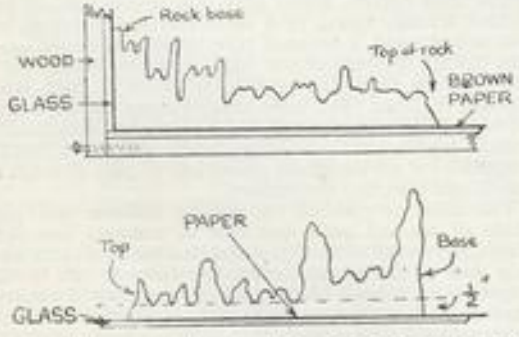
In some designs I have utilised a number of pieces to build the total structure (actually the rock work in the illustration is made up of six parts), and, although it is very tempting to try out the arrangement immediately, it is safer (and wiser) to wait a few days until the concrete has set sufficiently hard to withstand handling and bear the weight of other pieces piled on top. On the other hand do not wait too long, for if the first trial arrangement reveals that an adjustment is desirable to get a better picture or balance, it is much more difficult, if not impossible, to make the alteration after the concrete has set hard.

When testing the effect of the total construction it is necessary to put the piece or pieces in a space close to the actual size of the tank into which the rockwork is to be placed, as this will tell you whether your design is well related to the size of the tank, and will also give you some idea of the effect achieved. If satisfied with the results of your work, the next stage is to "cure" the concrete, or neutralise the alkali which, in solution in your tank, would harm your fish.

There are several methods of doing this—coating with waterglass, soaking in certain acids, or merely by soaking the concrete in plain water with repeated changes. I have tried many ways but have always come back to the plain water method, soaking for a number of weeks and changing the water twice each week. The greater the volume of water compared with the quantity of concrete the shorter is the period necessary to achieve "curing." The waterglass method is satisfactory so long as the concrete remains unbroken, but should the latter occur then the alkali is released into the water, and, if this should be in an aquarium, harm will be done to your fish.

Plan view *Front elevation* *End elevation*

Plans made before making "rockwork" and setting up the aquarium. A: rocks at back and ends. B: rocks "peeping" through sand. C: area of tall plants. X: dwarf plants. Dotted lines indicate profile of end rocks in the middle drawing



Sectional diagrams to show technique of making "rockwork" from cement and sand

Colouring "Rockwork"

The rockwork at this stage, of course, is of a drab grey colour, and, although with time it will assume a more natural appearance, your ambitions will doubtless incite you to try to achieve a more colourful effect. I have tried a number of methods of colouring, including the addition of ochres in the dry mixing. The latter is quite good but of course it gives a uniform colour to the whole of the rocks, and lacks the light and shade which we usually find in natural surroundings. You can also mix ochres with pure cement and paint this on to the rockwork, but, of course, this should be done before "curing." Ingenious minds will no doubt devise other means of achieving a pleasant appearance, but if you can exercise sufficient patience, one of the best ways, in my opinion, is to leave the whole of the rockwork in the open air, in a position where it will catch rain and sun, and in time you will find a nice growth of algae—nature's covering and beautifier. When this has materialised the prominences can be rubbed over, and as this removes part or most of the algae on the protruding points but leaves the algae in the crevices, a very pleasing effect is produced.

There is little else for me to say except to emphasise that when arranging the rockwork in your tank see that the strata effect is correct—especially does this apply to the small fragments which are to give the appearance of tips of underground rocks protruding through the gravel. To "re-cap," as they say:—

1. Plan your effort on paper first to ensure balance, or proportion.

2. Endeavour to achieve a natural effect which really looks as though the rocks are growing out of the compost.
3. In making the actual concrete choose the right time for the "shaping" operation.
4. Be sure the rocks are properly cured before placing them in your tank (this can be decided by pH test on water in which the rock is immersed).
5. Do not be easily satisfied with your first arrangement but try various other arrangements until you are convinced you have obtained the best out of the material at your disposal.

I am aware that many may frown on the use of "artificial rocks," and prefer natural stone. This is a legitimate point of view, but the choice is for each individual to make and, at least, I would claim that the type of rockwork described in this article is much to be preferred to the painted bits of clay some people buy, as these, in my opinion, are entirely unconnected with natural conditions. (I know I may be starting a controversy on this matter but nevertheless I hold that view.) We British are very slow to adopt new ideas, but I notice that in the north there are one or two dealers who have regular sales for concrete rockwork as mentioned in this article, and, as the recent Manchester show has also brought forth enquiries it would appear that there is a growing number of aquarists who see possibilities in this form of decoration for aquaria.

IN THE Water Garden — *by* Dr. W. E. SHEWELL-COOPER

SOMETIMES I get so enthusiastic about a plant that I foolishly forget to mention its name. Do you remember some time ago my writing about a Chinese plant which loves to be grown at the water side? It has, I said, large shiny leaves which are often 20 inches across, plus stout stems which carried crowded heads of rich orange flowers. This was, of course, *Senecio clivorum*. It blooms at intervals between July and September and is very lovely. The flower stems are invariably three feet high.

If I start talking about the water salvia I must remember to say that its Latin name is *Stratiotes aloides*. It is one of the most unusual plants to grow, with long tapering serrated leaves, plus flowers, and it will either grow floating on the surface of the water, or it can be fixed, that is to say attached to the bottom of the pool, or even aquarium. Give the plant plenty of room to spread and it may easily be a foot in diameter. I always think the flowers look like cactus dahlias. Unfortunately they float just under the surface of the water, but the colours curiously enough vary with age and environment. On the whole it is better not to plant a water salvia but just drop it in the water and it will find its own root hold.

The bladderwort (*Utricularia vulgaris*) is not on the whole easy to get hold of (I only hope some nurseryman who sees this will write and tell me that he has got plenty of plants!). Anyway, it is a floating aquatic and is insectivorous. It has largish bladders which attract the water fleas and such like and then digest them to assist in its own growth. It is a very handsome plant, the leaves are thin and hair-like, and it produces tiny yellow flowers well above the surface of the water. It is quite a useful thing to have in as an oxygenator, not only in a pool but in an aquarium too.

Vallisneria is easily obtained and just as easily grown. It is what the experts describe as a submerged aquatic, and the reason that it is so interesting is that the male and female flowers are borne on seperate plants. The method of fertilisation is quite unusual. The female blooms are carried on the end of long spiral stalks which rise to the surface of the water when they are ready for pollination. When this happens the male flowers break up automatically and rise to the surface too and so pollination takes place. Then the spiral stems contract, the seeds ripen under the water and are ready for propagating. Like the *Utricularia*, the plant is a good oxygenator and can be grown quite happily in the bottom of a pool in sand.

It is rather fun to grow a plant that is edible. Such as water cress for instance. It is a submerged aquatic and quite a good oxygenator in fact. I am referring to *Roripa nasturtium aquaticum*. It will not grow unless it has some running water, and it is better too, of course, if the pool is shallow. Water cress spreads very much and becomes a nuisance in time, and that is the reason why it has lost its popularity in gardens. Furthermore, it has not any flower, and so is not particularly beautiful.

Just as easy to grow but far prettier are of course the various members of the buttercup family or *Ranunculus*. They can be divided into three groups: first submerged aquatics, secondly those grown in or near water, and thirdly the hardy species for the waterside. A good example of a submerged aquatic is *Ranunculus aquatilis*. The submerged leaves are divided into hair-like segments, whereas the upper leaves are three leaved and floating. The flowers are white with yellow stamens and they are quite tiny. The plants themselves will grow in running water and in shallow bogs and it is one of the most hardy types I know. For the shallow pool it is an excellent oxygenator.

If you want a specimen to grow near the water, or even just in a shallow pool, there is *Ranunculus lingua*. This has undivided leaves and branching stems carrying the typical yellow flowers. The petals are like shining brass and they usually look magnificent from July right the way through to the third week of September. There is a variety, *grandiflora*, which is even more magnificent, but I think it is usually a little more expensive to buy. For the hardy species for the waterside, I am going to recommend *Ranunculus aconitifolius* var. *flore pleno*. This is sometimes called the fair maids of France, or perhaps more rightly so the fair maids of Kent. It produces beautiful double white flowers and dark green leaves which I always think are palm-like.

One has to be very careful in introducing pondweed, which is a submerged aquatic. Most species are a nuisance, but one or two of them are fairly suitable for pools as oxygenators. There is *Potamogeton pectinatus* which is often called the fennel-leaved pondweed because its leaves are almost hair-like and it produces much branched stems and foliage. I like it because it gives good cover for small fish in the breeding season. The slender pondweed *P. pusillus* is another you might try; it has thread-like leaves and stems, plus brownish flowers which are borne just above or just below the surface of the water. It is certainly a good oxygenator both indoors in an aquarium and outdoors in a pool.

More Experiments with "Stripping"

by C. E. C. COLE

REGULAR readers of *The Aquarist* will doubtless recall my article, which appeared last February, entitled "Spawning fishes in a salt-cellar." Since then another breeding season has passed, and now, looking back, it is possible to recount further progress towards perfecting this method of breeding.

It was not long after the season had started that correspondence began to come in reporting the failure of attempts to use the stripping method of breeding. There was sufficient evidence to indicate that the method was by no means so fool proof as I had imagined—and yet my own success continued unabated. What, then, were the other people doing wrong?

Reasons for Failures

Careful inquiry into the exact procedure most of them were following answered the riddle. In almost every case over-anxiety to ensure plenty of sperms being in the water to fertilise eggs was the cause of the trouble. *In one single drop of spermatic fluid there are more than sufficient spermatozoa to fertilise all the eggs from a single female.* Yet anxious breeders were squeezing every drop of milt from their males, and often using more than one male to fertilise a single batch of eggs. Not only this, but often the containers being used were very small—far too small.

One gentleman told me the eggs were so thick on the bottom of his stripping bowl that they stood piled up one on the other. The milt was so thick that the water appeared cloudy with it. Every egg was fertile, and his joy can be imagined. On the second day, all the eggs were bad, and smelling to high heaven. "I couldn't stay in the fish-house," he said, "the stench was ghastly." There was quite a simple explanation for his experience. He had approximately four thousand eggs. Four thousand sperms were sufficient to fertilise these, but he must have had millions in the water. Those which failed to find a mate perished miserably, and rapidly decomposed. Putrefaction started, the water became thoroughly unwholesome, and the embryos perished also. It was simply a case of too much of a good thing.

Now I realise that it is impossible to put just sufficient fluid in to fertilise the eggs. Apart from the impossibility of counting out the sperms, the eggs are not added to the water until after the milt. But it is easy to see whether milt is leaving the male fish. It emerges from his vent in a white stream, which almost immediately spreads and disappears in the water. Firstly, then, do not use anything like sufficient to cloud the water.

Secondly, wash the eggs after sufficient time has been given for the sperms to fertilise them. Fertilisation is almost instantaneous. The eggs are adhesive, and will stick quite hard to the container into which they are stripped. Washing is a simple matter. Those of you who have prepared for this stripping will have a quantity of clean, matured tapwater available. Empty away the water in which the eggs have been lying and refill with some of this matured tapwater, swirl it round and over the eggs, and again empty away. Refill, and leave. The eggs are surprisingly tough, and can stand quite a lot of this sort of treatment without suffering harm.

It is useless to attempt stripping unripe fishes. In this respect it should be emphasised that the presence of tubercles on the opercula (gill covers) of the male is not necessarily an indication that he is ready to spawn. Cases have been known—I had one myself—where females developed these tubercles, and this in no way interfered with the production of eggs.

Correct "Stripping"

Catch your male fish and hold him in a net so that his vent is uppermost. Exert slight pressure either side of this, at a spot a little above and in front of it. If ready he will emit a little milky fluid, which is spermatic fluid. If unripe, nothing will be emitted.

A female, held in a similar position, will appear very much swollen either side of the vent, which may even appear bloodshot, and much larger than normal. If very ripe, the slightest pressure on her sides, or even her own movements, will start a veritable cascade of eggs.

One experience I had during the last season may be of interest at this point. I netted a ripe male, which struggled and moved about in the net while I was transferring him to a shallow dish of water. When I caught his mate a moment or two afterwards she also flopped about in the net, and left a quantity of eggs behind. Purely as an experiment, I hung the net so that the eggs were under water. Within a week, 137 alevins were hatching in the net. Easy, isn't it?

Editor's Note:—Artificial spawning methods have been used for many years in commercial fish farms, but the technique has been applied to goldfishes only comparatively recently. Mr. A. Bourder was the first aquarist in this country to report on the subject, in *The Aquarist* (December, 1950), and Mr. C. E. C. Cole, author of the above article, also did pioneer work and described his results in *The Aquarist* dated February last year.

Breeding the Flame Fish

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to actual spawning necessitated feeding the parent fish in the hatching tank. This often gave a poor hatch of eggs owing to the decomposition of the uneaten particles and very often, after a period, planarians appeared which will attack fish eggs. (Always feed small pieces of very small earthworms and not dried food or *Daphnia* prior to spawning. The risk of introducing egg enemies is much less.)

3. When using floating fern or other fine-leaved plants, left floating on the surface and not planted, a spawning was always quickly attained. The fish seemed to desire to spawn at the surface and not lower in the water. Without such abundance of surface plants spawnings were very difficult to obtain.
4. When fry hatch out, they do not give much movement in the first few days and are very difficult to see. Do not agitate the water or attempt to make them move by artificial means. Disturbances in the water caused by anxious aquarists will result in a high death rate among the fry during the early stages. Leave well alone until the fry are robust enough to be netted.
5. If ultimately you find it difficult to get them to feed on dry food, introduce a guppy or two, from which they will soon learn.

A page for the beginner contributed by

A. BOARDER

AT the commencement of the year I think that it will be a very good idea if I review all aspects of fish keeping. I offer no apologies for doing so as this page is intended for the beginner and I know only too well where most people go wrong in the early stages. My post nearly every morning brings me queries on topics which one would think were quite well known, and it is with the intention of trying to give plain details for these enquirers that the following notes are written.

Aquarium Water

The first essential is water, but this is not always given any thought at all by aquarists. The question is always asked by beginners as to the value of rain water. Many say that only rain water must be used, but I have found that tap water is the safer. It must be realised that rain water can contain many impurities, especially if it has fallen in an industrial area. As to rain water collected from a roof, it can be seen plainly by its colour how it is fouled by soot and other dirt. I know that tap water varies from district to district, some being hard, that is, containing a fair amount of lime, and some is soft.

Most waters are treated with chlorine and the amount of chlorine used can, I believe, vary according to the time of the year and also the weather. This chlorine kills small animal life and bacteria and so it will be realised that it can also kill small fry, if in sufficient quantities. Often when water is run straight from the main the chlorine can be smelt, but if the water is allowed to stand for a few hours the smell goes off and the water can be considered safe for fish. Also, if the water is played from a hose on to a hard surface so that it is well broken up in the fresh air, much of the chlorine will be removed. If a hot water system is installed in your house it is advisable to use water which has run through this system, as much of the lime, etc., will have been removed. Of course, it must be allowed to cool before use, and if well splashed about it will take up more oxygen from the air to replace some which may have been lost when it was heated.

Fish Respiration

The mention of oxygen brings me to my next point. As is generally well known the fish obtain their oxygen from the water by means of their gills. Water is drawn through the mouth and then passed out over these organs. The gills act as lungs and oxygen is absorbed by their thin-walled blood vessels. The amount of oxygen can vary considerably in a given amount of water. Cold water contains much more than warm, because as the water is warmed up so oxygen is driven off. If fairly large fish are placed in water which is warmed up gradually, they will die from lack of oxygen when the temperature of the water reaches between 85° and 90° F. A large number of fish in a given amount of water soon use up so much oxygen and add to the water so much carbon dioxide that it becomes foul and unsafe for them.

Water takes in fresh supplies of oxygen from the air, and so it can be realised that the amount of water in direct contact with the air makes all the difference to the fish. The very deep narrow container is not of much use and the more shallow with a wider surface is much to be preferred. A fairly safe formula is one inch of fish to each 24 square inches of surface area. In an average tank, say one 24 ins. by 12 ins. by 12 ins., containing a few fish, it is certain that after a time the upper area of water will be the most pure. The centre portion is fairly good whilst the lower part is as a rule far more impure. Foul gases from decomposing foods, droppings from the fish and decaying vegetation collect at the bottom of the tank.

If the water at the bottom can be moved about so that it comes near the surface much of the foul gas can be removed. An ideal method would be to have a small form of water wheel working so that a steady circulation was kept up, from the base towards the top. This can be achieved by placing a very small wattage heater in the base of a tank, when the water warming up will rise and so allow cooler fresher water to sink in its place. Another method is to use an aerator. This will create a slight circulation and some oxygen will also come from the air being pumped in. Although I consider that no tank should be so over-crowded with fish that an aerator is necessary, I do know that with a very crowded tank the fish may be kept alive by using an aerator.

Warning Signs

The fish will always tell you, by their behaviour, when there is insufficient oxygen in a tank. This may be due to an excess of carbon dioxide or other foul gases but if the fish are seen mouthing at the surface most of the time, and swimming slowly in an inclined position, the tank can be treated as if there is not enough oxygen in the water. Often the sight of small bubbles at the surface in the morning will indicate that the fishes have been at the surface for air during the night. When fish are seen at the surface they can be relieved immediately by removing some water and replacing with some fresh; sometimes if the surface of the water is agitated with the fingers it has the desired effect.

If only a few fish are kept in a good-sized tank they are able to obtain all the oxygen they require and foul gases will gradually pass out of the water and fresh oxygen will be absorbed. The movement of healthy fish in the water does assist this change to a great extent. It can be seen from all this that as long as fresh water or sufficient air can be supplied the fish should be able to obtain all the oxygen they require. If you can supply this condition you are well on the road to success with fish keeping.

The amount of oxygen can also be altered by the action of water plants and I shall deal with the question of the provision of the necessary plants in my article next month.

Tropical Fish-breeding Records

Detailed records of breeding experiences with tropical fishes of the egg-laying species are invited from readers. One guinea will be paid for each record published in "The Aquarist" under the above heading.

Siamese Fighting Fish

ALTHOUGH friends say I have had a lot of luck, my past experience shows that breeding Siamese fighting fishes is quite easy and is not only a matter of luck.

First, I put the male in the breeding tank and let him become accustomed to its layout. While he is alone he usually builds a bubble nest. I find it best to put the female in the tank in the evening and then to leave the fishes alone. They sometimes settle down together in the first few days but if not I remove the female and put her back later. The spawning often starts in the early morning, and the courting of these fishes is something you must witness.

The male swims round the nest enticing the female towards it, with his fins displayed in exquisite colours. He wraps his body around the female, practically squeezing the eggs from her. As the eggs fall the male will swim down and pick them up in his mouth, dispersing them into the nest to make a kind of raft. The spawning may go on over a total period of two to three hours. The female too will copy the male and put eggs into the nest.

The male fighter looks after the eggs until they hatch (about two days). The youngsters are not free-swimming at first, and the male does not desert them—as soon as they begin dropping out of the nest he returns them to it. In three or four days they are free-swimming and scatter all over the aquarium. (Plants are not necessary in the breeding aquarium but it is best to have them present.) I find that old flower vase water is a good source of Infusoria as first food for the fry, though it should be checked with a microscope first. Newly hatched brine shrimps are the next food used, followed by sifted *Daphnia*, then larger *Daphnia* and so on to dried food.

When the young fighters are about one-and-a-half inches in length they start nibbling at one another, not doing much harm at first, but later they will begin tearing fins. I often find small youngsters without tails or dorsal fins and even with both missing; without these they are helpless and soon become eaten by bigger youngsters. I save a good young female for another spawning as I find that crossing the daughter back to the father fighter brings better coloured and stronger youngsters.

A. A. KEHURST

White Cloud Mountain Minnows

AFTER studying various species of egg-layers with regard to their hardiness, temperature ranges, size, attractiveness and spawning habits, I finally decided to specialise in white cloud mountain minnows. Eventually I managed to purchase a fine female and two vigorous males, all from different sources.

Conditioning the fishes was commenced, using these foods: micro worm, chopped white worm and earth worm and small quantities of fine, mixed dried food. The two conditioning tanks were at a temperature of 72° F. After a month I set up a 14 in. by 8 in. by 8 in. tank at 72° F. with small (half-inch diameter) pebbles covering the base, and on the evening of 7th September I introduced the three fishes to it. The following morning I replaced a third of the water with fresh from the tap, keeping the depth at five inches. The temperature dropped to 69° F. and the fishes became very lively, chasing the full length of the tank and stopping periodically with fins quivering. On 9th September I removed the fishes but when no fry were seen a week later my spirits were dampened.

On 17th September I decided to try again, with a few alterations to the aquarium set-up. I tethered a large bunch of mixed *Riccia*, bladderwort and blanket weed to the bottom and replaced a third of the water by fresh, heated to the tank temperature of 72° F. The tank was placed so that it received an hour's sunshine every afternoon. The following day I noticed the male darting at the females during the time the sun was on the tank; if this had happened at other times that day I did not see it. On 19th September the female's anal fin was split so I removed the fishes to their separate tanks again.

The first fry were seen clinging to the glass on 22nd September and within a few days there were 33 fry swimming at the surface. By using the usual Infusoria culture, pond water and egg-yolk I reared the fry without losses. After a subsequent unsuccessful attempt to spawn the fishes in an unlighted and unplanted tank in November, the female looking extremely "heavy," the fishes showed great activity and, although the sexes were apart in their heavily planted and well lighted conditioning tanks, I feel sure that the female shed her eggs then, for she seemed to become decidedly thinner.

From these observations I consider that the following conditions are necessary for spawning white cloud mountain minnows:

1. An aquarium of minimum size, 14 in. by 8 in. by 8 in.
2. Seasoned water, one-third replaced with fresh water at the same temperature—72° F.
3. A pebbled base and a quantity of plants.
4. Half light broken with a short period of bright light.
5. Really plump females.
6. Allow the fishes time to settle down in their new surroundings and give small feeds of live worm to give them confidence.

G. R. HILL

Epiplatys chaperi

A BREEDING trap of dimensions 14 in. by 6 in. by 4 in., with a glass sheet in the bottom instead of bars, was suspended in a 24 in. by 12 in. by 12 in. aquarium. The trap was almost filled with *Myriophyllum* from a local pond and the female was placed in it, the temperature being about 75° F. Both male and female were fed liberally on chopped earthworms for a week and then the male was introduced to the trap one morning. The temperature was raised to 80° F. and the male began driving soon after introduction.

The pair was left together for a complete week and then both fish were removed, the plants being transferred into the aquarium proper. Infusoria was already present in fair quantity in the water and was encouraged to multiply by the addition of dried food. The eggs hatched after 14 days, to produce fry which were large and with little or no egg sac. They grew rapidly feeding on the Infusoria in the tank and after about a week were taking brine shrimps and micro worms. In a month their sizes varied from about a quarter-of-an-inch to half-an-inch.

At six weeks the fry were nearly an inch long and were showing the characteristic bars on their bodies. Their food consisted chiefly of small white worms, chopped earthworms and washed prawn eggs when available. At two months the fry were one-and-a-quarter inches long and the males showed dark edges to their anal fins and also blue highlights on their bodies; they were then taking dried food as well as the live foods mentioned. The number of fry was 62, a surprisingly large number, as planarians were present whilst the eggs were hatching. In my opinion, *Epiplatys chaperi* is ideal for the beginner, as this fish does not eat its eggs, and these are quite tough and the young are large and easy to feed.

J. G. BULL

A Worm Infection of Toad Skin

by Dr. EDWARD ELKAN

READERS of this article might do well to look up vol. XVI, pp. 164-166 (November, 1951) of this journal. They will find there a fairly detailed account of the normal structure of the skin of the South African claw-footed toad (*Xenopus laevis*). It is much easier to notice something abnormal if one remembers the normal well. Figure 2 in the article quoted showed the arrangement in the posterior end of the animal of the "lateral line patches."

We are all familiar with the lateral line in fish and we know that this is the seat of important nerve endings which keep the fish informed on water movements and vibrations and, possibly, about its own position with regard to gravity and water currents. It is far less widely known that lateral line organs occur in some amphibia too. They still take the form of lines but these are mostly broken up into

Fig. 2. Section through skin neuromast (sensory bud) of Xenopus, showing nerve fibres supplying the organ. (× 500)

Fig. 1. Normal lateral line patches of Xenopus. Note that the patches stand out white against the dark skin. The single neuromasts can be distinguished—5-10 in each patch. (× 10)

patches and are by no means lateral only. But, however many there are, they never occur on arms or legs. There is a ring of them around the eyes, rows of them around the mouth, the chest, the back and the abdomen. Obviously, organs so widely distributed must be of great importance to the toad and we are not surprised to find that the nerve end-organs (neuromasts), of which there are five to ten along each patch, are supplied by nerves coming, not from the spine but straight from the brain. The importance of these nerves must be ranked with those of vision, taste and equilibrium. Without them the toad is as lost as if it were blind.

There is no animal in which the normal lateral line patches are easier to see than *Xenopus*. In fact, they are so obvious and characteristic of the creature that they have jokingly been referred to as "suture lines." They do really look like untidy surgical stitches, white against the normally dark brown colour of the rest of the skin, and if you have kept *Xenopus* for a number of years you become used to their weird appearance and you expect to see them as they always are—mud-coloured with white lateral line patches. (Figures 1 and 2.)

I need not, therefore, describe my astonishment when, on looking over my stock of toads one morning, I found one specimen which looked like a photographic negative of the rest: the skin was pale yellow and the lateral line patches coal black. The toad was a fully grown female and had come from South Africa over a year ago. Its fellow travellers looked alright but this discoloured toad was obviously ill. It could not swim properly and had difficulty in coming to the surface. I took it out, very puzzled at what the reason might be for this colour reversion, put the toad into warm shallow water and hoped for the best. But the toad would not eat—always a bad sign in so voracious an animal—and during the third night it managed to turn over on its back, whereupon it drowned because it could not right itself. Three more cases, identical with the first, occurred after that among my colony.

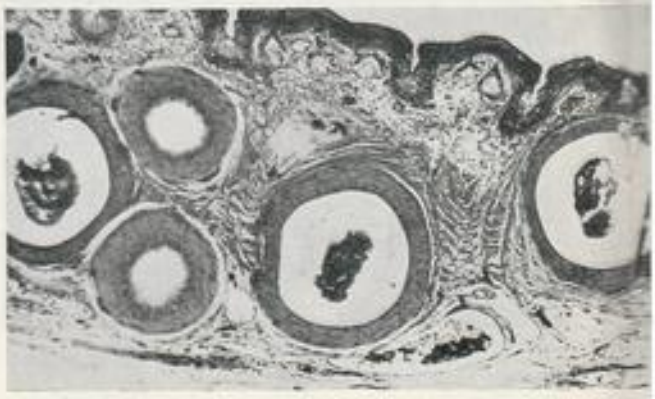
Then the "epidemic" stopped, and I now wonder if I shall ever see such toads again. Not only did they show *every* lateral line patch pitch black, they also showed a line of these black patches running from the anus forward towards the middle of the abdomen where no "lateral" line

Fig. 3a (*left*). *Adult female Xenopus with black lateral line patches due to melanophore reaction against larval trematode infection*
Fig. 3b (*above*). *An enlarged view of the abnormal lateral line patches of an infected Xenopus*
Fig. 6 (*right*). *Section through neuromast from Xenopus infected by trematodes (to be compared with Fig.* 1). *Cellular infiltration around the neuromast and degeneration of sensory cells can be seen* (× 300)

patches had been known to exist (Figs. 3a, 3b). But there were no black patches anywhere else on or in the toads; the disease, whatever its nature, had something to do with the neuromasts. But what?

Little did I know what a hare I was starting for myself when I put the first of these four casualties into formaldehyde to fix it for further investigation and I may as well

Fig. 4 (*bottom left*). *View of inner aspect of skin of Xenopus, showing groups of vesicles containing trematode larvae, along subcutaneous blood vessels.* (× 40)
Fig. 5 (*below*). *Section through lateral line patch of Xenopus infected by trematode larvae. The sensory buds, the various layers of the skin and the thick walled cyst containing the metacercariae can be seen.* (× 90)
Fig. 7 (*right*). *Section through skin of Xenopus toad showing encysted trematode larva.* (× 350)



admit here that without the aid of friends both in Oxford and at the British Museum I should never have been able to unravel the plot.

The first thing I noticed on putting small pieces of skin under the microscope at low power and looking at the skin from the *inner* (under-) side was that, wherever there were neuromasts on the surface there were round, transparent little vesicles below, distributed, but not connected, with capillary blood vessels of the skin and surrounded by large black chromatophores (Figure 4). This explained the

Fig. 8. Metacercaria (larval stage of a fluke worm), coiled up in its own cyst in Xenopus skin. (× 700)

blackness of the lateral line patches but it explained nothing else. What were these vesicles? What did they have to do with the blood vessels? Why did they occur under the neuromasts only? Why were they all of the same size and why were there always approximately the same number (10-17)?

The microscope, instead of offering a solution, increased the number of points that seemed enigmatic. Nor did this unhappy state of affairs change in the least when I looked at the first sections made of this material (Figure 5). Here were the little vesicles. They had thick walls, made of badly staining connective tissue, and an outer reinforcement of chromatophores. Most of them seemed empty. They had no connections with one another nor with any other organ of the skin. All the four toads suffering from this condition died. What killed them?

Particular attention was, of course, paid to the state of the neuromasts, always lying in the immediate neighbourhood of these vesicles, and it was soon found that they were mostly in a bad state (Figure 6). Cells accumulated around them as if to fight a foreign invasion and their own structure showed signs of degeneration with swollen and badly staining cells and large gaps in the lining of the sensory pockets. Some mysterious agent was ruining the toad's sensory organs. It was not a bacterium, it was not a cancerous or non-cancerous growth; it was connected with the little cysts and with the over-production of black chromatophores. It was, indeed, something very unusual and it took many many sections, stained with everything the microscopist's "paint box" has to offer, before the culprit was hunted down. And yet, he was not even very small, he could be plainly seen occupying the centre of many of the

small cysts, enclosed in another, thinner envelope of his own and curled up, resembling the cross-section of a Swiss roll (Figs. 7 and 8).

There he was, or rather, they were, for there was one to every cyst, only in many sections they could not be seen Having finally established them as the villain of the piece we took them to the British Museum for an identity parade, and the answer we got was: a metacercaria of a trematode. A trematode or fluke, goes through many stages of development before it becomes an adult worm. The stage before the last is called a cercaria and it has to enter an intermediate host animal which, when eaten by the "final" host, transfers it to its final destination. My four unlucky toads must have swum through a cloud of metacercariae. But for an unknown reason it took them many months before they fell ill and died.

In the meantime these wormlets had each encysted themselves on the underside of the toads' skin, not even distributed but choosing as their resting place the spots under the lateral line patches. To this the toads skin reacted by trying to wall them off with connective tissue and chromatophores, but in vain. The poison, excreted by the cercariae, destroyed the toads' nervous organs and killed them before they could be eaten by a crane, a pelican, or a crocodile. If these toads had remained in a South African lake, some such animal would certainly have eaten them sooner or later, particularly when they could not properly swim any more. Then the metacercariae would have speedily transformed themselves into mature fluke worms in the final host's intestinal canal; they would have laid millions of eggs which would have hatched along the banks of the lake. The larvae would have found their way into the bodies of snails and, perhaps, again into frogs or fish and so on *ad infinitum*.

And here our detective story ends—for the time being, and like most of these stories it leaves us with many ends not properly tied up. Why did the toads live for over a year in captivity before they showed any sign of disease? Why did the cercariae choose to encyst *only* under the lateral line patches and how did they get there? And, finally: why did the interference with the lateral line organs kill the toads? Or was it perhaps not this interference at all that killed them but the poison excreted by the fluke worms? Were these worms perhaps finding themselves accidentally in a wrong intermediate host, "mistaking" the aquatic toad for a fish? If only we had answers to all these questions our book might have become a best seller; as it is it remains, in the best sense of the word, a "thriller."

Acknowledgement.—Figures 2, 5, 6 and 7 were taken from sections made by R. W. Murray, M.A., of the Oxford Institute of Zoology and Comparative Anatomy.

Dwarf Rush

THIS is a plant for the decorative aquarium. It comes from Japan, the home of so many charming aquatics, and, though it accommodates itself to most conditions, grows best in a bright light in a shallow pot of loam or wholesome garden soil topped with grit to prevent the fish muddying the water. The pot can be easily hidden from view by sinking it in the sand and arranging a few slabs of stone or pebbles around the rim.

The flat, sword-shaped leaves of the dwarf rush average about a quarter of an inch wide by four inches long and grow from a stout rhizome. They stay fresh looking for months on end, and are tough enough to resist the onslaughts of snails and most of the smaller, greenstuff-eating fishes.

Acorus gramineus var. *pusillus*, to give the plant its scientific name, looks well in the foreground of any aquarium, temperate or tropical, and though it is purely ornamental, a well-established clump of it will make a useful cover for livebearer fry. It is easily propagated by severance of the rhizome, but it is unwise to divide the plant until it has reached a large size or has outgrown its container.

A less-common variety has its leaves prettily striped with creamy white or yellow. This plant grows to about eight inches high and does best in temperate conditions. Unless it receives sufficient bright light its leaves will lose their attractive markings and revert to pale, grass green.

J. H.

FRIENDS & FOES No. 10 — Water Fleas *(Daphnia)*

DAPHNIA

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

CLASS:—Crustacea, from Latin *crustaceus*—having a shell.

THE Daphniidae comprise but one family of the tribe Anompoda (with dissimilar pairs feet) in the division Calyptomera (with hidden parts) of the Cladocera (branched antennae). There are seven species, with a number of varieties. Sizes range from one to five millimetres.

Males are produced more frequently than is commonly stated, and are invariably much smaller than the females. Each female *Daphnia* is independent of the male for the greater part of her life, producing frequent batches of partheno-genetic eggs, which are carried round in a special brood chamber behind the body between it and the dorsal extremity of the carapace

Daphnia magna female — *Daphnia magna* male

Resting eggs (ephippium)

(the shell which protects the *Daphnia* vitals).

The eggs develop into perfect baby *Daphnia* within a few days, and are then released into the water by the female. The number in a brood seems to be regulated only by the capacity of the brood chamber, and may be as few as seven in a young female, or as many as 62 in a mature specimen. Within a few hours of giving birth, the female moults and lays a fresh batch of eggs in her new brood chamber.

Once at least in the life of almost every female comes a time when a male *Daphnia* embraces her, and within a day or so afterwards she lays two single eggs. Part of the carapace thickens round these eggs, and goes black. The eggs are moulted and drop into weeds or lie on the mud. They can withstand drying and freezing, and are nature's guarantee of a future generation of *Daphnia*. All species are much relished as live food by fishes, which hunt out every single one placed in their pond or aquaria.

C. E. C. Cole

Building Your Own Fish House—3

by

CUTHBERT L. NICHOLSON

WHEN I left you in November last we had progressed as far as the building of a three-foot wall to form the outer skin of the fish house. Now a little thought may be given to the method of heating to be used. Correspondence which appears from time to time in *The Aquarist* will have helped you to form an opinion on this important matter. Possibly the ideal arrangement is for a thermostatically controlled gas boiler sending heated water through pipes which themselves run through and return through the water held in concrete tanks about two feet deep. This method could be helped by immersion heaters (electrical) to step in should the gas fail at any time, or to share the load should the air temperature become abnormally low.

We shall explore the matter of gas boilers together later, but for the meanwhile I must confess that I installed a greenhouse heater type of coke-burning boiler. The cost, with coke fuel feed, 45 feet of 4 inch piping, elbows, expansion box and stoking tools was about £28, and it is an efficient heater when it continues to burn. A drawback, however, is that unless you are at hand to see that it is burning well it may let you down. For a retired man who loves to smell things burning and who delights in fiddling with fires it would be a joy, but for the business man who can only afford a minute or two in the fish house on the way to work, it is not ideal. I have considered converting my greenhouse heater to a gas-heated boiler by fitting a gas ring and baffles but the makers do not recommend the experiment and my friends in the National Gas Board tell me that, although it could be done, the thermal efficiency would be very low and the idea quite wasteful.

Having in mind that you are later to construct two feet high concrete tanks to hold the tropical fish you must bring

View of the completed outer brickwork of the author's fish house

The building at a stage during the construction of the "boiler house"

in the heating pipes as low as possible, otherwise the rise you give them of one inch in nine feet will bring them out of the water at the expansion box end of the fish house. To get the lower pipe entering the house as near tank bottom level as possible is ideal, and it means that an excavation must be made for the boiler house. During the pipe laying, which is very easy, a spirit level should be used to make sure the desired rise is obtained. The bubble should move steadily to the extreme upper end of the level when you test each run of piping.

Fitting the Pipes

The boiler should be set level in your heating shed and each expansion joint should be held up by a pipe stand set on the concrete bottom described earlier. The expansion box should rest on a platform of bricks. The joints of the pipes are simply made by placing a flange on each pipe and placing a special rubber ring on each pipe about ¾ in. from the end; the two pipes are joined with a cast iron ring covering the joint. The flanges are then bolted together and a single turn of each nut, after being finger tight, should make a watertight joint.

I built the heating house over the door of the glass house so that a trap is formed and one may go in and out through the two doors without letting in any cold outside air. The roof of the heating house, for high light and low cost, is made of glass. The walls are half timber and the lower walls are of brick. The floor is concrete and the door extends to the top of the structure so that smoke arising at the lighting of the fire may pass outside instead of seeping into the fish part.

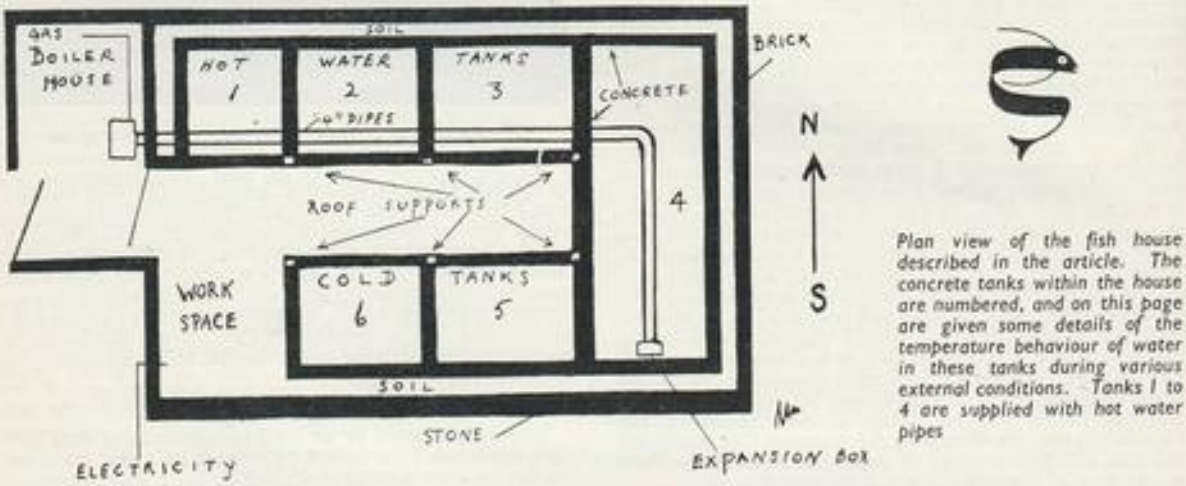
Be generous with your heating house dimensions and follow the earlier process of levelling and digging a small trench round the outside of the base to form a foundation for the walls. Use waterproof cement mix of four sand and one of cement between the bricks so that the place may be dry below ground. To be on the safe side, after measuring the boiler inlet and outlet holes from the ground, lay the concrete floor lower so that you may mount the boiler on bricks and concrete. The boiler will then handily stand above the level of the heating house floor. If you examine the illustration you may see a space left in the outer skin brickwork for the pipes to pass through.

Boilers are made with left-hand, right-hand or back

outlet holes and in the building shown a back outlet boiler was used. If you wish to run the pipes right round the house and to build tanks round them you will need a size larger boiler than mine (which is the smallest) to give the temperature required. The L-shaped run is recommended for it leaves two large concrete tanks for a good filling system and for coldwater fish purposes.

The Other Tanks

I am getting rather ahead of my building schedule by mentioning glass tanks at this stage but in order to explain some of the temperature behaviour I must first tell you what is inside the house. Strong angle irons (from a scrap yard) running over the tops of the concrete tanks now support several glass tanks. The heated concrete tanks are on the *north* side of the fish house and therefore get the most sun. The coldwater tanks are on the *south* side and are kept cool by the shade thrown by the three-feet wall, the dimmed



Plan view of the fish house described in the article. The concrete tanks within the house are numbered, and on this page are given some details of the temperature behaviour of water in these tanks during various external conditions. Tanks 1 to 4 are supplied with hot water pipes

light coming through limewashed roof glass and the shadow of the electrically heated tanks running across the concrete tank tops. These cold tanks are ideal for fantail goldfish and I have grown on some nice specimens almost as fast as the cucumbers (which are most successful in this type of house).

The heating problem is so important that before I get on with the telling of timbering and glazing I shall give some facts from the fish house log to show how the arrangement works. The diagram of the siting of the concrete tanks, shows their numbers.

Tanks 1, 2, 3 and 4 have 4-inch pipes running from the boiler to the expansion box and back. Tanks 5 and 6 are unheated. The way temperatures move is fascinating. Look at these figures taken from the log: 14th June, 8 a.m., sun nil, air inside 68° F. Tanks 1, 2, 3 were 73° F., tank 4, 72° F. Outside water temperature was 56° F. Ventilators were still closed and drops from plants were bursting up the bubble nests in the breeding tanks. Wooden covers were used at these points. The day before it had been a heavy day and there had been heavy evening rain with an outside water temperature of 55° F. and an inside air temperature of 68° F. The boiler was lit at 11 p.m. and it was out at 8 a.m. when the temperatures you read earlier were taken. See how the water retains its heat unaided over a long period.

At 1 p.m. on 14th June the air inside had dropped to 66° F., tanks 1 to 4 were 70° F., 5 and 6 were 68° F. Things were moving the wrong way so the fire was lit at 1.30 p.m. At 5 p.m. although air temperature inside had dropped another two degrees to 64° F., tanks 1 to 4 were 76° F., tank 5 was 66.5° F. and tank 6, 66° F. As tank 5 adjoins tank 4 it tries to climb slowly to the temperature of the heated 4.

The temperatures recorded at 7 p.m. show a startling difference and give one confidence in the ability of the apparatus to meet adverse weather conditions. Here they are: outside air and water 46° F.; inside air 62° F., tanks 1 to 4, 78° F., tanks 4 and 5, 66.5° F. and 66° F., respectively. These readings show that the boiler is able to deal with rapidly falling outside temperatures and the presence of the coldwater tanks enabled one to assess what the tropicals would experience if the source of heat failed. It will help you to see what goes on if you write the temperatures down inside the sketched plan of your own fish house.

You may have kept your physics up to date and remember that the heat lost by one body equals the heat gained by another. I have forgotten most of mine but it is easy to remember that open ventilators at night plus no heat supplied means fish lost by experimenter. Happily I see that around the dates I have mentioned 65 newly born fry were transferred from tank 2 to tank 3. I must, however, keep to the subject of heating and leave tank handling until another opportunity comes.

On a sunny day in the summer, if the house is left shut, the air temperature may rapidly rise to 120° F., the water in the small glass tanks to 90° F. but the water in the excellent concrete tanks will only slowly absorb and retain a suitable temperature of about 75° F. The main thing to remember in dealing with this type of fish house is that when the heaters are off the inside air temperature governs the rise or fall in water temperatures, and to aid you in your choice of heating method I shall give the calculated figures for a gas heater applied to the piping installation earlier described. I must gently confess at this stage that I am taking out my coke fired boiler and having a thermostatically controlled gas boiler connected to the existing piping. The reason? Dirt, and the inability to leave the apparatus for a few days unattended.

Running on Gas

A friend with the Gas Board has kindly given me figures which should apply to the house I am describing and these figures are based upon a number of factors. Heat has to be

supplied to the tanks at the same rate as it is being lost and though some is lost through the poor conducting walls and floors of the fish house, the greater proportion is lost by radiation and evaporation from the surface of the water. These losses are all governed by outside temperatures with the exception of the heat loss by evaporation. If the air is very humid inside, there is little loss by evaporation and this condition is easily obtained during winter time by keeping the ventilators closed.

In a fish house of this design with its deep tanks there is no close relationship between the temperature of the water and the air temperature inside the house and the running costs when gas is used can only be roughly estimated. My friend, with his special knowledge, tells me that with an outside temperature of 30° F. the heat loss from the tanks will be approximately 6,000 B.Th.U.s. per hour. However, the average temperature for the 30 weeks' heating season is 43° F.; thus the average temperature difference between the water at 75° F. and the outside air, is 32° F. against a design temperature difference of 45° F.

For the academically minded the average heat loss for the 30 week season will be $6{,}000 \times 32/45 = 43$ B.Th.U.s. per hour. Allowing for a boiler efficiency of 80 per cent. the total gas consumption for the season will be:—

$$\frac{4{,}300 \times 100 \times 24 \times 7 \times 30}{80 \times 100{,}000} = 262 \text{ therms}$$

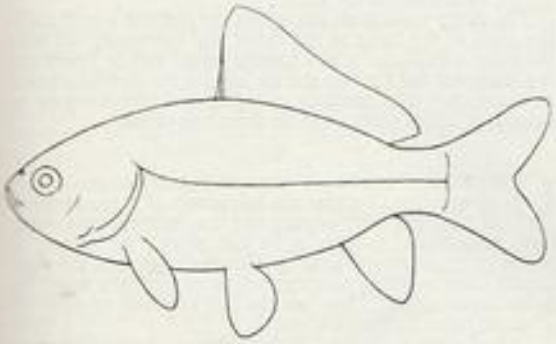
With gas at 1s. 3d. per therm the total cost will be £16 7s. 6d. or approximately 10s. 6d. a week for the heating period. The overall weekly cost per year is about 6s. This looks a little high to me and, as you know it is not necessary to maintain a temperature of 75° F. all the time, I expect a saving can be made. Experience will show how near this estimate comes.

The size of boiler required for this installation, allowing for a 20 per cent. boiler factor to cope with severe weather conditions, is 9,000 B.Th.U.s. per hour output. You will find these boilers cost £5 5s. these days and that the thermostat may be obtained at a price under £3. In addition, if you choose wisely to start with gas, remember there is the cost of the flue pipe, installation and laying the pipe to the fish house. It is for you to choose the method of heating. The coke boiler is inexpensive to run, but it will not run itself. Gas is efficient, clean, and very good use will need to be made of the place to justify the high estimated costs of installation and running.

Aquarium and Pond Goldfish Varieties

1. The Common Goldfish

IT is intended in this and following articles to deal with all the main varieties of the goldfish (*Carassius auratus*). The common goldfish is the nearest type to the original Asiatic carp from which all the fancy varieties have been evolved. To most casual observers all goldfish are more or less alike, but this is not so by any means. These fishes vary considerably in shape and colour and when exhibited at shows they are judged on a system of pointings as to quality, etc. Very few common goldfish are seen at shows which are anywhere near perfect.



Outline of a good specimen of the common goldfish. The illustration is from "Show Standards for Cultivated Fishes," published by the F.B.A.S., price 2s. 6d.

A glance at the illustration will show the general outlines; the colour must be a rich warm red for the best type. There are other colours; a self-lemon colour is well thought of and variegated fishes are sometimes seen. The main colours in a variegated common goldfish should be red and silver. Occasionally they are seen with black markings. These are not desirable qualities for the following reasons:—common goldfish should be visibly scaled (i.e., the scales should be brassy and distinct). These types of fish are not red when young but are bronze in colour. The red gradually develops as the fish grows and as the paler colour moves up the sides of the fish, the upper parts turn quite black. When most of the body of the fish has turned pale red, the top of the back, the dorsal fin and the tail may be quite black. Any black which shows on a fish should soon clear and so this black is not a good feature.

The fish must have a single anal fin and caudal (tail) fin. Any fish which shows calico or "semi-scaleless" patches should be disqualified in a common goldfish class. The illustration shows a clean curve from the nose over the back to the commencement of the tail. This curve is often broken and gives to the fish the appearance of a snout or a humpty back. Many otherwise good fish are down-pointed at a show because of this fault. Another common fault is a hollow belly. The fish should be quite stout and the long stream-lined fishes sometimes seen are not considered show specimens.

Common goldfish are suitable for either an indoor tank or an outdoor pond as they can stand very cold conditions. I consider that they develop a much better colour when they are reared, after the age of about three months, in a pond where they may obtain as much sun as possible. Feeding should present no problems as they will eat anything which a pig will eat.

Common goldfish reared entirely indoors do not get that real rich warm red colour. The change of colour from bronze to red does appear to be controlled to some extent by the breeding of the strain. If fishes are bred from which have changed colour early in life the chances are that their young will also have a tendency to change early. The subsequent methods of rearing can also have a good deal to do with this quick colour change as it is noticeable that if fish from an early colouring strain are given warm treatment, plenty of food and space they do turn red much sooner than fry of the same hatching which have had poorer conditions.

A. Boarder

AQUARIST'S Notebook——

by

RAYMOND YATES

SOME time ago I carried out an experiment with heat treatment on a large number of fish, partly to observe the effect on white spot, and partly to watch the effects of sustained heat in general. I kept a 25 gallon tank at a constant heat of approximately 92° F. for six weeks, aeration being supplied for some 17 hours daily. The tank contained a luxuriant growth of plant life and about 20 fish comprising zebras, pearl danios, mollies, platys, spanner barbs, paradise fish and one representative each of blue gourami, tiger barb, catfish (*Melanotaenia*) and a small zebra cichlid.

The high temperature did not appear to have any bad effect on the fish. All showed excellent colour and, as might be expected, considerable activity and appetite. As time went on it became obvious that the platys (which were very young) were not growing at all, a fact which I put down to the heat. Similarly the adult platys and mollies showed no sign of having a brood, and it is interesting to record that four months later none of the young platys had grown any larger and no fresh births were recorded.

The two spanner barbs had white spot when they were obtained and they were put in this tank so that the effect of heat treatment could be closely watched. Of the other fish only the platys and mollies developed the disease and then only one or two spots on any one fish. After five days all sign of the disease had vanished and I now took drastic action (to see if it was merely dormant) by gradually lowering the temperature to 72° F.—a fall of 20°. This "shock" treatment produced a few white spots, but the fish did not appear to be otherwise troubled by the enormous change in temperature, and only the platys and mollies retook the disease.

In all, this lowering of the temperature was tried out four times, at weekly intervals, for a space of 24 hours, long enough to enable any white spot present to show itself. On each occasion a few white spots appeared although these later disappeared when the temperature was raised. At the end of the six weeks I still felt that the disease was present in spite of appearances, and I introduced a few healthy swordtails and Australian rainbows. These fish did not contract the disease. However, I was still unconvinced that all traces of white spot had been removed and accordingly I put in the tank an adult harlequin which was very weakly indeed. In a few hours this fish was covered in white spot although all the other fish were clear.

At this stage I felt certain that sustained heat treatment alone is useless as a cure unless the entire tank is "disinfected" and the plants and gravel thrown away. I now lowered the temperature to 75° F. and dosed the tank nightly with quinine hydrochloride for a week. By this time there was again no sign of the disease but I still had doubts. To make certain I introduced a beacon (head and tail light) . . . the one fish of all tropicals which white spot will attack if it is present. After another fortnight had gone by with no sign of the disease I felt safe in moving the fish concerned to other tanks.

Undoubtedly the heat treatment makes life hard for the parasite, but in this instance it appeared to affect fish growth and fertility. It seems as if quinine is the most reliable remedy yet available.

* * *

THE harlequin is considered by many to be a difficult fish to keep. Undoubtedly, many of those offered for sale of adult size are wild fish, and it is true that these do not always take kindly to life in an aquarium.

After purchase they should be watched for signs of a fungoid growth on their dorsal or pectoral fins, or even on the body itself. The fins appear to fold up and be glued together. The fish mopes at the surface, refuses food, and dies within about three days. Treatment is easy and almost always successful. Put the affected fish in a tank or container to which has been added a small quantity of sea salt. The fungoid growth disappears within two to five days and the fish is once again lively and brilliant. It can now be returned to the aquarium. Occasionally after a week or so the same symptoms recur. If this happens repeat the treatment as before, and as often as may be necessary.

Usually one treatment is sufficient but I have had difficult cases which required three or four of these salt baths spread over a period of six weeks. Harlequins in dealers' tanks are almost always in water to which sea salt has been added. Once the fish has taken to aquarium life it is very hardy indeed, and surprisingly long lived.

* * *

THE life of electric lamp bulbs in aquarium covers is relatively short, and for this reason I buy the cheapest obtainable, usually from a departmental store. The atmosphere of the space between the surface of the water and the tank cover is very humid indeed, and when not in use each lamp is covered with condensation. This drips down to the lowest portion of the glass of the bulb and in time a slight crack appears and the bulb fails. The only way to obviate this tendency is to wipe each bulb dry immediately before switching on the lights.

The damp conditions also affect the cement which holds the glass of the lamp to the metal cup surround. In time the water will loosen this, a hissing sound will be heard and the lamp will fail because the air has got in. It is important to remember that constant changing or interchanging of aquarium lamps shortens their lives considerably.

* * *

OWNERS of good male Siamese fighters are frequently disappointed because the fish ignore all other varieties of fish, and slink around the tank without displaying their magnificent finnage in its full glory. At shows, of course, they are placed next to other male fighters, the sight of each other ensuring that they will be at their best when the judge comes along. How can the fish be made to show off when no other fighters are near?

The solution is simple. Fighters are not unduly worried by the presence of other types of fish, even although they are irritable and aggressive with small fish which come near to them. As always, there is an exception, the paradise fish. This is a very close relation indeed to the fighter and the presence of a sizeable male paradise fish annoys the fighter sufficiently to ensure a display of threatening behaviour (with spread finnage) whenever they meet. No damage or injury results, however, because the paradise fish always retreats, and in a day or two the fighter merely spreads his finnage (rather like a growling dog with no bite) and goes his way.

OUR READERS Write

Fishes and Batteries

PERHAPS you will be interested to know that I was the person who set up the tropical community tank at the Motor Show, mentioned in the Editorial of your November issue.

I trust you will not mind my making a slight technical correction! We were using what is known as the separator (in this instance, a porous plastic product) as the diffuser to demonstrate its porosity, not the plate. A separator is placed between each positive and negative plate of the battery—its high porosity gives it a low electrical resistance, this being a great advantage to the heavy discharge currents batteries are called upon for in engine starting. However, returning to fishes again, all this is irrelevant and I was very pleased to read that my effort was recognised.

STANLEY HARKER,
London, S.E.10.

Potassium Permanganate

IN your September, 1952, issue, two of your contributors make statements which appear to be at variance with facts. On page 126, Mr. A. Boarder writes: ". . . isinglass, which is silicate of soda." Isinglass is made from the dried swimming bladder of the sturgeon, *Acipenser huso*, and other species, its uses include the making of court plaster. Silicate of soda is known commonly as waterglass; solutions of this are used to preserve eggs.

On page 119, John Gunn remarks: ". . . potassium permanganate is often recommended as a solution for 'sterilising' aquaria. It is useless for this." This is surprising news. *Martindale's Extra Pharmacopoeia*, 23rd Edition, uses the words "markedly bactericidal *in vitro*" to describe potassium permanganate, while the *British Pharmacopoeia Codex*, describing the same chemical, employs the phrase "possesses disinfectant and deodorant properties."

If a solution of permanganate is used in the way that your correspondent advises for Lysol satisfactory results can be obtained. At the same time traces of this solution will be visible when the aquarium is filled and, further, no harm will be done if fish are allowed to remain in aquaria containing traces of permanganate solution. I do not like to think of Lysol being brought into fish houses. This preparation is extremely caustic and has already been responsible for hundreds of human fatalaties to say nothing of almost innumerable cases of burning.

H. C. B. THOMAS, M.P.S.,
Bristol, 7.

John Gunn writes: Aquarium conditions are far more "in vivo" than "in vitro," and that is why I consider potassium permanganate to be useless when employed in the usually advocated manner. The chemical is rapidly reduced in the presence of organic matter and so cannot kill all the pests against which it is employed. Despite the description in the B.P. I wonder how many practical applications of potassium permanganate as a disinfectant in modern medicine Mr. Thomas can quote?

Gas and Aquaria

WITH reference to the reader's query on the effect of gas on fish tanks (*The Aquarist*, October), I very much doubt if a gas fire would cause trouble. I have 12 tanks varying from 9 ins. by 9 ins. to 36 ins. by 14 ins., all of which are heated by base gas jets, and in these tanks I have about 300 tropical fishes and have never had trouble at any time. The gas heating is very satisfactory and reasonable in cost, which is about five shillings a week.

G. O. LATAM, Derby.

The AQUARIST Crossword

Compiled by J. LAUGHLAND

CLUES ACROSS

1 Does this fish shake its caudal fin? (7, 5)
2 Atmosphere: a fish's need (3)
10 A fault of herrings? (3)
11 A bag-net for trawling (5)
12 This fish is a shining light (6)
13 Belonging to a river-bank (8)
17 Ate (3)
19 *Argulus*, for instance (5)
20 What the water does, and an animal does too (4)
22 Put out or outs another way (4)
24 *Labiotes reticulatus* (5)
26 Out-flow (3)
28 A tide of sorts, but a bore (5)
30 Runt, perhaps (3)
31 The opposite of all right (1, 1)
33 Chinese mile (2)
34 I've a notion its too big for ide (4)
36 German river "— rolling rapidly" (4)
38 Popular name of a barb variety (10)
40 Nearly death for Cleopatra (2)
41 Pot-bellied (5)

CLUES DOWN

1 Aquatic plant (5, 7)
2 A breath of the fairy shrimp (3)
3 Whale (7)
4 Catch with bait (6)
5 Pertaining to lips, hence *Cubiza labiosa* (6)
6 Wicker net (4)
7 Part of a curve (3)
8 Fly fisher's favourite (5)
14 Receipt of a sort (1, 1, 1)
15 Star-fishes (8)
16 Seahorse, perhaps (3)
17 Cleopatra's snake (3)
18 This isle is no good for fishing (3)
21 Dud ping (anagram) (7)
23 Degree of the doctor fish? (1, 1)
25 The freshwater shark (4)
27 "The Venerable —" (4)
29 More of 2 down (4)
30 Dare or dart (4)
32 Whales (4)
35 Lochinvar's river (3)
37 Short female saint (3)
39 And ditto editor (2)

PICK YOUR ANSWER

1. "Fishes that —— in the deep." The missing word is: (a) Dwell. (b) Live. (c) Swim. (d) Tipple.
2. *Barbus stoliczkanus* is very similar in appearance to: (a) *Barbus chola*. (b) *Barbus oligolepis*. (c) *Barbus terio*. (d) *Barbus sicus*.
3. The flowers of the water violet (*Hottonia palustris*) each have: (a) 4 petals. (b) 5 petals. (c) 6 petals. (d) 7 petals.
4. *Gambusia punctata* is popularly known as: (a) Black Gambusia. (b) Blue Gambusia. (c) Red Gambusia. (d) Silver Gambusia.
5. *Esomus danricus* (the flying barb) was once known as: (a) *Barbus danricus*. (b) *Brachydanio danricus*. (c) *Danio danricus*. (d) *Nuria danrica*.
6. *Synodontis nigriventris* (the upside-down catfish) has: (a) 2 barbels. (b) 4 barbels. (c) 6 barbels. (d) 8 barbels.

G. F. H.

(Solutions on page 219)

News 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.

PRESSURE of other commitments has compelled Mr. Brian Vesey-Fitzgerald to resign from the presidency of the **North Hants Aquarists' and Pondkeepers' Club,** although he remains a member. Former chairman Mr. H. G. Rundle, was voted president at the club's October meeting.

* * *

TROPICAL fish-breeding has been dealt with in two lectures recently received by the **Rugby and District Aquarists' Society,** including one on breeding Siamese fighting fishes, given by the society's chairman, Mr. K. Cave. Mr. L. Bloom secured first and second with fishes entered in a club table show, consolidating his lead in the table of points and making him certain winner of the Herbert Cup, an annual award for this achievement.

* * *

OFFICERS of the **Stockport and District Aquarist Society** were elected at the recent annual general meeting, when a detailed programme of monthly talks and evenings to be devoted to members' exchanges of opinions and experiences was announced.

* * *

FIRST public exhibition of tropical and coldwater fish was staged last November by the newly formed **Isle of Sheppey Aquarist Society.** This was arranged by courtesy of the local Cage Birds Society, and as a first attempt it aroused much favourable comment. The display included three tropical tanks, three coldwater tanks, and a miniature pond, with golden orfe, green tench, goldfish, and shubunkins. Tropical tanks showed a variety of the more popular fish from the humble guppy to the male Siamese fighter. Although the society is at present small in numbers, it has already planned to stage two exhibitions during 1953. The secretary is Mr. G. A. Dawkins, Green Gables, Oak Lane, Minster, Sheppey.

* * *

MR. W. C. CLEVELAND talked about water plants when he visited the **Willesden and District Aquarists' Club** by special request. He pointed out that the chief enemy of plants in an aquarium was the aquarist who would not take the trouble to ascertain the best growing medium, or who failed to study which plants did best in plenty of light and which plants grew to perfection in shady places in the tank. He stressed that while loam, peat or oak leaves for a time seemed to bring on plants, after a while they failed because of the bacteria set up by decay. He explained for the members the best results to be obtained and the proper method to grow such plants as *Vallisneria, Sagittaria,* hairgrass, *Ludwigia, Hygrophila, Ambulia,* Indian fern, *Cambomba, Aponogeton* etc., altogether the subject was well dealt with and various snags were enlarged upon for the benefit of the tyro. The talk was well received and drew a number of pertinent questions.

* * *

THE **St. Leonards Fishkeepers' Society** has now obtained a permanent meeting place, at the Cinema Cafe, Norman Road, St. Leonards-on-Sea, where meetings are held on alternate Wednesdays at 7.30 p.m. Recently, members have heard a talk by Mr. Collins on "Tropical Fish Breeding" (the speaker also displayed an excellent series of fish paintings) and a talk by the secretary on his experiences in keeping a marine aquarium. The society has decided to make visiting invalids who are interested in the hobby a permanent part of their programme.

* * *

FORTY members and friends of the **Kingston and District Aquarists' Society** assembled to celebrate the society's sixth anniversary of its birthday recently. The president, Mr. N. Lumley, stated that the society was in a healthy state and had been successful at a number of shows during 1952.

Photo: Phelps & Marchant

Lord Kingsale (with hand raised) at the opening of the exhibition held by the Redhill and District Aquarist Society at the Odeon Cinema, Redhill. Lord Kingsale is president of the Society

A TALK on livebearers was heard by members of the **Warrington Aquarist Society** last November, and on the same evening a Dutch auction raised two pounds for society funds. Results of a furnished aquarium contest were announced last month at the society's Christmas party, when the presentations of the Dave Shepherd Challenge Cup and the Warrington A.S. plaque were made.

* * *

GAUMONT British films seen at a meeting of the **Oldham and District Aquarist Society** included "Life in the balance," "Fish Face," "Father of the Family" and "Seahorses"—all films of natural history and aquatic interest. Last month the society held a Christmas social and dinner.

* * *

PROCEEDS from the annual show of the **Great Yarmouth and District Aquarists' Society** enabled members to present a furnished aquarium to the children's ward of a local hospital. Recent evening meetings have included a display of films and a table show for members' guppies.

* * *

WINNERS of the home aquarium contest for members of the **Southall Aquarist Society** were Messrs. A. Hastings, L. Wincott, E. Ebelthite. Annual general meeting of the society is scheduled for early this month and the bi-monthly meetings take place on second and fourth Wednesdays at 7.30 p.m. at the Beaconsfield Arms, West End Road, Southall, Middlesex.

* * *

PROBLEMS of members of the **Workington and District Aquarist Society** were solved in answers by Mr. R. Brough after his talk on swordtails to the society.

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) and the only lettering on the badge (Aqua Cunae Vitae Ager Nobis) is borrowed from *The Aquarist's* crest. Broadly translated this Latin inscription means "Water, the cradle of life, is our field of study." This has, of course, an international appeal, and it is hoped that aquarists all over the world who wear the badge will find that it serves as an immediate introduction to fellow fish-keepers. The angel fish and the shubunkin are symbolic of the two main branches of the hobby. 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 xii,** to Aquarist's Badge, *The Aquarist,* The Butts, Half Acre, Brentford, Middlesex, and please specify which type of fitting you require.

Silver Jubilee Show

THE 18th annual show of the **Scottish Aquarium Society** was held in November, 1952, at the Kelvin Hall, Glasgow. There were many entries from all parts of the British Isles and they made a brave show in the excellent hall. The show was held in spacious quarters—there are few places providing such grand conditions. Furnished aquaria made a very good display and were arranged so that they appeared as pictures with hard-board surrounds; unfortunately the lighting of the tanks was rather weak, and did not bring out the best of the colours. Hendon Society won the first award in the tropical section for furnished aquaria. An interesting feature was the provision of a class for schools, which was well supported and, judging from the crowds of school children around the tanks on the Friday, the children were very keen. *The Aquarist* was represented

Display of aquaria by the Dundee Aquarium Society at a local horticultural show. The tank in the foreground is made of perspex and was designed for the exhibition of water plants. Surrounding vegetation greatly enhanced the beauty of the small aquarium exhibit

The picture at the bottom of the page shows the magnificent collection of trophies awarded at the Lambeth Aquarist Society's Fourteenth Annual Exhibition in London, behind a row of furnished aquaria on view at the exhibition

at the show and Mr. A. Boarder was kept very busy answering questions from visitors; trophies were on display at *The Aquarist* stand during the show. The coldwater section was fairly well supported; the winning common goldfish had come from Hendon and had been placed first on more than one occasion by Mr. Boarder. The judges must have had some difficulty with some of the cold classes, as the first prize fish in the variegated goldfish class was a pale shubunkin with soft gillplates. Quite a good comet had been entered in the goldfish class but the lemon coloured pair of fish in the other self colours class was admired. About 10,000 people visited the show compared with about double the number last year. This year, however, the show was open for two days only instead of three as last year. The Reptile Hall was very popular and a continuous queue could be seen there all of the last open day. The welcome from all in Scotland was very much appreciated. Some Englishmen are inclined to think that they are not generally liked by the men north of the Border, but what the Scot thinks of the English is nothing to what the Glaswegian thinks of the Aberdonian, and vice versa.

Secretary Changes

CHANGES of secretaries and addresses have been reported from the following societies: **Belfast and District Aquarists' Club** (Mr. A. McCormick, 17, Jameson Street, Ormeau Road, Belfast, N. Ireland); **Bridlington and District Aquarists' Society** (Mr. J. Bulmer, 20, Lansdowne Road, Bridlington, E. Yorkshire); **Doncaster and District Aquarist Society** (Mr. P. B. Templeman, 28, Newlands Drive, York Road, Doncaster); **Seaham and District Aquarists' Society** (Mr. G. Drighton, 18, Adolphus Street, Seaham, Durham); **Stonehouse and District Aquarist Society** (Mr. T. N. Artus, 21, Dudbridge Hill, Stroud, Glos.).

New Societies

Altringham Aquarist Association: *Secretary:* D. Malam, The Cottage, Hale Lodge, Grove Lane, Hale, Cheshire.

AQUARISTS living in **Dereham, Norfolk** who are interested in becoming members of a society in process of formation there, should write to Mr. J. H. R. Timpson, *Dereham and Fakenham Times*, 5, Quebec Street, Dereham, Norfolk.

Epsom and District Aquarist Society: *Secretary:* J. K. Ward, 1, Melton Flats, The Greenway, Epsom, Surrey. *Meetings:* Second and fourth Wednesdays each month, 7.30 p.m., at Epsom C.P. Boys' School, Pound Lane, Epsom.

Friends' Aquarist Society: *Secretary:* P. B. Salter, 28, Kestrel Avenue, Herne Hill, London, S.E.24.

Glastonbury and Street Aquarist Society: *Secretary:* K. Miller, 22, Benedict Street, Glastonbury, Somerset. *Meetings:* First and third Wednesdays each month, 7.30 p.m., in the Club Room, Mitre Hotel, Glastonbury.

Guppy Breeders' Society—Gloucester and Cheltenham Section: *Secretary:* P. E. Cox, 51, Naunton Lane, Cheltenham. *Meetings:* First Monday each month at Rosamund Lawn, Sydenham Road, Cheltenham.

AQUARISTS living near **Harringate, London,** who are interested in becoming members of a new society there are invited to write to Mr. P. Kadwell, 13, Munster Road, Tottenham, N.15. Meetings are being held each Thursday, 8 p.m., at the Hermitage Social Club, Hermitage Road, N.15.

Irvine and District Aquarist Society: *Secretary:* A. M. Sleith, 88, High Street, Irvine, Ayrshire, Scotland. *Meetings:* First Monday each month, 7.30 p.m., in Irvine Y.M.C.A.

Perth and District Aquarists' and Pondkeepers' Club: *Secretary:* R. M. Ross, 46, Rose Crescent, Perth, Scotland.

Crossword Solution

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

PICK YOUR ANSWER (Solution)
1 (d), 2 (d). 3 (b). 4 (b). 5 (d). 6 (c).