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VI
AQUARIUM lighting is a subject of such obvious importance to the aquarist that it is no wonder it is frequently discussed. Not only does the arrangement and type of lighting have a great influence on the appearance of the fishes seen beneath it but it is, of course, the major factor that determines success or failure with water plants. In the last 15 years or so fluorescent lighting has been tried by many aquarists with results that have been mainly disappointing ones, and it is probably true that most aquarists have come to believe that this is an unsatisfactory method of aquarium illumination. How much is this attitude justified?

In an article on the use of fluorescent lamps for aquaria in a booklet called Plant Irradiation, just issued by Philips of Holland, it is suggested that the poor results obtained have been due to failure to allow adequate time for the aquarium to accommodate itself to the effects of the change from incandescent to fluorescent lighting. Advantages of the fluorescent lighting are given as (1) a more favourable light spectrum for growth of plants, (2) a more uniform lighting because of the tubular shape of the lamp, (3) a threefold increase in output of light and (4) low output of heat. It is this last-mentioned factor that is said to be the cause of an initial regression in plant growth when a change from the heat-radiating ordinary lamps is made. An example is given of incandescent lamps of 75 watts being replaced by a 30 watts fluorescent lamp; whereas the former gives out about 50 watts as heat the latter produces only 8 watts, so that the top of the aquarium is heated less “and the biological balance is disturbed”. This “sometimes may take some months” to be remedied, according to the booklet. We would like to know if comparison has been made of the effects of the two types of lighting on two newly set-up aquaria of otherwise identical content, arrangement and management. It would seem to be such a simple matter to decide which lighting produced the better plant growth in this way.
Notes on the keeping and breeding of Rasbora heteromorpha

by Dr. R. O. B. List

Populn name: Harlequin fish.
Natural habitat: Malacca, Sumatra and Singapore.
Normal adult size: 1 1/2 inches (4.5 cm.).

This very popular fish seems to be a fish of seasons. One often finds reasonably large quantities, and then again a scarcity. But it cannot be denied that the harlequin is a very colourful inmate for your aquaria.

For ideal fish, one should look for those with a dorsal size of about 1 inch, with an anal fin of 1 1/4 to 2 inches. The lateral line should have a scale count of 26 to 27 scales. Colours are, however, important. The dark patch at the rear of the fish should be of a deep blue-black colour, with edges of the patch showing a clear gold shimmer. The rest of the body to be of a silver-grey colour with a red to violet matt shine. Dorsal and caudal fins should have a good showing of red, merging into a yellow gold.

As a community fish, the harlequin is ideal and comparatively easy to sex. The males are said to show a golden edge to the triangular mark, but I do not find this infallible.
as the golden edge is also to be found in pronounced females, but it is suggested by some authors that both sexes carry the golden edge and that it is more pronounced in the male. I prefer to differentiate by examining the abdominal bulge. It is steeper in the female than in the male and the lower forward point of the dark triangle is more sharply pronounced in the male than in the female. In the latter this point seems to be more dissolved. I would therefore suggest a careful examination of the various points before deciding on your sex.

Having found a pair of fishes, we must now consider the breeding tank. The size of the tank must allow space for movement. It is often suggested that broad-leaved plants should be used, but my preference is for Cryptocoryne and Mygrophila. The water should be kept at pH 6 to 6.5 for best results, with a temperature of 75°F (24°C), but temperature variations of 70° to 85°F (21°-29°C) are not considered harmful.

The eggs are usually laid on the underside of the plant leaves, and eggs usually hatch out in 24 to 28 hours. It is, however, important that the breeding pairs should be well matched and of good size, and should be conditioned with ample supplies of live foods. A 50/50 mixture of tap and distilled water can be used, but this should stand for a period of not less than 7 to 8 days. Care should also be taken in the selection of plants for the breeding aquarium.

Having selected your plants, which should have good leaf surfaces, they should be carefully cleaned. I have noted that some breeders wash their plants in an alium solution, but my personal preference is for potassium permanganate crystals dissolved in water, with an immersion of about 3 minutes and a thorough wash over with clear water to follow. As one does not use sand for breeding aquariums, there will, of course, be difficulty in anchoring your plants. Take some small stones, have them thoroughly washed and tie them with short lengths of nylon thread to the leaf. This will keep them up in sufficient space and will render the plants quite successfully.

Having introduced the fish to the aquarium, it is quite obvious that the male has very little interest, if any at all, in his partner. The female now becomes quite coquettish. She betrays, on the underside of her tail fin, and plays at being a butterfly by hanging upside down and moving her fins. The male still may take no notice. The female now swims to the male and again goes through her coquettish play. She then returns to the leaf and repeats the process. If you have the patience and, of course, the time, just count the number of times the female goes through this process. The result will surprise you, as I have myself counted up to 22 repeat performances, before the male realizes that the exhibition is for his benefit and that he must do something about it.

The male then begins his chase of the female, all the time being guided by her to the selected leaf. He appears to press himself tightly against the female, and with his tail pressing against her head, the spawning begins. This may not happen immediately, but once the male has decided to follow the female, he does not give up until spawning does commence. By timing the process I have found that it can be anything from 1 to 1½ hours' duration. The eggs stick in tight clusters to the leaves and the pair should now be removed. Here is an important point. Do not remove the pair with any old net. Have one carefully sterilized and use that. It will pay dividends. Now cover the tank up to exclude light. Having tried both methods, I always advocate the darkened tank gives better results. Having never heard of any eggs, perhaps a reader can give a reasonable explanation.

With the memory of a lecture given some years ago by Commander Marsack from Singapore, I came to the conclusion that Nature's methods, as contained by him, should be of use. I thereupon used aeration with a filter soon.

Marsack described the spawning of barbels in swiftly flowing water, with the males teasing the females in the swift currents and then pushing them into quieter waters for the spawning. This was the solution that I was looking for and the aerator did the trick. There were no losses in the spawning and in 24-28 hours I had the results: strong healthy fry, which in 4 to 5 days took readily the supply of micro worm that I gave them.

The same pairs, if used again, will repeat their spawning in about 21 days, provided that they are well conditioned beforehand.

For feeding with micro worm, I recommend the use of a fine sieved feeding ring, as the young fry soon to appear to rise to the top surface for their food.

I also replace nearly three-quarters of the water content with fresh water each week, until 3 weeks have elapsed. As a sure guide for this period, it is usually on the third week that the first sign of the black triangle makes its appearance. If not visible at 3 weeks, continue with the water change until the characteristic mark does show.

As 6 weeks the fry are big enough to disperse on a change to another aquarium you will notice that each fish has a collection of tiny air bubbles adhering to it. Dependent on the size of the bubble, these tend to drive the fish upward, and I have found that the weekly water addition builds up a resistance in the fish which negatives the upward urge caused by the minute air bubbles. A severe test is not to change part of the water each week, and you will find that on the 6-week dispersal period the fishes are unable to overcome the upward drive to the top surface and will accordingly perish.

Those of you who are able to consult foreign text-books on breeding various species will often notice that it is always considered important to delve into a little in what I term "Water Chemistry". Apart from simulating degrees of acidity or alkalinity (pH) I am inclined to keep away from such methods. I cannot, of course, deny their use, as I am often made aware of splendid spawnings with scientifically controlled methods, but one very seldom hears of the failures. I prefer to try and keep to Nature's own methods, which would not know the difference between spirits of salts and, for example, acriflavine. Let us rather consider those things to be found in Nature than those which are the products of a laboratory.

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Increased Popularity of Canadian Aquarium

ATTENDANCE at the Vancouver Public Aquarium in 1961 was 310,647, as compared with 298,746 in 1960. Both of these figures represent mainly paid admissions and thus the income of the Aquarium was greater last year than the year before. By virtue of its great popularity it was able to be completely self-supporting without the necessity of utilizing a civic grant—an unusual achievement for a public organization.

However, last year, as in all other years, most visitors came to the Aquarium during the summer. In order to boost winter attendance and to promote the utilization of the Aquarium by schools, the Board of Governors authorized the distribution of free passes (issued for one student admittance until 15th March, 1962) to all elementary school children in Greater Vancouver. Each of the 80,000 passes distributed has a full colour picture of a local marine species, together with its common name, scientific name and life history. There are four kinds: lingcod, copper rockfish, sunflower starfish and Pacific octopus. The cards resemble those that children sometimes get with sweets.

March, 1962
Tropical Marine Aquarium-keeping
Difficulties are over-rated

Says MAX GIBBS
(The Goldfish Bowl, Oxford)

EALRY in 1961 I decided to start stocking marine tropical fishes. My decision was largely made as a result of my own desire to keep these beautiful creatures and learn more about them from personal experience. With only a rather frightening abundance of "do's and don'ts" gleaned from various articles and books on the subject, I launched into my first attempt, and purchased a very varied collection from German suppliers. The fishes arrived in perfect condition and they were placed in a couple of specially prepared tanks containing natural sea water. This water was newly collected from a stretch of the very beautiful Cornish coast.

The immediate interest shown by customers in the shop, both aquarists and others alike, signified a promising future for this fascinating branch of our hobby. The most significant element in the interest shown was the fact that something like 19 out of every 20 customers noticed the display, remarked on it, and asked questions about it. Such interest has never been shown in the freshwater displays by such a large percentage of the public. So it was that I resolved to develop this interest.

Soon after the fishes had been displayed in the shop I toured various wholesale establishments in Germany to see what the supply situation was like and to receive invaluable first-hand advice. I was amazed by the apparent indifference with which these experienced people showed in their handling of these fishes. In nearly every case single-ton tanks were used as stock tanks. These tanks were deep and the water level was far below the top edge of the frame. In only one case (Tropicarium, Frankfurt) were special non-toxic asbestos and cement tanks used. Indeed, at one obscure Munich retail shop I saw a most beautiful marine set-up housed in a large single-ton tank. The density of the water was much greater than that recommended, the one corner of the iron frame was completely rusted away, by the action of the salt water being sprayed against it by the filtration unit, the fishes were cramped in—and they looked to be in perfect health and exceedingly active.

In every one of these places it was out of the question to use natural sea water owing to the great distance of each of them from a suitable source. Every one used a prepared sea salt to be mixed with ordinary domestic water from the tap. One well-known wholesaler in Munich, Andreas Wernig, makes his own salt water to a formula which he has used for some time now (was it my imagination, or did his fish really look a little less active than others from each of the persons with whom I discussed the "problems" of keeping sea-water fishes? I gathered a common conclusion; that far too much humbug is made by publicity of marine fish-keeping by publication on the market to-day. The one exception was a chemist, again in Munich, who dispensed the finest marine aquarium that I have ever seen anywhere, including many zoological establishments. In his shop he has a huge stainless-steel aquarium, fitted with an expensive sea-water pump in conjunction with a massive filter-plant, packed with special filtration media (but not ion-exchange media). The tank was decorated with a fabulous collection of the most beautiful corals, and housed six huge angelfish, three very large fish, the size of a dinner plate. His recommendations for keeping marine fishes were even more meticulous than those featured in the many publications that I had read (change the nylon wool in the filter every day etc.).

However, I remained home weary, but resolved to make marine fish-keeping a reality here in England. But on returning home I found that nearly all of my recently purchased fishes had mysteriously died while I was away. I am still not really sure what the cause was, but I think that the newly collected sea water probably carried some form of disease which attacked the fishes and quickly killed them. Since then I have used artificial sea water and such a tragedy has not occurred.

Shortage of tank room during the busy time of the year for freshwater fishes forced me to change back my marine aquaria to freshwater and the collection of marine fishes was finally housed in one 36 in. by 24 in. by 12 in. aquarium, in a store room at the back of the shop. This same tank I have kept many different lots of marine tropicals and the water has been there since last June. It is still bright and clear, being filtered by two internal bottom filters in which the nylon wool has been changed only twice. At times there have been as many as 34 fishes in this body of water, including large clowns and angelfish, but at no time have they shown signs of distress due to overcrowding. The tank is on a concrete floor with the putty seams and top single-ton rail treated with aquarium sealer, and the water level is within a couple of inches of the top iron rail, so to which the water splashed from the bubbles bursting from the two filters.

In fact, I have now had a clear run of trouble-free marine fish-keeping since my setting up of this one 36 in. by 24 in. by 12 in. aquarium back in June or last year—and by the look of it I am sitting pretty for a further trouble-free period.

I have kept together in this same aquarium: Platax, five species of clowns (Amphiprion), three varieties of blue damselfish and three varieties of anthias. Apart from the worrying and fin-sipping which the Platax suffer in this mixed collection, the only trouble occurs amongst the others when there are smaller species together. Then they worry each other, plus more than other species. This has happened with the "blue demsels", and three-spot demsels, and the Pygmy Angelfish (Pomacentrus pinguirostris). The common clownfish (Amphiprion percula) seems to settle down quickly and any bickering soon ceases. The Xantherus clowns seem to be quite peaceful and never take part in any domestic disputes. All being well, I am hoping to extend my premises this year, which will enable me to re-house my stock cages of foreign birds and parrots so that I can build up a comprehensive section of marine tropics in their places. Since my advertisements featuring marine tropics in The Aquarist I have been inundated with enquiries and requests for advice from all over the country. I have
supplied quite a number of customers with fishes, mostly
in the north of England (I wonder why?). However,
unnecessarily long delays on the railways have resulted in
several losses and for the time being I have been obliged
to stop sending rail orders where long delays are likely
delays of 36-48 hours from the time of despatch have not
been uncommon). I hope that the situation will quickly
improve and that deliveries will soon be possible again
outside of the summer months, and once again we shall be
able to send marine fishes to the north. Apart from requir-
ing a reasonable water temperature, marine fishes are
very demanding on oxygen and it is this requirement which
forces the length of time for which they are to be packed so
critical.

Many callers at my shop have asked about starting a
marine aquarium, but as most of these were wanting to
make their début into fish-keeping in this way I have
discouraged them and tried to convince them that they
would be better advised to start with a freshwater tropical
set-up to learn the principles of fish-keeping. However,

Barbus arulius

by JACK HEMS

This comparatively new cyprinid—it was introduced
to aquarists in this country and America about 6
years ago—is native to southern India and has
proved an easy fish to keep in captivity. It will eat almost
anything (including vegetable matter) and appears to be
quite comfortable at a temperature range of 65° to 90°F.

Though good feeding and plenty of swimming space in
a well-kept aquarium will result in the fish attaining a
length of about 6 in. in 2 years, it is reasonable to suppose
that in the wild state it is capable of reaching an even
larger size.
The basic colour of the species is silvery white, with a
dusting of bluish green and gold on the large scales. Four
black bars and a black spot just below the posterior base
of the dorsal fin decorate the sides. A variable grey band,
overcast here and there with indescribile green, extends
along the middle of the body from the gill covers to the
tail.

The sexes of young fish look very much alike, but at
roughly 9 months to 1 year old, that is to say when they are
about 2½-3 in. long, the rays of the male’s dorsal fin
develop black, streamer-like extensions. At about the
same time, if not before, his caudal, anal and pelvic fins
become suffused with red. The female’s fins are clear.

Although B. arulius is a peaceful and spectacular in
appearance, in its larger sizes it does not make a satis-
factory occupant of a tastefully set up community tank.
For one thing, it dashes about too wildly for the comfort
and well-being of smaller or less robust companions.
For another thing, its extremely boisterous movements do
not permit stirred up sediment to settle, and this results in
permanently dirty water. Furthermore, the larger it
grows the more demanding becomes its appetite for
greenstuff (oh, how the tender-leaved plants suffer!).

Nevertheless, for all its failings, B. arulius makes an
interesting fish to keep by itself, or among a collection of
larger, non-aggressive species. For such a collection, the
tank housing them should be as large as possible and

Please turn to page 253
Expedition—Y.B.G. by R. E. MACDONALD

It was on one of those rare Scottish days with the sun beating mercilessly down from a surprisingly cloudless sky that our party left the base camp at Dunoon to penetrate the rugged Highland outback of Argyll. The object of our expedition was to investigate a legend concerning the existence of a gigantic species of the carp family.

We had pondered for some hours the previous night with the local natives (an act that called for the consumption of a vast quantity of illicit hooch that had been distilled, judging by the kick, somewhere high in the mountains of the Island of Islay), and had eventually learnt that our destination was to be the Younger Botanic Garden on the Benvorrie Estate.

Packed with stores and provisions, we left base just after high noon for the perilous 6 miles journey northwards along the A815 road. Being a descendant of Donald (Grandson of Somerled, King of the Isles), I was duly installed as interpreter and guide, a position which also arose from having made many night escapades from England across the Scottish border into the dangerous Norwegian territory.

Luck was with us and we covered the first stage of the journey without mishap and in good time, but on arrival at the outskirts of the Estate we were forced to dismount from our vehicle, which by now was to leave in a prepared reservation, and proceed on foot. It was by this method of motivation that we entered the 85 acres woodland area of the Benvorrie Estate and the trek began in earnest!

The first part of our journey took us through an extremely impressive cathedral-like avenue of giganto Californian redwood trees. These trees are approximately 120 feet in height and are nearly 100 years old. Keeping to the beaten track we passed on to enter dense shrubbery, which later became more impenetrable, giving a wonderful view of the Forestry Commission offices (Benvorrie House) and Forestry School with its well-kept lawns that proved to be a fine example of Scots baronial architecture.

Leaving behind us, our last glimpse of civilisation, we entered the bush once more and started an extremely acute uphill climb through dense rhododendron vegetation. The going was hard and frequent rests were taken to ease our heavily-heavy knees while the sun bore ferociously on the rhododendron leaves—some a mere one-third of an inch in length, others a full 24 inches. Conifers, pine, spruce, fir, larch and sneaky-puzzle trees were passed until the summit known as the 'View Point' was finally reached. What a breath-taking scene lay before us! The landscape in all its magnificence unravelled itself into the far distance, where etched across the scene lay the sparkling waters of the flooded Holy Loch.

After a much-earned rest, we left the summit and made our way down-hill towards our goal. Tension mounted as we passed once more through the dense undergrowth until eventually the Formal Garden with its roses and flowering shrubbery came into view. We were not so very far from our destination and after passing the water garden with a beautiful willow garden in all its glory we had arrived!

To an aquarist with a love for natural settings, the sight that beheld us was indeed a picture of perfection. Amid all of the wonder of the surrounding Scottish scenery lay a most superbly set-out piece of aquatic architecture. In an open area, there emerged from the still waters a most delicate fountain that gave forth glittering droplets of liquid colour when caught by the sun’s rays, and which added an exquisite tinkling of sound to a most pronounced air of serenity. Towards one end of this most beautiful and natural pond arose an island made accessible by means of a rustic bridge. Nearby, a small stream emerged from the undergrowth and all around were splendid rhododendrons, primulas, Himalayan poppies, azaleas and fuchsias that gently covered the rich soil from which sprang Lobelia felina.

It was here our search ended, for inhabiting the pond were the most gigantic golden carp that I have ever seen. Some of the specimens observed were every part of 15 inches in length! In this fine secluded spot, free from the ever-hungry leeches of heron and in an environment of clear and virtually parasite-free mountain water, they were enjoying a life almost completely unmolested.

The fish proved to be quite friendly and in response to some enticement, great gaping holes of mouths were thrust clear of the surface to provide onlookers with spectacles for spare food. After many gifts of this nature had been bestowed upon them, the fish obligingly glided through the water to provide us with the opportunity of photographing them. When our wants had been fulfilled, these impressive creatures majestically disappeared into the depths of the surrounding water like the ghost of a lost tribe.

Our mission completed, we departed from the area with the feeling most prominent that we had observed something very rarely seen by human eyes. Then, after a short break for liquid refreshment, we returned to our base with absolute pleasure from the awe-inspiring creations of Nature that we had seen on that wonderful sun-drenched afternoon.

THE AQUARIST
The Outdoor Reptiliary

(1) MAKING A START

by ROBERT BUSTARD, B.Sc.

Every keen collector has, as one of his major aims, the construction of an outdoor reptiliary where he can watch his animals in some semblance of their natural conditions. Indeed this is the only way in which many sun-loving lizards such as the green lizard (Lacerta viridis) can be kept alive and healthy for long periods. Indoors, with permanent artificial light, these lizards are apt to develop skin diseases that may prove fatal. The beginner will want to know what type of reptiliary he should build—and this is the purpose of this article. Although many of the writer's friends have their gardens dotted with reptiliaries and ponds, the average collector will be able to build only one reptiliary, and must therefore plan it most carefully. The first consideration is what type should be built?

The most popular type of outdoor reptiliary—at least in the South of England—consists basically of a mound island with a containing wall. An excellent reptiliary of this type is to be seen in the gardens of the Zoological Society of London, and is suitable for most of the European animals that the collector is likely to obtain. It occurred to the author, however, that there would be advantages in a reptiliary that was completely enclosed—in fact fly-proof.

The fact that it is roofed over would allow it to house many species that do not appreciate the amount of rain to which we are subjected, would ensure that it did not allow such born climbers as anoles lizards to escape, provided they are with ridged lamellae on their feet so that they can climb a vertical sheet of glass, and, also worthy of consideration, would allow the feeding of large quantities of pellets that would not be lost whenever they turned into blue bottles. This type of reptiliary, with only minor modifications, can be made quite suitable for European amphibians (the provision of a glass roof to allow the rain to enter, instead of a glass roof as recommended for reptiles, and the addition of a larger pool, are the only changes that need be made).

The location of the reptiliary is the first important consideration. If for reptiles, then a sunny position should be chosen. The one in my garden shown in the accompanying photograph faced east, so that it received the early morning sun. Indeed it had the sun all day until late in the evening, when the lizard inmates would climb up to rest in the last rays of the setting sun. When it was constructed I had planned to extend it towards the left to enclose the lower portion of a wild plum tree and to make this shady...
corner into a home for European amphibians. The cement font was laid, the pool constructed, but alas the work progressed no further as my interests turned more and more to tropical and bizarre amphibians that were not suited to a life out of doors.

Once the site is chosen and the size decided—this latter being largely governed by personal preference—then the cement font can be laid. The repitulary illustrated was 6 feet 6 inches long by just over 4 feet wide. The height at the back was 5 feet 6 inches, falling at the front to 4 feet 9 inches. The purpose of the font is twofold: (a) to provide a sound foundation on which to build and (b) to prevent animals digging their way out. Despite this precaution slow worms (Anguis fragilis) appeared in the garden quite often, having presumably burrowed their way out. The font was laid to a depth of 9 inches and was 9 inches broad. It was constructed of 3 parts of ballast (gravel) to 2 of sand and 1 of cement.

After several days had passed and it had had a chance to set firm, the brick work was commenced. This involved building the two ends to a height of approximately 2 feet 6 inches and the front only two bricks high. For this purpose old bricks were used and the cement work was left rough on purpose. This provided excellent climbing places for the lizards later on. The concrete was made from 4 parts of sand to 1 of cement. In this repitulary a brick wall acted as the back of the enclosure. The remainder of the construction was of wood. The two ends were covered with perforated gauze of the type used in meat safes and the roof and front were glazed. The front consisted of two sliding doors for easy access and these were removable if required at any time.

In the construction of this repitulary no floor was provided so that it was possible to plant the vegetation directly in the ground. A well-established plant of everlasting sweet pea was enclosed during the construction and provided excellent cover, and a small purple osier (willow) tree was planted the following spring. A small concrete pool had been provided; as in the author’s opinion this natural-looking pool was preferable to a baking dish sunk into the ground. Some people indeed cover the bricks on the inside with pieces of bark. It is a good plan to plant some well-growing ferns in small pockets of soil in the rough brickwork.

The repitulary is now ready for use and late April is the best time to stock it. Suitable inmates will be considered in the next article.

Who Judges the Judges?

WOULD you allow an untrained surgeon to remove your appendix? Trust the repair of your car to some unskilled mechanic? Of course you wouldn’t—yet all over Britain fishkeepers in all good faith entrust the judging of their fishes to untrained judges.

Now don’t me wrong; I’m not criticising judges personally, but rather the system that throws them into the lion’s den of show business without adequate training. There are exceptions to this, of course. The Fancy Guppy Association and the Federation of Guppy Breeder’s Societies (to mention but two) run excellent training schemes. Through these organisations aspiring judges can learn the necessary groundwork about the theory and practice of show judging, both backed by two excellent Standards Handbooks. It is the other systems, that choose their applicants by society proposal and committee selection, that are in need of overhauling.

Every single fishkeeper is a judge in the dictionary sense of the word: he exercises his selective powers with every breed of fish he rears or shows. But now let us examine the “official” meaning of the word and its implications.

A “judge” is usually a fishkeeper well versed in aquarium-keeping. He must display the right temperament (and thick skin), to travel about visiting shows to perform the thankless task of selecting winners. His remuneration is small, praise usually coming only from those “in the trade.” In fact, if it wasn’t for his keenness he wouldn’t do the job at all; to sum up judging is just plain hard work!

Most of the present-day fraternity consist largely of a core of old hands, who, having had little to guide them in their youth, have formed their own ideas on what constitutes a good fish. Mention has been made of the guppy followers being well catered for; so, too, are the coldwater followers. It is the balance that I am concerned about.

Much hard work has been done in the past by the aquatic Peers and organisations like the F.N.A.S. and F.R.A.S. to formulate standards and guides for judges, but more can be done. What, for example, has been achieved to bring existing standards in line with the new fishes concerned?
The Garden Pond in March

by ASTILBES

There garden pond will now be springing into life after the winter's rest. There will be many signs that life is awakening by the appearance of frogs and newts, to say nothing of the new growth among the water plants. This is always an interesting time for the pondkeeper, as hopes springs eternal, with thoughts of the many fishes which will be bred during the coming season or of the gorgeous flowers on the new water lilies. These plants will always be the prime favourites among pondkeepers as no water plants can approach the water lily in beauty in the pond. Not only are the flowers handsome but the foliage on most of the species is also very attractive. The types Nymphaea maritima are particularly handsome in leaf as the large shiny leaves have bronze markings on them which give added colour to the pond.

There are many colours in this strain and for the average sized pond few types of water lily can beat them for ease of culture and beauty of flower. April is usually the month for planting water lilies but planting can be done in March if the weather be fairly mild and the plants do not have to be left out of the water for long periods. If one is dividing an established plant then it will be quite easy to take outside off-shoots that are already well rooted and which can be planted up to form new specimens. The old stock can become rather gnarled and worn and there is no doubt that young pieces taken from the outside of the clump will soon make splendid plants.

These off-shoots should be treated with great care; the flower buds should be visible and as these are very tender they are easily broken off. Naturally, if most of these buds are broken there will be a dearth of flowers for the coming season. The roots are also very tender and care must be taken when planting to see that as many as possible are saved. For any medium sized pond, say not larger than about 10ft by 10ft, it will be an advantage to plant the lilies in separate containers rather than in earth at the base of the pond. It may seem all right when first done but after 2 or 3 years the plants will have made such enormous growth that there will be a danger that their roots have taken charge of the whole base of the pond and other plants will be choked out. Not is this the only trouble, as once the stage is reached when the lilies have taken too large a hold it is no easy task to get things back to normal. On the other hand, if the lilies are planted in pots or similar containers it will be a simple job to remove them from the pond for cleaning purposes or for repotting when necessary.

Special large pots with holes in the base of the sides can be obtained and if a mass of concrete is made on a sheet of paper the pot can be pushed down on to it so that when it sets the pot will be surrounded by it and will not fail over when in the pond. Another useful tip is to run some plastic cord round the rim of the pot and then over the top of the lily reice. This will prevent the lily from floating up out of the pot when there is a good head of leaves to the plant. Some growers recommend that some form of manure should be used, such as rotted cow manure or broken bones, but the use of any form of fertilisers can upset the water in the pond and also there is usually no need to encourage the growth of a water lily.

Provided that the stock was a healthy one the new plant will grow apace, as it will never be short of water, as might a plant in the garden, and if fishes are present there will never be a shortage of droppings to give any necessary manure. Remember that one of the most important uses of the lily is as a form of scavenger. When growing healthily the plants will one up most of the waste matter in the pond and so assist in keeping the water pure. Another point is that their leaves will give a welcome shade for the fishes on hot days, and in fact on most days it will be seen that some of the fishes are always just below the leaves where they can watch for any food that may fall into the pond.

Having excited the water lily so far one might imagine that their usefulness was ended, but such is not the case. The chief bugbear of the pondkeeper is green algae, which turn the pond water into a kind of green soup so that the fishes are invisible. As these algae will only thrive in water which receives plenty of sunlight it will be appreciated that the shade given by the lily leaves will help to keep down their growth considerably. When planting a pond for the first time one is often tempted to overdo the task. Great care must be taken when planting to see that there is little chance of the lily leaves covering the whole surface of the pond. Should this happen it will be proof that the pond has been over-planted. A balance must be kept between plants and water surface, as once the lilies become too rampant their leaves can cover the top of the water, and when unable to find space there they will grow up into the air. Not only will their beauty be lost but the inhabitants of the pond will not be seen.

Few other water plants can equal the lily but there are several very useful underwater plants that will perform a useful service. Although it is not so important to have a good crop of oxygenating plants in the open pond as it is in the tank, as plenty of oxygen will enter the water from the atmosphere, the presence of plenty of these types of plants will ensure that the green algae do not get a chance to become established. There are only a few of these plants readily available and suitable for this purpose. The best ones for the general pond are: Eleocharis densa (formerly Eleocharis densa), Lagarophyton major (formerly Eleocharis crassipes), Eleocharis canadensis, Ceratophyllum demersum and Ranunculus aquatilis.

It is not suggested that all these plants should be used in a medium sized pond. In a small pond any one would probably prove sufficient. As the season wears on so the growth of these plants becomes tremendous, and one
A healthy piece of plant in early spring could almost cover the bottom of a small pond by the autumn. *Laguncularia racemosa* is an exceptionally fine plant as it sends out many shoots, which can grow several feet in a few months and each side shoot can send out many more. The *Ceratophyllum demersum* does not make any roots but will become embedded in the muds at the bottom and make rapid growth. The fine tightly packed leaves form an excellent receptacle for holding the eggs of these fishes that lay adhesive eggs. *Remora* aquilina, or water crowfoot, is often deprecated by some aquarists but it is one of the finest plants for the garden pond. The underwater leaves are very fine, and if the plant grows in fast running water these are the only type of leaves grown. In still water, however, the plants send out almost round showy leaves to cover a large part of the surface, and these are followed by pretty white flowers, with the shape of buttercups. A mass of these flowers makes a very pleasing sight and no other readily available water plant can equal this plant for decorative value or as an oxygenating plant.

Do not neglect the floating water plants for the newly planted pond. A really good covering of duckweed, *Lemna gibba* or *Lemna minor*, can give shade to help choke out the green algae that might form in the new pond. This plant is also eaten by many types of fishes, including the goldfish. Here is one point to watch, however, when using this plant, and that is if it is left alone for too long it may become too thick and a nuisance. It can soon be cleared from a medium sized pond by placing a hoe on it and so driving it towards one side, where it can be raked out quite easily. The ivy-leaved duckweed (*Lemna trisulca*) is not of much use in the pond as it grows just below the surface, and is inclined to become very pulpy and weak and mass into an unsightly layer after a time.

When planting a new pond or remaking an old one always try to visualise what it will look like in five or six months' time, and remember that most water plants make rapid growth if due care is taken when planting.

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**BREEDING FANCY GOLDFISH**

**Conditioning the Parent Fish**

By A. Boarder

Having obtained a good stock of breeding fish the most important task will be to prepare them for breeding. The method to adopt will depend on whether breeding is to take place under cover in tanks or in an open pond. There are several differences of procedure and so the method for indoor work will be described first. It is usual for the sexes to be kept separately through the winter as when the fish are put together in the spring they generally take more interest in each other than if they had been together all the time. Before the introduction the fish should be fed very liberally. As long as they will clear it up food should be given two or three times a day.

Garden worms should be given every day if possible, with any other live food available. See that a fairly mixed diet is given; do not limit to one food only as so matter how good it might be there may be something lacking in it that the fish might miss. Each day the fish should have some vegetable matter, such as wheat germ or rolled oats. Then give a little dried shrimp and some dehydrated meal as used for cat or dog food. Make sure that the water in the tanks is kept pure, as once a slight fouling takes place the fish will go off food and what is given will only make matters worse.

See that all food given is cleared up completely in about 5 minutes. As long as the temperature of the water is about 60°F (16°C), the fish will be able to digest their food quickly and so can be fed three times a day.

Do not be afraid to change some of the water in the tanks occasionally, say once a week. The idea that tank water should never be changed is an old-fashioned one that does not hold up to modern reasoning. A partial change, up to a third, of water each week tends to remove some of the excess of soluble and supplied substances that is accumulated by the fish. The difference in the appearance of the water that has just been correctly serviced will reward the aquarist for his trouble.

The treatment of fish that are to be bred in the open pond will vary slightly, as there is no need to feed as often. Although the prospective breeders must have plenty of good nourishing food it must be realised that they will not need as much food as the fish kept under cover. The colder water will slow down the digestive processes for one thing, and it must be realised that the fish are likely to obtain plenty of natural food in the pond. Care should therefore be taken to ensure that no extra food is given. Try to feed at the same spot each time, where surplus food could be seen if it is not eaten soon after having been given. Watch the weather and the temperature of the water as the feeding of your fish is almost completely governed by these. On cold days no food should be given at all. Once the temperature of the water rises above 70°F (21°C), it is possible that the appetites of the fish will increase. This is the time gradually to increase the food so that the fish are in the very pink of condition before breeding time.

What is breeding time in the pond? Well, it can be any time from April to September. In odd seasons I have known a spawning in October (not that this is worth troubling over, as the fry are just a nuisance all through the winter). An early spawning, not later than the middle of June, will enable you to get the fry to a size of about 3 inches overall by the winter. This will make things much easier for you. It is quite a good plan to give all breeders a salt bath before the season is too far advanced. Do not put in too much salt, a tablespoonful to 14 gallons will do.

Examine the fish to see that there are no parasites such as fish lice on them. At the same time discard any fish that does not possess the characteristics required for your particular strain.

Now it is necessary to see that you have plenty of the right kinds of water plants for spawning. These are not always easy to procure early in the year, although later on they may be in such quantities as to be a nuisance in the pond. The fine-leaved plants are the best, as these give the eggs a good chance of adhering and also provides some cover from egg-eating parents. Hornwort (*Ceratophyllum demersum*) is a very good and *Myriophyllum aquaticum* is another suitable plant. *Elodea canadensis* is a useful plant and can often be obtained early in the year. This can make a denser mass which is favoured by spawning fish. Artificial material can be used if desired, and nylon pads opened up make good receptacles for eggs and will not hold the peas often found set plants. The next article will deal with the actual spawning.
The Butterfly Cichlid

(Apistogramma ramirezi)

by T. ROLAN

CICHLIDS! To many an amateur aquarist the word raises a picture of a rather large, striped, mean-looking fish, savage and aggressive. Certainly this is true of many cichlids, but they are nevertheless one of the most interesting of all the aquarium fish, and among the dwarf cichlids can be found species that do not exhibit the precarious qualities of their larger kin and which are eminently suited to aquarium life.

Of these, many who have kept them would claim pride of place for Apistogramma ramirezi or butterfly cichlid, native to Venezuela. Like most cichlids, their colour can be acquired only just before spawning, but when they are in breeding trim their magnificently variegated fins are intensely beautiful. Swallowing only to a length of 2 in., they are active and peaceful and behave themselves with other fishes. They breed easily, producing numerous young, and if it requires a little extra care to keep them in first-class condition this should present no particular problem if the basic principles of fish-keeping are followed.

A great deal has been written about their care, possibly to the confusion of the amateur fish-keeper, as the definitions of the best conditions under which to keep these fish seem to vary somewhat. This is doubtless due in part to the fact that, for instance, while the degree of hardness and the pH of the tank water, they have been kept under a variety of conditions. It would seem agreed, however, that the fish reach a peak of condition only in clear, soft, slightly acid water, kept at a temperature of about 80°F (26°C). Unlike the majority of cichlid species, in whose tanks rockwork must be left as decorative feature, A. ramirezi like tanks planted with Echinoderus rangeri, Amazon sword or Cryptocoryne. Food should be as varied as possible, and since fish food will be taken, a selection of Daphnia, chopped earthworms, chopped Tubifex and, eventually, white worms and chopped earthworms can be given.

The young of the young fish is almost impossible, but once they start mating the female is easily recognised by her plumpness of body and the fact that they do not allow spawning her breeding tube can be clearly seen. Mating pairs withdraw themselves from their tank mates and the males defend their position in characteristic cichlid fashion with their dorsal fin held stiffly erect to frighten and drive off any enemy.

It is possible to keep butterfly cichlids as community breeders, and successes with this method have been recorded, but anything that is likely to disturb the parent fish increases the difficulties of hatching the fry and the likelihood of the eggs being eaten. The safest way is to transfer the breeding pair into a specially prepared tank, temperature about 85°F (29°C). The floor of the tank should be covered with sand or gravel, which may now be pushed by the female fish into small trenches for spawning; it is much more likely, however, that the flat surface of a stone or of a broad-bladed leaf will be chosen, so the tank should contain both rockwork and a quantity of plants such as Cryptocoryne. In any case the chosen medium will be cleaned by the fish of algae and dirt and spawning will begin. Any number from 100 to 300 amber-coloured eggs will be laid in a neat round formation, which immediately is removed by the eggs after spawning. This is recommended as parental care of the eggs is not always reliable. The tank should be placed in water similar to that in the breeding tank, to which has been added a little methylene blue (four drops of 5 per cent. methylene blue solution per gallon should be weak enough to prevent the eggs being spoilt and yet sufficient to prevent fungus covering them). Steady aeration must be provided and hatching will take place from 36 hours later. During this process the temperature must not be less than 80°F (26°C), though some aquarists advocate a sharp increase to about 95°F (35°C) to speed the hatching process and thus lessen the time lag during which the eggs could become covered with fungus. In this case, once the fry have hatched the temperature must be slowly reduced. Some 4 to 6 days later the young fish make their first attempt to swim and, if they are well fed on newly hatched brine shrimps, will grow very quickly. After about 14 days they may be fed on sifted Cyclops nauplii and then micro worms and Daphnia, chopped Tubifex and, eventually, white worms and chopped earthworms.

Providing that the parent fish are being given a varied and liberal diet they will spawn again quite soon. An adult female will spawn at about 14 day intervals and will naturally mate non-stop provided she is not overcrowded and is not too often handled. The number of each hatch will vary from about 50 to 6 months and produce fry for a further 5 or 6 months but it has been noticed that when the parent fish reach the age of about 1 year a number of each hatch become very dark-coloured and do not grow with the customary speed, and the process of deterioration becomes more marked with each hatching.

Unlike many cichlid species, which live from 3 to 10 years, Apistogramma ramirezi have a life span of only about 2 years, but that will be sufficient time for the aquarist who possesses them to become convinced that these beautiful fish are in every way the ideal representatives of their family.

Barbus arulius

continued from page 287

head light are now provided egg-laying fishes almost as a matter of course.

The male is a hard driver, and he doesn’t stop chasing the female until she is stripped of eggs. After mating is over, the male is transferred to fresh quarters; for though spawned-out fish look wan and grey, it never takes them long to develop an avid appetite for fresh food.

At a temperature of 78° or 80°F the fry hatch out and become free-swimming within the space of 6 days. For the first 3 weeks or so of their lives they require plenty of infusoria; and though not a necessity, a cupful of green water (free-floating algae) introduced into the aquarium (at exactly the same temperature) every other day helps to promote healthy growth.

From this point onward, larger food should be given, and among the most suitable kinds are very small Daphnia brine shrimps and micro worms. If powdered dried food is on the menu, it is important to see that it is chopped or dip-tried from the bottom at the end of each day.

March, 1962
House-Plants in the Fish House

THE INDIA RUBBER PLANT (Ficus elastica decorum)

by BARRY R. JAMES

This species is undoubtedly the most popular of the large house-plants. In appearance the India rubber plant is quite striking, with large, glossy, ovate leaves which may reach up to a foot in length and some 6 inches in width. The leaves are arranged spirally on the stem and originate from an upright terminal shoot protected by a bright red sheath. Although specimens offered for sale are comparatively small, the type, Ficus elastica, will grow up to 100 feet tall in Southern Asia, its native habitat. A fine specimen some 15 feet in circumference can be seen in the Reptile House at the London Zoo.

Rubber plants appreciate a cool shady position and an average temperature of 60°-65°F (15°-18°C). Watering should be frequent during the growing season, which extends from the end of March to the end of September. Feeding either with liquid or solid fertilisers should be carried out regularly during this period; but no feeding and a minimum of water should be the rule during the colder months.

To keep rubber plants in sparkling condition, regular cleaning of the leaves is necessary, as they soon collect the dust, which if allowed to remain would be detrimental to the health of the plant, as well as its appearance. Occasionally the leaves should be gently wiped over with a solution of water and milk, to retain the glossy texture on the upper surface.

Propagation of these species is not practicable in the home, as a temperature of some 50°F (26°C) is necessary. Cuttings are normally taken in late spring and terminal cuttings, i.e. those containing the terminal shoot, are more likely to be successful than cuttings from other parts of the plant. Hormone powders such as Seradix are used extensively by nurserymen these days and will ensure faster rooting.

Repotting when necessary should be done with John Innes potting compost no. 2 (J.I.P.2) or J.I.P.3 and a little leaf mould and well-rotted dung should be added to the mixture for the best results.

A beautiful variegated variety of this plant, F. elastica var. Doucetii, has been available for some years and differs from the type in having longer, narrower leaves, coloured light green and cream. It is rather more delicate than F. elastica and needs a warmer environment and a rather more delicately balanced watering schedule than its hardy cousin.

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<th>Troubles</th>
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<td>Drooping of leaves and stems</td>
<td>Overwatering</td>
<td>Cut away diseased parts</td>
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<td>Yellowing of leaves</td>
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<td>Repot with fresh compost</td>
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<td>New leaves small and wrinkled</td>
<td>Plant is pot-bound or needs additional feeding</td>
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<td>Sudden dropping of leaves</td>
<td>Fluorescent temperature, drought or too bright light</td>
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<td>Leaves hang down instead of remaining upright</td>
<td>Wilting due to insufficient light</td>
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Book Notice

Parasitology of Fishes edited by V. A. Dogiel, G. K. Petrushhevsky and V. I. Polyanski. Oliver and Boyd Ltd., Edinburgh. 84s.

A concise account of fish parasitology, marine and freshwater, based on the research of Russian biologists. Titles of sections in the book include "Ecology of the Parasites of Freshwater Fishes", "Relationships between Host Fishes and their Parasites", "Physiology of Fish Parasites", "Parasitic Diseases of Cultured Fishes and Methods of their Prevention and Treatment".

Dwargnost Water Test Kit

Distributors of the Dwargnost water hardness test kit, Windmill Products (London, S.W.1), have asked us to give notice of the adjustment of price of this product it has been necessary to make. The new price is given in their advertisement in this issue.
The comet goldfish is a very handsome variety but one which I consider to be essentially a pond fish. It can be kept in a tank but a tank under 3 ft. long would not be a safe home for any comet with a body length of 3 inches or more. This is because the fish is a very fast swimmer, and so it needs plenty of space if it is to remain healthy in a confined area. For the pond, however, this variety is ideal. It is such an active fish for the pond that I consider it to be one of the very best for inclusion there. Undoubtedly the comet appears to be difficult to obtain these days. Some 20 years or so ago there were quite a few of these handsome fish about, but of recent years very few good specimens are to be seen. I tried many years ago to get more aquarists interested in the variety but was not very successful in my efforts.

Streamlined Shape

The comet is a streamlined fish with a very long tail or caudal fin. This is the special feature which must always be present in a good fish. The body of the comet should be rather slim, with the depth less than half the length. The dorsal fin is rather high, more than half the depth of the body, and the pelvic and anal fins are of a similar size. The pectoral fins are small in comparison. The tail or caudal fin is very well developed, long and well forked with pointed ends. It should not be too well spread or flowing. The body of the fish should be covered with visible scales and not have the apparently scaleless body as seen in shubunkins. The colour can be all red, all silver or a combination of the two. I have noticed that most of the comets I have seen have a large proportion of silver on them. This is no set-back for exhibiting such a fish and as far as the pond is concerned it is such fish that show up very well and make a very attractive addition. Comets are sometimes found in a rich chrome yellow, and this colour is also recognized by the Federation of British Aquatic Societies as suitable for showing.

For exhibition purposes the fish must have a body length of 3 inches, excluding the caudal fin. Such a fish will need a good-sized tank for exhibition purposes, as nothing looks worse than to see a fish which is unable to swim about in comparative comfort.

Main Faults

The chief fault to be seen in many of the present-day comets is that they lack the long tail. This is the distinctive feature and so without it the fish is not a comet. I feel that one of the disturbing points about the development of the comet was the standard issued by the Federation in 1947, this showed an illustration of the fish with a huge spreading tail. This is in direct contradiction to the necessity of keeping a strain of fish that were fast-swimming. The wide tail would have been an obstacle to fast-swimming and many aquarists thought also that such a fish would be very difficult to breed. When the Standards were revised the caudal was shown as being far narrower and was definitely more suited to a fast-swimming fish. It is to be hoped that breeders can now produce some exception fish somewhere near the present-day standards.

Another fault seen in some of the comets is that their bodies are too deep or stout. This heavy body does not go well with the desired streamlined general appearance of the fish, and so all such fish should be avoided in the breeding strain. To keep this fine fish healthy I suggest a fair-sized pond and plenty of garden worms in the diet, these being given at least twice each week. Too much starchy food should not be given and an almost entirely animal diet would be better if possible. The fish is quite hardy and rarely gives any trouble provided that the normal care is taken to see that the water in the pond remains pure.
Can Fishes Hear?

by DAVID GUNSTON

Can fishes hear? It is an interesting question, but because of the absence in fishes of ears of the human or mammalian type, and the vast difference between sound in the air and sound under water, it is a controversial and complex matter, full of apparent contradictions and marked by a startling lack of real knowledge.

For a long time it was generally supposed that fishes were, to all intents and purposes, deaf. Then various anecdotes and experiments occurred which began to elucidate the question, and in recent times there have been many accurate scientific tests on the hearing of fishes of all kinds. The classic example of the inconclusive type of early experiment is that of the Benedictine monk who kept a fish in a pool at Krems, in Austria. He had the notion of ringing a dinner-bell whenever he fed them. Standing on the edge of the water he had only to swing his bell a few times, and the fish would collect for their food. Then one day someone tried the trick without using a bell, merely swinging his arm up and down. The fish came just the same; it was the sight, not the sound, that had attracted them.

Sounds, to exist, must be vibrations in the water, not vibrations in the air, which is what we ourselves hear. Not many fishes can hear aerial sounds to any extent unless they are accompanied by some vibration through the ground into the water. Fishes have no external ears, and, unlike human beings, no middle ears. They possess only the sensitive inner ear, embedded in the bones of the skull. This leaves them under no disadvantage, however, for human ears are designed to catch sounds from the air and the actual hearing mechanism is the delicate inner ear, a capsule surrounded by bone and filled with liquid. In the water, which is a far better conductor of sound waves than the air, the fish needs neither outer nor visible ear nor middle ear to transport the sounds. It needs only a simpler inner ear, immersed in the liquid, for it is already in that transmitting liquid, the water.

But in human beings, the ultimate organ for turning actual heard sounds into nerve impulses is altogether missing in fishes. All it has is a small projection on the Auditory nerve (the sac-like region surrounding the spiral cochlea, when it is present, as in human beings and mammals) called the lagena, which appears to be a far less delicate piece of mechanism. This fact seemed to indicate that, after all, fishes cannot hear. But missing cochlea apart, experimenters have proved that fishes can hear, and hear well, so we must conclude that the lagena plays as its function in the actual retribution of sounds on the brain.

The ear of various kinds of fishes, although conforming to that prism, vary considerably. The simplest type of ear occurs in the bagfish, where a semicircular canal has a swelling at both ends which contain a jelly-like substance connected by fine hairs through sense cells and nerve fibres direct to the brain. Hearing is effected by oscillation of the jelly, which in turn moves the hairs and sends messages to the brain. In lampreys there is an additional canal set at right angles to the original one, and with swellings only at one end. This gives a better sense of movement and balance, which are, of course, the other function of ears. In the cartilaginous fishes there is a third canal covering the remaining space, and the more highly developed fishes have minute grains of chalk, or otoliths, suspended in the jelly to make it even more sensitive. There are also some variations in the way the ears are connected to the external surface of the fish. Some lead through ducts direct to the water, others to the swim bladder. In the latter cases, vibrations of the water are picked up by the swim bladder and transmitted to the ears.

Even when it became obvious that fishes could detect what we call sounds, some objected with the explanation that such noises as tapping on a fish tank, or making a vibratory sound close to the water, were not really "heard" by the fish, but registered through the skin in much the same way that we can "hear" the sound when we place a hand on a piano being played.

But the experiments of Professor J. P. Finlay proved beyond any doubt the hearing capacities of fishes. Defining hearing in fish as "any disturbance that produces hearing in the human ear which calls forth response in fish if it acts through the ear and not simply through the skin or some other organ," he placed a telephone inside a small basin, submerged it in water and directed sounds of varying pitch at goldfish. He found that normal goldfish responded to all vibrations from 43 to 2,732 per second. Human hearing is roughly from 30 to 30,000 vibrations per second, with middle C at 256. By submerging the fish with an electric wire loosely fastened so that they could swim easily, the telephone sound was omitted and a weak electric shock given to the erethic fish simultaneously. They reacted with violent movement in the water. After 40 tests, the shock was omitted and the fish responded as before to the telephone sound.

Other tests have shown that fishes can be trained to come for food, or move from one tank to another to eat food, by making noises close by overhead. Tin whistles, organ pipes, guitar strings and tuning forks have all been used in this way with marked success, often as low as five or six trials only being needed to make the fishes understand. Minknows have actually been trained to react differently to two different sounds by feeding them when one is made and hiding them gently when they hear the other. Killifish responded to frequencies of only 50 when a violin string was stretched across the aquarium. Other fishes have been recorded as responding to much higher sound frequencies: the minnow to 7,000 vibrations per second and the cutthroat trout to 13,000. Frank Lane records a meeting a lady who stated that her two pet corgi actually "danced up and down" when dance music came over the radio near their aquarium.

The subsequent work of the two German investigators.

Please turn to page 288.

THE AQUARIIST
Crayfish—Information Wanted

For a long time we have been interested in the study of the life of crayfish (Astacus fluviatilis). Careful research has been made in our fresh waters and some scientific conclusions are nearing to their end. As a result a scientific paper is being prepared for publication.

Our research covers not only the field of the crayfish's life and its habits but studies the preservation of its life as well. Industrialisation with its waste-waters, various diseases and parasites, uncontrolled and unplanned catches, all these factors, no doubt, are reducing considerably the number of crayfish.

To make our study as complete as possible we shall be greatly obliged to you if you could write to us about the life of crayfish in your country. Any publication, manufacturer's literature, articles in the press etc. will help us.

Mainly we are interested in the following questions:
1. What kind of crayfish is living in your waters?
2. What are the animal's weights and measurements?
3. How are the qualities of the respective waters?
4. Is the crayfish in your country artificially raised (crab-farming) or is it an item of your food industry?
5. What are the most important diseases or parasites?

Zdenek Beranek
Anglicka tr. no. 3
Prague 2-Nové mesto
Czechoslovakia.

Plastic for Metals

There is now on the market a polythene powder sold under the name of Plastitone, for the plastic coating of metals. What a boon this would be to aquarists (especially marine aquarists), if some enterprising manufacturer would produce tank frames treated with this substance. The cost is quite reasonable (5s. treats 300 sq. in.).

I hope you can print this letter, and that it will catch the eye of an aquarium manufacturer.

F. Dryway
(Goole and District Aquarist Society)
Manufacturers of Plastitone are: Electro Chemical Products Ltd., High Street, Coleshill, Bucks.

Calling Cornwall

In the near future I am going to live in Penzance (Cornwall). Can you give me any addresses of tropical-fish dealers or hobbyists near Penzance? I keep eight fairly large tanks, and I intend to move them down there as you will understand. I would like to know somewhere to get my plants, fish and foods etc. from.

Just recently I visited Penzance, and, after asking at various places, I couldn't find any dealers at all.

R. Claridge
74, Kingscliff Road
Small Heath, Birmingham 10.

Readers and dealers in Cornwall who can help Mr. Claridge are invited to correspond.—Spectro.

March, 1962
Owls and Pond Fish

I do not wish to be guilty of dragging up old scores, but I think that such a move may be justified when entirely fresh and relevant information comes to light. My article "Of Cats, Fishes and Bears" appeared in the Aquarist for January, 1961. In the April issue, 1961, a letter by Mr. P. M. Fuller, in strong disagreement with my claim that owls sometimes take goldfish, was printed. In rebuttal I was only able to state, at that time, that fish remains, not necessarily goldfish, had occasionally been found in the stomachs of owls.

I hope I may now be allowed to point out that in Adventures Among Birds by Hugh M. Halliday, a professional bird photographer, on pages 73 and 74, appears a clear statement that screech owls commonly catch fish, and fish remains are to be found in their pellets. Following this, the author gives an authentic account of a screech owl caught in the act of eating a freshly caught goldfish.

The screech owl (Otus asio), a very common small owl widespread in North America, almost certainly has a counterpart in Europe, though I do not know what common name it goes under.

R. GUPPY,
Wellington, B.C., Canada.

Hawaiian Mouthbreeders

My pair of Hawaiian mouthbreeders have just spawned and hatched out 50 or more. I understand this is unusual, according to your December issue?

J. R. Robinson,
Rumon, Harrow,
Middlesex.

Can Fish Hear?

continued from page 256

at the University of Munich, von Fritsch and Stetter, have shown that fish hearing is better than was originally supposed. Minnows were blinded and when fed were taught to associate the appearance of food with a low sound made by a whistle or a tuning-fork. After 12 or 15 times a reaction was obtained, and the fish could actually hear sounds made 10,000 feet away. A man diving into a larger aquarium alongside that containing the minnows could not be heard by the sounds any better than they obviously did. The range of sounds heard was proved to be quite great, and the experimenters showed that sounds much higher or lower could also be heard, as well as sounds only very slightly different in pitch, provided that food-reactions were set up by practice. Some fish were even able to distinguish between a note and its minor third.

So therefore we have quite definite proof that a number of kinds of fishes, among them minnows, goldfish, eels, carlfish and whitefish, do hear, and there seems every reason to believe that tunny, tarpon, pike and many larger fishes hear likewise. Only the sharks and rays hear less well, it appears. Fishes in shallow waters hear as a means of avoiding approaching danger, and those in the deep sea, well, the ocean has now been proved to be a noisily, not a silent, place, and if its denizens make sounds as they quite definitely do, Nature obviously means them to be heard.

In next month's issue of The Aquarist will be included photographs of tropical fishes in full natural colours.

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THE AQUARIST

The AQUARIST
Crossword

Compiled by J. LAUGHLAND

CLUES ACROSS

1. Very large family of tropical fishes including urge (9)
2. Qualified accountant takes half the carp (6, 4)
3. Object of the claim (3)
4. Fat, fishy smell (2, 3)
5. The movement of the egg (4)
6. Stained animal or enamel (7)
7. Fished in short and partly frozen seas (9)
8. Mأ‌ncأ“ca, one of the great orders of fishes (5, 5)
9. Drop ends (9)
10. A crossbreed or a medium, aquarium plants (7)
11. Common etymon you may get in the throat (9)

CLUES DOWN

1. Aquarium plants with lance-shaped leaves (12)
2. Sickly and fill most of the bowl (5)
3. The (5, 9) acres (1, 4)
4. Auburn brown sounds like a chew (12)
5. Mercury dryer (8)
6. Style of a knight (6)
7. Is better than for fry that grew badly (13)
8. The king's cross needle (8)
9. That sounds of (6, 5)
10. Contain in general (6)
11. Mixed wash in lake (8)
12. eye of pair (6)
13. abbreviated but no animal (7)
14. One-up one, the place a money (12)
15. Operations to be held (9)
16. River lapins (6)
17. Feed fish and mouthbrooders (6)
18. Afton (9)
19. As in 37, Goldfish (6, 4)
20. Fish feeders, especially from old duck (4)
21. Live (6)
22. This is in 7 (1)
23. Nearly all, Mr. Capone (8)
24. (Solution on page 265)
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.

THE WELSH NATIONAL A, election of officers held on May 12th. Mr. A. H. Smith, was elected Chairman. Mr. M. J. Hughes, was re-elected Secretary. Mr. D. R. Smith, C. G. Williams, and Mr. D. F. Jones, were re-elected Committee members. Mr. W. H. Hughes, was elected Honorary Secretary. A show was arranged for the coming year.

Mr. John White was elected Hon. Vice-Presidnet.

ONE Society in a happy position is the Bred- ford and Huddersfield A. With an increased membership—lighter than it has been for some years—sufficient support for the various events will now be assured. Several new members have joined the society and new shows have been arranged for the coming year.

Mr. S. W. Brown was re-elected Secretary, Mr. D. G. Smith, C. G. Williams, and Mr. D. F. Jones, Committee members. Mr. W. H. Hughes, was elected Honorary Secretary. A show was arranged for the coming year.

The Society welcomes new members and those who are interested are welcome to attend.

The seventh meeting of the Dundee A was held at the Royal Hotel, Dundee, on April 25th. The main event of the evening was the show for the Society Trophy, which was won by Mr. J. H. Brown, with Mr. G. M. Brown, and Mr. J. H. Brown, runners-up. A good attendance was reported. Based on the report and attendance, the society is building a strong foundation for future success.

The society's enlivening Chairman, Mr. D. Anderson, was elected Hon. Vice-President. The society continues to grow and attract new members, with a focus on educational and social events. Attendances at events are regular, and new members are welcome to join.

SOME changes took place in the administration of the South London Aquarists' Society. Mr. G. H. Grieve, was elected President and Mr. J. A. Mayhew, was appointed Hon. Secretary. The society continues to thrive with regular meetings and events. Attendances are high, and new members are welcome to join.

At the Annual General Meeting of the Northampton and District A, Mr. C. G. Morris, was elected Hon. Secretary. The society continues to grow and attract new members, with a focus on educational and social events. Attendances at events are regular, and new members are welcome to join.
AT the monthly general meeting of the Brighton and Southern A.S. it was reported that mem-
bers had been much interested during the year,
which was the most successful in the club's history.
Events in shows were the highest ever, with many of the most unusual plants appearing for the first time. It was hoped to
form a Junior Section this year. Other plans included the
restitution of the P.N.A.S. and the A.Y.A.S. and a visit to the
Exhibition in the Public Library. The show secretary, Mr. R. Carter, was
appointed to the committee and the arrangements were
made by Mrs. E. Fisher. The show was to be held on the first
weekend, and the details were
published in the Club's magazine.

AV the last meeting of the Altrincham and District A.S. Mr. W. Roberts, presided. He
introduced Mr. J. Skinner from Altrincham who went on to give a very interesting talk on the
method of budding plants by his own method. This was followed by a discussion and
Mr. Skinner was asked to continue.
The main theme for the evening was the propagation of plants and the Society has
agreed to hold an exhibition at the Showground. The exhibition
will be held on the first Saturday in November.

AT a show for Pansy lovers organised by the Middlesex and District A.S., and
held in the Guards' Hospital, the results were
as follows:—L. Pearson, Mrs. E. Whitmore, L. Col. Sir E. Baring, the Judges.
The winners were Mr. W. F. Jeffries, Mr. T. W. Jeffries, and Misses
E. T. Jeffries and E. T. Jeffries, respectively, and the
Secretary, Mr. J. H. Jeffries, was present.

AT the Devon and Cornwall A.S. the
meeting was held on the first Saturday in February, and the
details were published in the Club's magazine.

AT the last meeting of the A.S. for the
North of England, the Secretary, Mr. J. Cameron, reported
that the Society had decided to hold an exhibition at the
Showground. The exhibition
will be held on the first Saturday in November.

AT the last meeting of the Chesterfield and District A.S. the
Secretary, Mr. J. Cameron, reported
that the Society had decided to hold an exhibition at the
Showground. The exhibition
will be held on the first Saturday in November.

AT the last meeting of the Yorkshire and District A.S. the
Secretary, Mr. J. Cameron, reported
that the Society had decided to hold an exhibition at the
Showground. The exhibition
will be held on the first Saturday in November.

AT the December meeting of the Liverpool
A.S. the Secretary, Mr. J. Cameron, reported
that the Society had decided to hold an exhibition at the
Showground. The exhibition
will be held on the first Saturday in November.

AT the last meeting of the North Eastern A.S. the
Secretary, Mr. J. Cameron, reported
that the Society had decided to hold an exhibition at the
Showground. The exhibition
will be held on the first Saturday in November.

AT the last meeting of the South Wales
A.S. the Secretary, Mr. J. Cameron, reported
that the Society had decided to hold an exhibition at the
Showground. The exhibition
will be held on the first Saturday in November.

AT the last meeting of the Welsh A.S. the
Secretary, Mr. J. Cameron, reported
that the Society had decided to hold an exhibition at the
Showground. The exhibition
will be held on the first Saturday in November.
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NEW ARRIVALS

**TROPICALS**

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<thead>
<tr>
<th>Name</th>
<th>Price</th>
<th>Size</th>
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<td>Mollies</td>
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**RARE FISHES**

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<tr>
<td>Silver Guppy</td>
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THERMOSTATS

- Probiotics
- Comal Thermostat
- Comal New External Type QL

AERATORS

- Beke
- Zweifel
- Marns

PISTON PUMPS

- Hy-a 1/2" x 1/4"
- Ha 1/4" x 1/4"
- Ha 1/4" x 1/4"
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- T-Fire 6" x 6" x 6"
- Koken 18" x 18" x 18"
- Exotica 18" x 18" x 18"
- Exotica 18" x 18" x 18"
- Exotica 18" x 18" x 18"

PLANTS

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<td>Ceratophyllum</td>
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<td>Hydrilla</td>
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Hykro Flakes. These are known the world over. Used extensively by exhibitors to get that condition and bring full beauty of fish.

Hykro Naturals. Contains 9 Live Foods, and will feed the rarest tropicals (or coldwater fish).

Hykro Concentrated Goldfish Food. Will keep your fish in tip-top condition, also relished by many tropicals. Including the 1 lb. pack.

Please note—in response to many enquiries, we do not supply these appliances and foods direct. They are obtainable at all the best shops, but in case of difficulty drop us a line and will put you in touch with nearest stockist.

Plants. We carry big stocks of plants, including Madagascar Lace Leaf, Water Hyacinth, Water Lettuce and all the popular varieties.

JOE GRASSBY, F.R.H.S
THE HYKRO DEPOT MOMBRELLEY NEAR KNUTSFORD, CHESHIRE
Phone Mopsorley 3272

March, 1962
BUYERS' GUIDE

The firms listed are wholesalers or retailers or both in fishes, tanks, plants, appliances and accessories, reptiles and amphibia. Abbreviations: W.—Wholesale only. R.—Retail only. WR.—Wholesale and Retail. C.—Coldwater. T.—Tropical. P.—Plants. AA.—Appliances and accessories. R. & A.—Reptiles and Amphibia.

E.C.D.—Early closing day.

BERKSHIRE

The Reading Aquarist
64, King's Road, Reading
Telephone: Reading 53632
E.C.D. Wednesday. R. C.T.P.A.A.

CHESHIRE

Grussby, Joe, F.R.I.S.
"The Glen" Fisheries, Mobberley, Nr. Knutsford
Tel.: Mobberley 3272 W. C.T.P.A.A. R. & A.

Robert Jackson (Naturalists) Ltd.
Holly Bank Nurseries, Grove Lane, Hale
Telephone: Ringway 3301
WR. C.T.P.A.A. R. & A.

DURHAM

Metcalfe, G. R.
2, High Northgate (near A.B.C. Winter), Darlington
On main A.1 road Darlington
Telephone: Darlington 0991

Powell, M.C.
The Honey Pot, Claypath, Durham City
Telephone: Durham 2108

The Fish Bowl
Laura Street, Sunderland
Telephone: Sunderland 69192

ESSEX

Goodmayes Aquarium
Shuffley Parade, High Road, Chadwell Heath
Telephone: Goodmayes 2594
E.C.D. Thursday. R. C.T.P.A.A.

Skelton, C. L.
"Ridgeway", 139, Galleywood Road, Chelmsford
Telephone: Chelmsford 56878. WR. C.T.P.A.A.

HAMPSHIRE

Arundel Aviaries & Fisheries
241/243, Arundel Street, Portsmouth
Telephone: Arundel Street, Portsmouth

Wingate Zoological Supplies
7, Market Street, Winchester
Telephone: Winchester 2406

HERTFORDSHIRE

Cara, L. & Sons
Water End, Hertford
Telephone: Water End 44
E.C.D. Saturday. W. C.P. R. A.

Wat-Pot Organisation Ltd.
351, London Road, St. Albans
Telephone: St. Albans 54099-55907
E.C.D. Thursday. WR. C.T.P.A.A.

KENT

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

LANCASHIRE

Horbury's
Travellers Bar, Old Trafford, Manchester, 16
Telephone: Trafford Park 2989

Lettie Kremmer
13, King Edward's Building, Cheetham Hill Village, (opposite Woolworths, Manchester)
Telephone: Cheetham Hill 3256

Liverpool Aquaria Company
23, Sir Thomas Street, Whitechapel, Liverpool
Telephone: Central 4819

LONDON (North)

Philip Castang Ltd.
91, Hauserstock Hill, Hampstead, N.W.3
Telephone: Primrose 1842 and 9452

Paramount Aquarium
95, Hauserstock Hill, Hampstead, N.W.3
Telephone: Primrose 1842 and 9452

LONDON (South)

Aquatic Suppliers
7, David's Road, Forest Hill, S.E.23
Telephone: Forest Hill 3816 (open every afternoon and all day Saturday).
WR. C.T.P.A.A.

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

"Our Corner"
316, Lee High Road, Lewisham, S.E.13
Telephone: Lee Green 3577
E.C.D. Thursday. R. C.T.P.A.A.

South Western Aquarists
2, Grimbarne Road, Trinity Road, Upper Tooting, S.W.17
Telephone: Balham 7334

Tachbrock Aquaria
244, Vauxhall Bridge Road, Victoria, S.W.1
Telephone: Victoria 5179
Open all week except Sundays.
WR. C.T.P.A.A. R. & A.

LONDON (West)

Owen Reid's, Aquarium Dept.
12, St. John's Terrace, Weymouth, W.5
Telephone: Ealing 3259

NORTHAMPTONSHIRE

The Aquarium
192, Wellington Road, Northampton
Telephone: Northampton 34610

THE AQUARIST
Shredders and Sagittaria (Giant)

Have you tried Shredded White Worm or Sagittaria for your baby fish? You need not bother with infusoria (it can be dangerous and pollute the water in your tank), but feed micro-organisms with this shredded live food.

Incredibly, I was advised by an aquarist that he was perfectly satisfied and still using his Shredders to purchase 10 years ago. Giant Sagittaria suitable for tropical, cold water or pond. Young plants 6" down; larger plants 1.5" each; postage and packing, 1/2d.

The Shredded Worms at Super Shredders Ltd. Corner Southend Road, Bexhill. All post 3/4d.

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WATERPROOF — DUSTPROOF — MOSQUITO proof

INEXPENSIVE

POLYTHENE SHEETING

Per Lin. 12" wide 16" wide 20" wide 24" wide 36" wide 48" wide 60" wide

3 x 3 1.25 1.50 1.75 2.25 3.25 4.25

3 x 4 1.60 2.25 2.75 3.50 4.50 5.25 6.25

4 x 4 2.50 3.25 4.00 4.75 5.75 6.50 7.75

5 x 5 3.25 4.00 4.75 5.75 6.75 7.50 8.75

POLYTHENE BAGS

FOR ALL PURPOSE PROTECTION

3 x 5 Small (500) Live Fish or Seeds

PREMIUM

45" wide 48" wide 54" wide 60" wide 72" wide 84" wide

14" wide 20" wide 24" wide 30" wide 36" wide 42" wide

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TRANSATLANTIC PLASTICS LTD.

Reptiles — Amphibians
Imports from all Continents
Write for current price list
Sale agency for England:

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ORS. W. DE ROVER,

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Putten (Gld.), Holland

I’ve Got Millions!

Worms! Foods! Composts! Results!

EUGLENA 3 x 3 — With 5 page instruction booklet
MICROWORMS 3 x 3 — Complete with feeding equipment
MICROFOODS 3 x 3 — Feed with feeding equipment
CRINIMALS 1 x 1 — May be used in a range of sizes
CRINIMAL FOODS 1 x 1 — High protein, low in yeast
CRINIMAL COMPOST 1 x 1 — High protein, low in yeast
CRINIMAL INSECT 1 x 1 — High protein, low in yeast
WHITE WORMS 1 x 1 — May be used in a range of sizes
WHITE WORM FOOD 1 x 1 — May be used in a range of sizes
WHITE WORM COMPOST 1 x 1 — Compounded for quicker breeding

Ask your dealer, or free delivery from

E. ARNOLD, 80, MOREGA ROAD, LONDON, E.7.
THE CONSTAT
THERMOSTAT TYPE Q.K.
OUTSIDE FITTING

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HAVE YOU SEEN THESE NEW FISH?

- Simpson Sailfin Swords 42/- pair
- New Blue Loach . 22 6 each
- Large Leporinus . 19 6 each
- Large Silver Sharks . 37 6 each
- Discus . 19 6 each 3 for 50-
- Larger Discus . 37 6 each
- Bleeding Hearts . 8 6 each
- Elephant Noses . 39 6 each

SPECIAL OFFER THIS MONTH

- Neons . 4 for 12- 8 for 20-
- Holoquins . 4 for 10-
- Tigers . 4 for 10-
- Zebras . 4 for 8-
- Cardinal Tets 7 6 each 4 for 27 6
- Giant Danios . 4 for 8-
- Serpae . 4 for 10-
- Glowlights . 4 for 10-
- Flames . 4 for 8 6
- Penguins . 4 for 10-

STANDS

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<td>61 6</td>
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<td>18 x 12</td>
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<td>20 x 12</td>
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AQUARIUM SCRAPPERS

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<tr>
<td>Aluminum Scraper</td>
<td>3 2</td>
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AIR PUMP ACCESSORIES

- Tubing, Checkers: 1/- to 2/-
- Plugs, 1/4": 1/- each
- "Y" piece: 1 2
- Air pump checkers: 1/-

DIFFUSER STONES

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PLASTIC TUBING

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<td>3/16&quot; to 1/4&quot;</td>
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DURAGNOST WATER HARDNESS TEST KITS

- (to large 1/2" each)

PRESSURE STELL

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REMEDIES

- Broomle White Tonic
- Chelated
- Sea Salts
- Luminous
- Terramite
- Terramite White
- Prozac Cure
- Metalac

NEW PLANTS

New Junior Amazon Sword Plants only 3/6 each
New Echinodorus Species—A beautiful centre piece only 7/6

FANTASTIC VALUE

- Air Pumps
- Filters
- Thermometers
- Piston Pumps
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- Aquarium Cleaners
- Aquarium Fixtures
- Window Fixtures
- Window Fixtures
- Window Fixtures
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This book has proved the world's best source of information on aquarium plants, describing 220 species and illustrating 180.

**Special offer of Tropical Fishes for April only**

**From S.E. Asia**

- **Silver Sharks**
  - Beautiful Specimens
  - 40/- & 50/- each

- **Monodactyls**
  - in fresh water
  - 10/- each

- **Fresh-water Puffers**
  - Curious Fishes
  - 7/6 each

- **Red-finned Blue Loaches**
  - Blue body, bright red fins.
  - 15/- each

- **Clown Loaches**
  - Brichella coerulea
  - Rare
  - 15/-, 20/-, 25/-
  - Boreio (Blue)
  - 37/6

- **Epalzeorhynchos Kallopterus**
  - Flying Fox
  - One of the spectacular aquarium fishes when adults: 17/6 & 25/-

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  - Silvery Flying Fox
  - 15/6

- **Bryconichthys Asymbranchus**
  - Many other species for callers

**From S. America**

- **Hatchets**
  - Silver & Glass
  - 7/6 each

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  - 2/6 each

- **Nonnatorius Trisomplex**
  - 7/6 each

- **Corydoras Punctatus**
  - 7/6 each

**Special Fishes**

- **Beautiful Black Angels**
  - 7/6 each

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The first of 1963 spawnings of Calico Veiltails should be ready in April. Some young Yearling Orandas and Moors from 15/- to 2/- each.

**Pond Fishes Ready for Sale from April 1st.**

- **Golden Orfe**
  - From 2/6 to 30/-

- **Shubunkins**
  - From 2/6 to 40/-

- **Goldfish**
  - From 2/6 to 25/-

- **Golden Rudd**
  - 2/6 each

- **Golden Tench**
  - Also our famous strain of Blood-Red Goldfish from 7/6 to 40/- each.

**Water Lilies and Aquatic Plants for Garden Pools**

Ready late April or early May.

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**HOURS OF BUSINESS:** Week days 10 a.m. - 6 p.m. Sundays 10 a.m. - 12.30 p.m. (Sunday afternoons May-July Only)

**CLOSED ALL DAY EVERY MONDAY.**

**TERMS OF BUSINESS:** Cash with order please. Fish sent by rail. Tropical minimum order £5, insulated container and carriage 10/-; Cold water minimum order £2 plus 10/- vans and carriage. Please by post (minimum order 10/-) please add 1/6 post and packing.

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