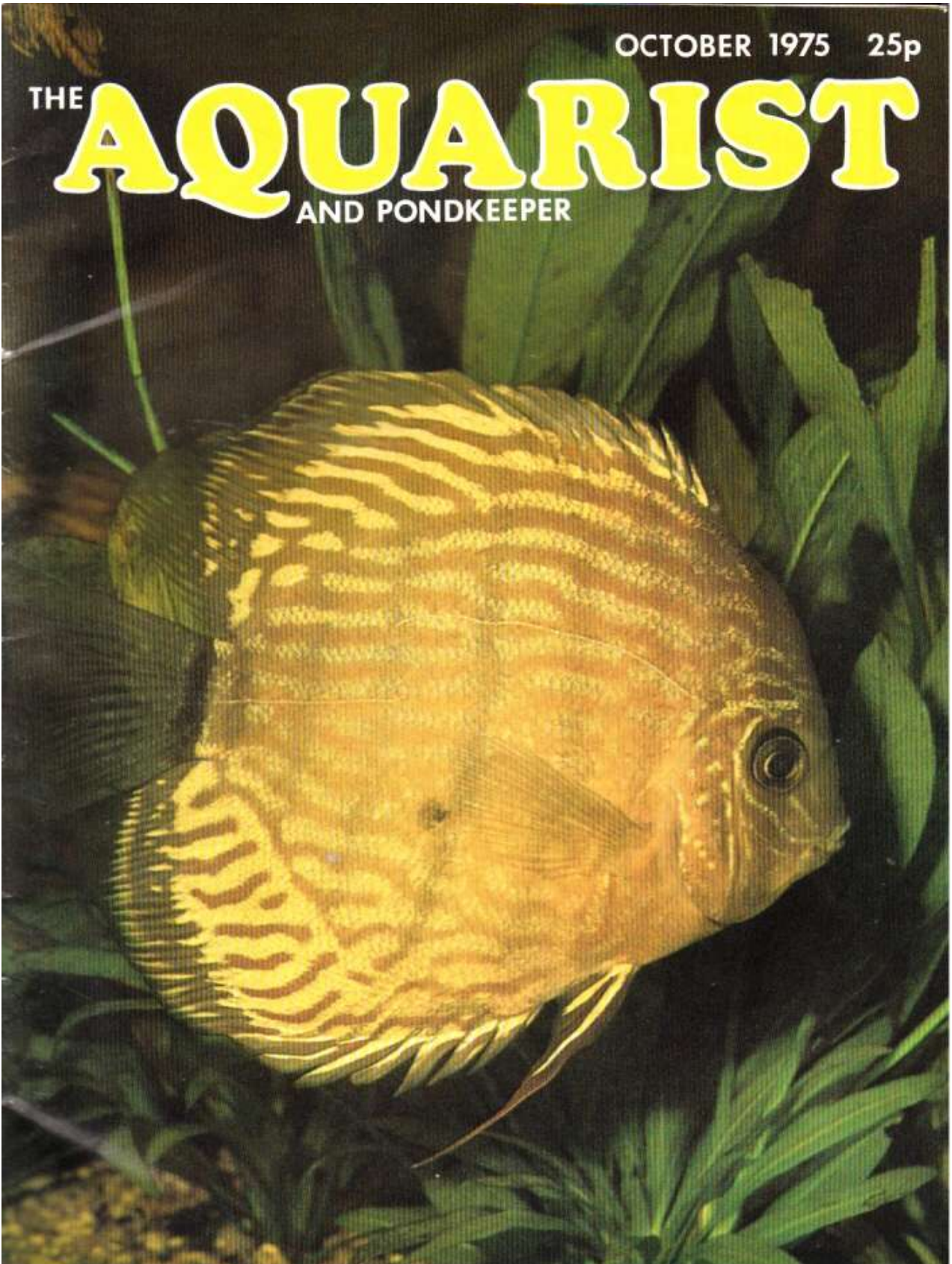


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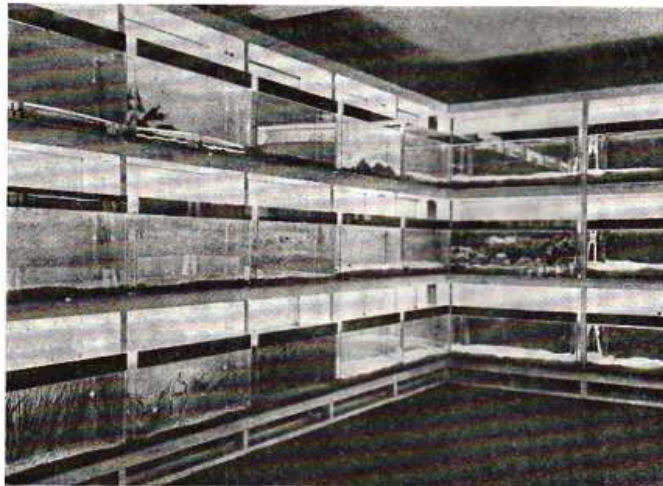
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Discus Fish. Courtesy of
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October, 1975

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The Editor accepts no responsibility for views expressed by contributors.

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KEEPING & BREEDING THE OSCAR

Written & Illustrated by Jorgen & Pamela Hansen

MANY YEARS have passed since we first decided to keep Oscars (or to be more precise *Astronotus ocellatus*) which come from the rivers Amazon, Parana and Paraguay in South America. The fish attains a size of 35 cm. (14 ins.) and is a free-spawning, monogamous cichlid. Male and female have similar colouring.

It was, however, quite by accident that we came into possession of Oscars, as our interest in the meantime had been more and more directed towards the newer African cichlids. A good friend was suddenly obliged for personal reasons to get rid of all his fish. For a week his aquarium cellar resembled a store in the middle of sales time, and when the crowds had disappeared he was left only with 2 *Cichlasoma*

citronellum and 4 *Astronotus ocellatus*, which he had the heart to sell; instead he quartered them with us as objects of study, photography and breeding. At that point the Oscars were 2 years old and varied from 20-25 cm. (8-10 ins.) in length. The largest of the *C. citronellum* measured 25 cm.

The six fish spent the first evening in a 200-litre chipboard tank in the livingroom. At one end of the tank large stones were built up in such a way that various caves were formed in which the smaller of the devil cichlids (*C. citronellum*) could easily hide, to which the larger of the species and the Oscars could not enter. No sooner were the fish introduced into the tank than the male devil cichlid began to chase the



The fish take turns in cleansing the chosen slate

strangers entered the room the fish lay almost flat on the excessive shyness they displayed at first: when the pair gradually became trustful as opposed to could not contain his language.

The pair gradually became trustful as opposed to could not contain his language. trickled from an exact impression of the fish's set of teeth, while our friend, so self-controlled normally, suddenly attacked him and bit him in the arm. Blood busy cleaning his cichlid tank when one of them each jaw. The original owner of the Oscars was once powerful. There is a single row of conical teeth in this, their teeth are well-developed and their bite the upper jaw was bitten right through so that the teeth of upper lip was bitten right through so that the teeth's bit each other in the mouth, and one day the female's quite violent with each other. Now and then they

After a month four *Tilapia zillii* (with whom the Oscars fought a little without, however, any serious incidents occurring) were added to the tank. A week later we noticed that the two largest Oscars kept to one end of the tank just above a piece of slate which lay on the bottom and would not allow other fish to approach. The female's genital papilla and the female's ovipositor would be seen to be extended.

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The first white eggs have been spawned on the slate which both fish circle. Note Female Fish on Right with her large ovipositor



The spawning occurred on one of our busy days, when we came home at 5 pm and had to leave again at 6.15. The spawning began at 6, and while the last mouthfuls of the evening meal were chewed, as many different photographs as possible were taken until 6.15. By that time a considerable amount of eggs had already been laid, but spawning was far from completed as we rushed out of the door. On our arrival home at about midnight, the female was to be found just over the slate, fanning fresh water over about 500 eggs; the male on the other hand did not seem very interested. Relying on the mother to follow her instincts and do her duty, we went to bed, only to find in the morning that all the eggs had been devoured.

In the course of the following months the fish were

four Oscars around the tank even though two of them were just as large as himself. In the course of half an hour all four covered in one of the upper corners. Now and then the male devil made a menacing movement towards them whereupon they turned on their sides and beat powerfully upwards with their tails in order to escape downwards. This resulted each time in a considerable amount of water being sprayed out on the floor. At first we thought that the tank had sprung a serious leak but discovered the true state of affairs when one of us got the equivalent of a cupful of water down the neck whilst drying up water from the floor.

The next morning we moved the four Oscars to a glass tank of about 180 litres (45 gallons) wherein the course of the following month they were fed with fish



Parent Fish guarding eggs

the bottom and resembled two very dead fish. Later, on discovering that the presence of visitors invariably meant that they were treated to a round of snails, the pair practically begged.

For a couple of months, feeding time was 6 p.m., and if one forgot they would be sure to remind one in their own special way: they jumped the 10 cm. up to the cover glass and after giving it a powerful push which produced a loud clicking noise, waited expectantly under the usual feeding place.

In the beginning of March we refrained from feeding the fish for a week, whereafter they received every day a handful of snails, some fish-balls, and a spoonful of Cyclops which they took more or less from the spoon. After a week things began to happen. 21 and 22 March. Both fish were busy cleansing a piece of slate on the bottom. Now and then the fish stood with mouth pressed to the slate and beat powerful blows with the tail with the result that water splashed violently against the cover glass.

23 March. The male's genital papilla and the female's ovipositor were clearly extended. The male's papilla was small (3 mm. in length) and thin, while the ovipositor was large and swollen (8 mm. in length and 6 mm. broad). Both fish confined themselves to the area around the slate, which they took turns to cleanse. In the evening spawning occurred in typical cichlid fashion. Both fish circled clockwise, the female released the eggs, and the male fertilised them. The ovipositor was so large and transparent that one could see the eggs fall through. Spawning lasted for almost three hours, in the course of which innumerable eggs were laid. These were about

2 mm. in diameter and white and sticky.

24 March. The pair looked after the eggs, which were still white. We did not feed.

25 March. In the evening the eggs began to turn greyish; in the centre of each a slightly darker line (the tail?) could be distinguished.

26 March. We were away for a couple of days and assumed that we would return to a tank full of young.

28 March. While waiting for the bus, we met the fish's owner on the way to visit us, and excitedly informed him about the eggs and expected fry. But alas we got home just in time to see the fish devour the last of their young.

We thereafter repeated the feeding procedure we had followed in the beginning of the month and on 9 April the fish again began to cleanse the slate. The male's genital papilla was visible. On the evening of 10 April a number of eggs were spawned on the slate; both male and female then attended to the eggs.

11 April. Some eggs had clearly fungused but the parents did not remove them. On the morning of 12 April we removed the slate complete with eggs and placed it in an aerated 10-litre tank, containing water which had stood for three days. We loosened the fungused eggs from the slate with a pin and sucked them from the bottom with a pipette. A new piece of slate was placed in the tank with the parent Oscars. The latter were furious when their eggs were stolen and it was necessary to hold them off with a large net which, in their anger and frustration, they bit almost to pieces. They later directed their anger towards the slate, whose edges they bit and jerked at.

On the morning of 13 April, 60 hours after the

spawning (at 28°C) the eggs had begun to hatch. Gradually as they hatched we loosened them from the slate with a sharp pin. Over half the eggs hatched and lay on the bottom with wriggling tails. The slate, containing about 230 dead/fungused eggs, was removed.

14 April. The eyes were in the process of being formed. The fry clumped together in a corner.

15 April. The eyes were now clearly formed; a line ran down the body from head to tail.

16 April. The yolk sac was still not used up; the fry wriggled about all over the bottom.

18 April. They swam freely at last. We fed with micro-worms.

19 April. We moved the young to an 100-litre tank and fed with Cyclops nauplii, which they could easily swallow. In all 375 fry survived. When added to the number of fungused eggs this amounted to a spawning of over 600 eggs.

28 April. The fish spawned again and neglected, just as before, to remove the fungused eggs; in the course of two days it seemed as if all had perished but the following morning we saw about 50 fry in the

bottom of a shallow pit dug by the parents. Now and then they took up a baby fish in the mouth, and moved it to another location; but all too often they forgot to spit the baby fish out again and all the fry thus soon disappeared. The next day the owner collected his fish. For the next few weeks it was with a slightly hollow feeling that we passed the large empty tank which had once housed the Oscars.

The young

The young's growth is varying. The lightest coloured young apparently grow most quickly and at 40 days old are double the size of the darker individuals. Up to this age and size (35 mm.) at least, they take only living food. If they are deprived of this food for a day the smaller and weaker fry are attacked. First the eyes are bitten out and then the belly split open. If one wishes to rear large broods the fish should thus be sorted according to size right from the beginning. The colouring varies from almost silver with brown finnage to dark brown with pale stripes here and there. They do not take on the adult body pattern until the age of 8-9 months.

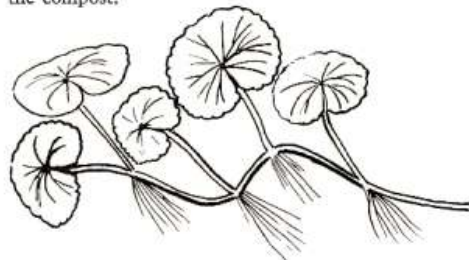
Hydrocotyle leucocephala

by Jack Hems.

THERE'S no question about it: the essential desirability of this new tropical aquarium plant lies in its ease of cultivation. Place a length of foliated stem on the surface of the water, give it a good top light, and it will forge ahead without further attention. Alternatively, firm it into the compost and it will flourish equally well. It will even grow as a terrestrial plant provided it is given a permanently wet planting medium. Hence the plant is admirably suited to a vivarium or aqua-vivarium kept at comfortable room temperature.

The foliage, that is borne on short stems which rise from myriad-branching runners, bears a resemblance to that of common frog-bit. However, the leaves are rounder in outline, ribbed, serrated along the edges, with a division of cleft that extends across half the leaf from the margin to the centre. The leaves at the surface float or stand proud of the water. They measure about $\frac{3}{4}$ to 1 in. across. Submerged leaves rise from stems which sprout at irregular intervals all along the vertically ascending strawberry-like runners. The leaf-bearing stems produce tufts of thread-like roots at the point where they develop from the runners or sometimes from the junction of the leaf and stem. It seems to matter little whether

the roots find an anchorage in the compost or hang free. For all that, a more compact and sturdy growth is obtained if some of the roots and stems can establish themselves in or in close proximity to the compost.



H. leucocephala is from Brazil and turned up in a few dealers' tanks only a comparatively short time ago. Yet aquarium keepers in Holland and further afield have known it for a decade or thereabouts. Brazilian pennywort demands nothing special in the way of water or temperature and appears to prosper at a range of from about the middle sixties to the upper 70°F.

WHAT IS YOUR OPINION?



by B. Whiteside, B.A., A.C.P.

Photographs by the Author

I'D BE interested to hear of the reactions of any other pets you may have to your fishes. Several months ago my elderly Scottish terrier, Trixie, had to be put to sleep as a result of an incurable illness. Having had Trixie for 12 years, and her predecessor, Judy, for 9 years, my family and I wanted a third Scottie to continue the 21-year-old tradition. A search of the U.K. eventually led to a puppy being traced in Kirkcudbright, Scotland. Neither Judy nor Trixie showed any interest whatsoever in my fishes; but the latest lassie, Corra, has a special interest in my discus and angels. She can frequently be found in front of either tank barking her head off as the large fish swim around. None of the fishes shows any interest in Corra or her noisy antics. One could appreciate a cat's interest in fishes; but does anyone else's dog bark at bigger fishes?

I've just returned home after a short holiday in London, and I must admit that the heat was almost too much for me. As usual I called with fellow-contributor Douglas Rose, at Abbey Lodge. I was interested to note that the temperature in the room in which Douglas keeps two of his three tanks was higher than the temperatures for which the aquarium thermostats were set. Obviously the temperature in the tanks was room temperature and not the set temperatures. No doubt the same circumstances prevailed in all parts of the U.K. this summer; and hopefully our electricity bills will be a little lower than usual because the sun's heat and light meant that aquarium heating and lighting were less frequently in operation. Douglas's tanks continue to thrive; and his delightful marine aquarium, complete with all the fishes I've seen on visits during the past couple of years, confirms his techniques and his view that marines can be kept as easily as freshwater tropicals. All his fishes and shrimps had grown considerably since I last saw them in April; and his large clown fish is an absolutely perfect specimen without a single blemish. Douglas's piranha has grown considerably and is a beautiful, if rather frightening, specimen. It amazed me to see its tank shared by a common goldfish. Some time ago the goldfish was added as live food, but the piranha hasn't touched it—unlike earlier goldfish provided as the occasional delicacy. The goldfish appeared to be none the worse for

sharing the tank with the piranha which, if it decided to do so, could snap it in two in a split second.

During my week in London I had the pleasure of making a visit to Brentford, at the invitation of Mr. John Young, Advertisement Manager of *The Aquarist*, where I made my first visit to the publishing complex where *The Aquarist* is turned out. Having written for the magazine for over eleven years made my visit a rewarding one: I actually saw where my typescripts are turned into the printed word. I thoroughly enjoyed meeting Mr. Young for the first time; and over lunch I had the added pleasure of meeting Mr. Charles Schiller, of Springfield Electronics, where the world famous heater/stats are manufactured. Mr. Schiller has been associated with the aquatic trade for well over half a century and, as readers of our Golden Jubilee edition will recall, he has set up and maintained aquaria for various members of the royal family. I could have listened to Mr. Schiller's tales of the past for hours; but time was limited as Mr. Young had to set off early next day for Birmingham, to attend The Midland Aquatic Festival which, unfortunately, I was unable to attend. I left Mr. Young and Mr. Schiller, the latter having given me a sample of his Springfield Mariner C200 automatic immersion heater to review for this magazine.

A colleague, recently returned from a holiday in Canada, brought me a leaflet about the Vancouver Aquarium. He would thoroughly recommend a visit to any aquarist who might happen to be in that part of the world.

Mr. Jeff Hutchings, editor of the F.G.A. Journal, informs me that the N.W. Lancs. Section of the F.G.A. will have slide shows and scripts available for hire later in the year.

I find it both encouraging and helpful to see that a small number of our general advertisers are now using 'list' type advertisements which are very useful if one wants to order items by post. It's also pleasing to note that there are now growing numbers of firms stocking a reasonably wide range of aquatic plants. Having ordered sample selections of plants from a variety of such firms I can confirm that the quality of firms' plants and service varies considerably. I object strongly to firms that supply named plants liberally coated with duckweed. Once this latter pest

is introduced into certain aquaria it is almost impossible to eradicate. New plants should be well rinsed in an attempt to clear them of duckweed—if it is present. I would seriously question the relatively high prices some firms charge for postage and packing on plant orders. Modern polystyrene and polythene packing for plants doesn't weigh very much for its volume; nor do smallish numbers of plants. The cost of the former synthetic materials can't be too high either; and postal costs, although continually rising, are still based on weight. A charge of 20p-25p (4/- to 5/- in old money) seems about right to me; postage and packing costs of 35p-50p (7/- to 10/-) seem rather excessive. I make these statements in the light of the fact that having paid some relatively high postage and packing charges I found that the parcels of plants arrived bearing 8p, 9½p or 11p stamps for second class postage. At the time of writing (July

about the correct lighting to use for the plants. My aquarist friend says that you can't beat bulbs; but I disagree. I personally want to test the new 'Truelite' but in the meantime I am testing the Gro-Lux tubes—which I cannot see doing any good for the plants unless a warm white tube is used with them. I would appreciate any information readers may care to give. All my research into the subject apart from the hobby is going into a project for school 'O' level in rural studies, and this involves a great deal of research and practical work. I enjoy keeping fish, and breeding too. I would like some information on 'Biol' food which, unless anyone hasn't come across it yet, consists of dried plankton. Any uneaten, after being fed to the fish, creates infusoria. I haven't tried it yet but mean to do so. I am an official of a society and we recently hired a slide show from a private source advertised in a magazine/newspaper somewhere,



Young *Pelmatochromis kribensis*

one can still send a ½lb package for 15p (1st class letter post) or 11p (2nd class letter post). One can send a reasonable number of plants, in modern packing, in an 8 oz. package! I understand that if one sends actual postage stamps, instead of cash, a postal order or cheque, to cover the cost of postage on items ordered by post, V.A.T. does not apply to the actual postage cost. No doubt postal costs will have rocketed yet again by the time you read this—but I hope you will still continue to send me letters for this feature. Please let me have your opinions on any of my above comments.

Mr. C. Atkinson's home is at 7 Mill Balk Place, Snaith, Nr. Goole, N. Humberside. He writes: "As you probably by now know I am for ever experimenting with my fish to try and give them the best home they can have. However, I am still puzzled

and we really didn't think it was worth it; therefore, perhaps it would be advisable to ask for samples first, in future. At the time of writing I still haven't received any information about lace gouramies. I would be grateful for such information as soon as possible as I would like to make use of it in my project."

The next letter reached me from 19 High Street, Hemel Hempstead, Herts., from Mr. M. Delaney. He states: "Concerning the matter of dealers making excessive profits, I feel that my local aquatic store is a very reasonably priced shop and bargains can often be found. However, in the aquatic shops in London I have found that by select buying a bargain can often be obtained as one shop may sell a fish for 50p, while another may sell the same species for 40p. It seems to me that where only one aquatic shop exists in a specific area, the price in that shop tends

to be fairly high as it operates a near monopoly on fish. However, in an area where a number of fish shops operate, e.g. London, prices will tend to be lower as the shops compete with each other for our custom.

"Many people have, in the past, written in to this and other magazines saying that scientific names should be abolished. However, I feel, in the main, that the use of common names should be lessened. The albino catfish is the title usually meant to apply to the albinotic form of *Corydoras aeneus*, but can equally apply to an albinotic form of *Clarias*. Many other examples could be used to illustrate my point. However, I couldn't envisage asking for a pair of *Poecilia reticulata* instead of a pair of guppies! Thus a compromise must be reached. My favourite power filter is the Nuova Turbo. Although it is advertised that filtration speed is up to 150 gallons per hour, the highest filtration speed I have got out of mine is 120 gallons per hour; but this is still fantastic value for money as I paid out £25.00 for it, although they cost more, and as a bonus got £2.00 worth of fish free in the shop as a special offer. If Nuova can make such a power filter for £25.00, why does a comparable model from Eheim cost more than twice as much? It fascinates me to see that Promin, that well known high protein food in a tin, costs 72p for 4 ozs., while my local aquarist club has been able to sell Promin to its members at 40p per pound and still make a small profit!"

Michael Brennan is 15 years old, and lives at 4 Vale Road, Otlands Park, Weybridge, Surrey. He writes: "I have been keeping tropical fish for just over a year now and have just started to move into the field of keeping cichlids. Ever since I started fish keeping I have got *The Aquarist* every month, and I have noticed that although there are a lot of letters from people who have spawned, say, the neon tetra or angel fish, there are still many problems surrounding the spawning of many 'easy' fish. In your feature, and in the query articles, there are letters from people asking how to spawn gouramies, certain cichlids, and various other fishes. My *Pelmatochromis kribensis* (Photograph 1 shows a group of some of my own young 'kribs'), dwarf gouramies and Siamese fighting fish all spawned on the same day, i.e. 20th June; but unfortunately the dwarf gouramies' bubble nest was destroyed because they spawned in the community tank. The Siamese fry are coming on well, and the 'kribs' are still being looked after by their parents.

Several readers have asked about the progress of my young discus. Photograph 2 will give you some idea of how well it is coming along.

No. 42 Rudd Street, Hoylake, Wirral, Merseyside, is the address from which Mr. T. Jones writes. "Some time ago I purchased a pair of convict cichlids,

Cichlasoma nigrofasciatum, from a member of an aquarist club, and placed the pair in a community tank housing anabantids, rasboras, danios and various other small fishes. Shortly after they were installed they spawned in a depression in the gravel, and the site was fiercely defended by both parents. When the fry were wriggling they were constantly moved about from place to place. When the 100 or so fry reached the free swimming stage I made no attempt to feed them; but the parents stirred up the small amount of mulm on the gravel, and this seemed to satisfy the needs of the babies. I have never seen such fierce little fish! All the inmates of the tank, regardless of size, were pinned to one end of the tank. Anyway, a peculiar thing developed: a few of the fry were a silvery colour, without stripes, and they were all females. As the fry grew and wandered farther away from the parents, they were snapped up by the other tank inmates. After each spawning, and there were four or five such occurrences, I found one or two dead fish—mainly danios—killed by the convict parents. From the last spawning about eight youngsters survived; so I sold the parents, and the youngsters grew to maturity in the community tank. The cycle started all over again, and again a percentage of the fry were silver with no stripes. Finally they grew so fierce, and, having no spare tanks available, I sold all my convicts to a fellow club member . . . At the moment I have just purchased a beautiful female blue acara, *Aequidens pulcher (latifrons)*, to partner a male which I reared myself; already the pair have spawned twice in the community tank. At the time of writing there is a clutch of eggs on a rock, outside a cave, right at the front of the tank. So I have prepared a 36 in. × 15 in. × 12 in. tank with rocks, petrified wood and a few Amazon sword plants; and when this spawning is complete I shall give them a home of their own. My wife, also a keen aquarist, is particularly fond of blue acaras because they were the first egglayers we successfully bred.

"My marine tank seems to be settling down now and at the moment houses a blue damsel which has survived over three weeks—and after my first experience that's a long time! The marine tank also houses two *Scatophagus* and one large *Monodactylus argenteus*. Perhaps the latter two aren't strictly marines, but they are beautiful and will help to fully mature my tank."

Mr. R. Scott's home is at 12 Blenheim Road, Ipswich, Suffolk. He says: "In response to your question about *Tubifex* worms as a food for discus, I have kept discus for a little over a year and throughout their main diet has been *Tubifex*. It has been my experience that if they are kept clean and in fresh water there is very little or no danger from feeding them to discus. I just drop some in and let them fall to the bottom where the fish feed. Usually a few are

left but these get eaten sooner or later. Now to a question. Some months ago I noticed small life forms in the gravel of the discus tank. These creatures resemble small *Daphnia* and grow no larger than a pinhead. They never leave the gravel or rocks. The reaction of the water is pH 6.8, the DH 3°. The tank is fitted with U/G filters."

Mr. J. Wood lives at 49 Edington Road, Abbey Wood, London S.E.2. He sends us details of his experiences with the banded convict cichlid. "I acquired my two fish from my regular fish shop, selecting them from a tank containing about 16 specimens. I chose my two because I noticed that they had dug a pit in the gravel at the very front of their tank. The male is 2 in. long and the female 1½ in. I brought the fish home and placed them in a 24 in. × 12 in. × 12 in. tank, with the prime aim of growing them on to a fair size. That was three weeks ago. One week after they were placed in their new tank they dug four pits in the gravel; they then went through the now established cichlid mating procedure.

male into the pit. Both parents stood guard over the babies. The female now started to leave the babies and go foraging for food; the male stayed on guard during these sorties by the female. When she came back she always came up to the male from the rear; and then he went out to forage for food. He also approached the female in the same way.

"The babies became free swimming on 18 July and there are now 40 small fish swimming around their parents which, at the time of writing, are models of good parents, watching their brood and putting them down at night in the same pit that the eggs were laid and hatched in. The babies are eating newly hatched brine shrimps, finely ground flake food, egg yolk and brown and green algae which is in abundance in the tank. Thus, I am quite pleased with my convicts—except for the fact that the parents, so far, have only eaten *Tubifex* worms—both before and after mating. I have tried all the usual cichlid fare but to date they have ignored it all. Is this usual in this type of cichlid?"



The water temperature was 76-80°F, and the tank was planted with plants of ivy leaf *Cryptocoryne*; both fish ignored the plants. On Monday, 6 July, the female laid her eggs in a pit at the back of the tank, about 50 eggs were laid.

"From this date the female kept the male away from the pit and the eggs; she did all the fanning and cleaning of the eggs herself, and did not move outside the pit. The following day about 10 of the eggs were covered with fungus and she ate these straight away. She continued to guard the eggs by herself, without any help from the male—which retired to the other end of the tank and stayed there. The eggs hatched out on 17 July, still in the same pit. They were a wriggling mass and at that stage the female let the

From 39 Stokesay Road, Buntingdale Estate, Market Drayton, Salop TF9 2HD, comes a letter from Mr. P. Farrow. He says: "I am new to the hobby but read with interest recent letters regarding the price of tropical fish. According to the reckoning of Mr. M. McDonald my local pet shop cannot make a lot of profit from their tropical fish sales as recently I have bought neons, harlequins and glowlights all at 10p each; and angels at 23p each. All these specimens are fairly large, mature adults. Although I am paying fairly low prices for my fish I find that I have the kind of problem Michael Brennan experiences: that of people who sell fish and don't seem to know the difference between males and females. Although some species can only be sexed by experts, I suppose

that somewhere along the line the fish must pass under the discerning eye of an expert; so I would suggest that most pet shops should employ people who know how to categorise fish into males and females and that the sexes be kept in separate tanks. I know this might be difficult for some shop-owners—but surely if it keeps customers happy it can't be all bad. I am thinking of trying to make myself an all-glass aquarium and would be pleased if you could tell me how I could get hold of the copy of *The Aquarist* that contained hints on this subject—as mentioned by Mr. R. Myatt in the July feature." (I am sure that if you wrote to the magazine, requesting the required back number and enclosing the cost plus appropriate postage, a copy, if available, could be forwarded to you; or can any other reader help?)

A plea for assistance comes from one of our lady readers, Mrs. Barbara Creed, who resides at 41 Eaton Road, Margate, Kent. Mrs. Creed begins: "Can anybody help? I have lost 8 broods of baby angels after they have hatched and absorbed their yolk sacs. Each hatching has resulted in several hundred fry—but not one has reached the free swimming stage. I have tried every method from very shallow to deep water; lights on 24 hours per day; lights off; feeding soon after hatching; and not feeding. I have used fresh tap water; matured tap water; water from the parents' tank; and water filtered through peat. I would be glad of any help your readers could give me."

Mrs. Creed continues: "With regard to feeding *Tubifex* to discus, I have six very magnificent specimens fed three times a day on large quantities of this food—as well as a variety of meats, spinach, peas, *Daphnia* and flake food. Personally I think that if the tank conditions are good and the fish are healthy there is little danger; after all, who sterilizes their food in the wild? I have one discus that continually exhibits hole in the head disease; but it rarely affects the other five. This time, however, it has lasted longer than usual; but apart from the fact that he is covered in holes and not eating, one would never believe him to be ill. He is active, has a good colour, and his eyes are bright and a good dark red. Where do I go from here? Any suggestions? I would like to say that I always turn to *W.Y.O.*? first every month and really enjoy it. PS. During the search for an envelope the discus with hole in the head disease has developed a stomach the shape of a pregnant guppy. I can find no reference to this in any book; and as it doesn't look like dropsy, can anyone advise me?" (I would suggest that you try Hexa-ex, a German preparation for the treatment of hole in the head disease. It's distributed by Hillside Aquatics. Contributors to the T.F.H. book *All About Discus* suggest a variety of 'treatments' for discus diseases. They include raising the water temperature; and treating with chemical such as ecridine-lactate, acriflavine, copper

'sponges', and phenol. As dosages are critical, I feel that it would be much safer to stick to Hexa-ex. imagine that your ailing fish will be dead long before your letter appears in print!)

My own pair of adult angels continue to spawn regularly—and just as regularly they eat their egg. On two occasions recently I removed the heater thermostat plug from my discus tank to use the plug socket to test an elderly air pump. On both occasions, after testing the pump, I forgot to replace the heater plug of the discus tank. Fortunately both incidents occurred during the month of July when the weather was warm; and the tank temperature, when I discovered my error on both occasions, had not dropped lower than 70°F. These temperature drops, of about 10°, lasted for several days; but the discus appears to have suffered no damage whatsoever. For periods of up to several months the discus has shared its tank with guppies and mollies—and none of the fishes suffered any harm (unless a few baby livebearers were eaten). I tested the tank water this week, purely out of interest, and found it to be quite hard—13° general hardness, and quite acidic—pH 6.2. Although conditions are far from being ideal, the discus continues to thrive and is not at all shy or nervous. I wonder sometimes if certain writers don't tend to over-exaggerate the 'softness' of discus and put potential discus keepers off having a go with them. My main recommendation is that one should buy fairly young fish as they seem better at adapting to new environments—including water conditions.

The subject of coldwater fishes in general, and the bitterling in particular, has attracted a number of letters recently. The latest reached me from Mr. R. J. King, of, appropriately, Willowpond, 41 Meadowcroft Drive, Kingsteignton, Newton Abbot, Devon. He writes: ". . . Having kept and bred (bitterling) for a few years now I thought I would send you an account of the method I use to produce these fish. This article has been written for *Toras Topics*, the Club magazine of Torbay A.S., and is an updated version of an article I wrote a few years ago. I am also in the process of making a tape and slide talk on keeping and breeding the bitterling; and when complete it will be available to other aquarist societies for a small fee. By the way, my original fish were bought in Petticoat Lane Market! (Although I'm not sure to whom the copyright of Mr. King's article belongs. I'm sure neither he nor my friends at Torbay will mind if I include a slightly edited version of this most interesting article. Indeed, *Toras Topics* is the only club magazine I receive regularly). The article is entitled *The Bitterling*, by Ron King.

Mr. King writes: "The bitterling has a very curious way of breeding. It is achieved by the female laying her eggs within the swan mussel and the male fertilises the eggs while they are within the mussel . . . (Hem: 3)

an account of the method I use to breed them. The adult fish are kept in an indoor pond, 6 ft. × 2 ft. × 8 in. deep. There is a fair amount of mud and gravel on the base; this is necessary for the mussels to anchor into. The plants used as cover for the fish are hornwort and Jap rush. No heat is used during the winter—Nov. to end of Jan.—and the pond is iced over when the weather is cold. The fish start to come into breeding condition around April/May; this is when they really show off their colours. The males have a body of multicoloured iridescence, with blue the main colour. The lateral line is very red, as are the fins. On the top lip there develops a fungus type growth—but only when the fish are in breeding condition.

"The female has a rather drab grey-green body colour, with pink fins. There is no growth on the top lip; but she develops an ovipositor which extends to about 2 in. past her body length. There is also a short tube in front of her ovipositor. Around March/April I start to feed the fish on live foods: water fleas, white worms, chopped garden worms, etc. The food soon brings them into condition and after about ten days I place some mussels into the pond and the spawning normally starts within 10-15 minutes. The males get very excited and start to drive the female over the mussel; and she will lay her eggs. She goes to the top of the mussel and then turns onto her side to push herself onto the mussel. At this stage the mussel seems to open slightly. The female then lays her eggs—through her ovipositor? (Sic.) I have witnessed the female with her ovipositor inside the mussel and also with it outside the mussel—see *The Aquarist*, Jan. 1975, re *Bitterling Behaviour*, by L. E. Perkins. So I am not certain whether the eggs are laid through the ovipositor or the short tube in front of the ovipositor. When the eggs are laid the males repeat the same act as the female, but release their milt around the mussel's inhalent siphon. The female makes two visits to the mussel within 20-30 seconds, and not again for about 15 minutes, when the act is repeated. I have witnessed the spawning going on for over four hours.

"I have read somewhere that the eggs hatch and the fry remain within the mussel for five weeks. In my case this year I witnessed the first spawning on 15 May and the first fry were found seven weeks later; but whether these were from this spawning or not I would not like to say as the mussels are left with the adult fish, and the fry removed when I see them. The fry, when taken from the pond, are approximately $\frac{1}{4}$ in. long. The body and fins are a dark green colour and the dorsal fin has a yellow and a black line across it—as on the tropical X-ray fish. The eyes are green but very shiny. The fry are placed in an aquarium in matured water and fed for around four days on Liquifry, and then on newly hatched

brine shrimps and sifted water fleas. They are very slow growers, reaching $\frac{3}{4}$ in. in about six months. The males start to get their blue colouring at about ten months of age. The females carry the yellow and black line on their dorsals for about eighteen months. I have had twelve month old fish spawn and produce young. 22 July, the time of writing: I have witnessed twenty spawnings (sic) and have taken twenty-eight fry from the pond; these have been in varying numbers at a time, sometimes only two or three. The most at once this year has been six. The most I have ever taken out at once was twelve; this was two years ago. I have had these fish spawning in an aquarium—but this was only set up for the purposes of photography, which turned out very well. I now have a fair collection of slides of these fish spawning." (I should imagine that Mr. King's highly interesting account will encourage other readers to try keeping and breeding bitterling—if they can find stock. I'd be pleased to hear from readers who know of sources; I'll pass on any information received through this feature.)

Mr. J. R. Wheeler, who lives at Wembury, Clun, Craven Arms, Salop, is another contributor who has comments to make about the coldwater side of the hobby. He writes: "Is this a common thing? Two little, male goldfish chased the slightly larger female round and round the 24 in. × 12 in. × 12 in. tank. The chase was so vigorous that it amazed all beholders. After some hours, however, there was a lull. Aware of something amiss, she realised at the turn that her pursuer-in-chief had lost interest and was even facing back the way he had come. Then, she had to turn on her side to do this—she very deliberately took a great part of his caudal fin into her mouth and gave it a good tweak. Immediately the chase was on again and resulted in the usual quantity of spawn. Inherent behaviour? I have seldom been more surprised. In proportion to size, goldfish have a much better brain-weight than pike have."

The last of this month's letters comes from 11 Merksworth Way, Gockston, Paisley, Scotland, the home address of Mr. G. Alexander. He writes: "I am writing to you after reading the harsh and severe criticism, in your recent monthly issues, about cichlids. I agree with everything that Mr. J. Dymott wrote in the April edition of *W.Y.O.*? Aquarists wrote in saying that most cichlids grow too big; are too vicious; tear plants; and dig pits, thus making the tank a mess; while the only cichlids they have kept are angels and various dwarf cichlids. At present I have convicts, Jack Dempseys, *Pseudotropheus auratus*, blue acaras, firemouths, angels, *P. kribensis*; and, until recently, I housed two pairs of *Tilapia mossambica*. One pair was 4 in. in length

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Some of the
author's
discus fish

THE DISCUS FISH

by *Eberhard Schulze*

This article first appeared in our Golden Jubilee issue of October, 1974 and is now reprinted in response to numerous requests from readers who were unable to obtain copies of that issue.

I FREQUENTLY receive letters from readers of this magazine asking for detailed information on the maintenance and breeding of the Discus fish. Although almost all of them state that they consider themselves as experienced tropical fishkeepers, they say that they have great difficulties in keeping this fish alive for any length of time. The ensuing correspondence almost always reveals that they are completely unaware of the basic requirements needed by these fish. Discus fish have now been kept in aquaria for a good number of years but it is most unfortunate that some of the successful hobbyists or breeders have felt the need to retain their knowledge—how else could one possibly explain the lack of genuine information in the many English language publications? Our present-day knowledge about Discus

fish is almost exclusively based on the success or otherwise of some of the German hobbyists or breeders, notably Günther Keller, M. Weingarten, Dr. Eduard Schmidt-Focke and Dr. Rolf Geisler, who have, through their studies and experiments and their willingness to publish their findings, given the average enthusiasts reason to believe that the keeping of Discus fish need no longer be a lost cause.

Any would-be Discus keeper willing to devote some time to learning their particular requirements and able to provide continuous care and attention, will succeed; but enthusiasts—and there are still some—who just fill a container with a drop of tap water and expect these fish to survive are bound to fail.

Although Discus fish are no longer considered to

be problem fish, they remain a somewhat demanding species and in order to be successful it is, perhaps, necessary to know a bit about their natural habitat, to understand the basic terms like hardness and pH, to be able to recognise unnatural behaviour, ailments and diseases. But it is even more important to be able to provide any environmental conditions called for: changes in hardness and pH of the water, the removal of any excess of nitrites from the water with a nitrite-removing resin or with a biological filter. Another equally essential requirement for the health and well-being of these fish is a varied and well-balanced diet. By carefully following these points enthusiasts will find that keeping Discus fish will no longer present any of the problems so often associated with them; but hobbyists who are not able to provide these conditions will generally find that keeping Discus fish will become a rather disappointing and expensive experiment.

Discus fish are a South American species and are found over a wide area of the large Amazon river and its many tributaries; they have never actually been caught, however, in the main stream of these rivers, but only where nature has created gently flowing backwaters or lakes. Depending on the time of year, these waters have a varying degree of hardness, pH and temperature which suggests to some authorities that Discus fish are quite capable of adjusting easily to changes in their environmental conditions. Dr. Rolf Geisler, perhaps best known to hobbyists as the author of the book *Wasserkunde fuer die aquaristische Praxis*, is also recognised as one of the leading Discus experts of our day. He was the first to publish comprehensive scientific data about the various known Discus biotopes and according to him these waters are very soft (Total hardness 0.0°-0.27° DH, with a Carbonate hardness 0.03°-0.2° KH and a very low conductivity (7.7-22 uS). This water could very well be compared with our commercially available distilled water. The acidity of these waters varies between 5.7 and 6.2 pH. These waters are very slow flowing and are never much deeper than 2 metres and the average temperature is approximately 29°C (84°F), but as some of these fish have also been caught in waters with a temperature as low as 24.5°C (76°F), some experts have come to believe that it is not absolutely necessary to keep these fish at the previously recommended high temperatures of around 29°C (84°F) to maintain their well-being and many hobbyists have found no deterioration in their behaviour, coloration or general state of health by lowering the temperature a few degrees. The water of these Discus fish "rivers" are usually a mixture of the clear water type and the black water type. The black water is coloured brown by humic substances which have dissolved out of the many trees and is usually quite murky which seems to

indicate that Discus fish prefer to live in semi-darkness. These rivers have no plant life as such and Discus fish will invariably be found in places where tangles of tree-roots or fallen tree-trunks with their branches provide some shelter and security.

Another and often discussed aspect which has fascinated most serious Discus enthusiasts for many years is the kind of food available to them in nature. We know that foods like *Tubifex*, *Daphnia*, White-worms, etc., are not found in these regions. As a result of the ceaseless efforts by Dr. Rolf Geisler, we now know from tests he was able to carry out on newly-caught specimens that Discus fish feed on the larvae of a one-day fly (*Campsurus*). It seems that these larvae occur in great numbers and possibly constitute their main diet. Several species of a small and soft-skinned freshwater shrimp (*Macrobrachium*) were also found in the same proximity but it could not be established whether these also form part of their diet. So far these are the only two known foods found in their natural habitat and it seems likely that Discus fish feed on them during the dry season. Whether the high waters during the rainy season bring with them any other suitable food is as yet not known. It is also not clear as to what constitutes the main food for young Discus fish and we have to wait until this can be established. But as aquarium-kept Discus fish seem quite happy and can be kept in generally healthy conditions with the foods we are able to provide, these answers will only be of academic interest. No Discus fish enthusiast need ever fail because of want of a suitable substitute food.

Discus keepers will have noticed and felt confused by the many different names under which these fish are usually offered for sale and when (as I very frequently did) they try to check certain information in the available literature, a definite answer is rarely found. Of course, it could be so easy if only wholesalers, retailers and enthusiasts were willing to name fishes and plants by their Latin names as is common on the Continent and in most other fishkeeping countries. Most hobbyists might be surprised how quickly one could learn these apparently difficult-sounding names and at least one would know that a "spade is a spade." Take, for instance, the case of the fish *Symphysodon discus* Heckel 1840. This fish is also known as: Heckel Discus, Genuine Discus, Real Discus, True Discus, Disc Cichlid, Pompador fish and possibly others I have never even heard of. It is not surprising, therefore, that some would-be Discus keepers might easily lose heart and I feel it should be the responsibility of editors of publications as well as their contributors to see that a certain amount of order is created out of this confusion.

It is not my intention to present a scientific classification of the genus *Symphysodon*, but rather advise

enthusiasts to familiarise themselves with the classification made by Schultz 1960 which is today generally recognised (by most but not all experts). According to him there are two species with their sub-species:

- (1) *Symphysodon discus* Heckel 1840 (Heckel Discus);
- (2) *Symphysodon aequifasciata* with their sub-species;
Symphysodon aequifasciata axelrodi Schultz 1960 (Brown Discus);
Symphysodon aequifasciata haraldi Schultz 1960 (Blue Discus);
Symphysodon aequifasciata aequifasciata Pellegrin 1903 (Green Discus).

All other varieties like the Red Discus, Cobalt Blue Discus, Turquoise Discus, Seven Colour Discus, Blue-Faced Discus or Royal Blue Discus are named by breeders or collectors. The Red Discus is a "wild" species and has so far not been recognised as a separate species or sub-species. The overall coloration is slightly more red and there are also a number of red markings covering the body. It is generally thought that the Red Discus is a "differently" coloured Brown specimen. The Royal Blue Discus, so named by the collector Willy Schwartz/Manus-Brazil is always found in the company of the Blue Discus; it is basically a Blue Discus but the overall coloration is more intense and the markings cover the whole of the body. The Cobalt Blue or Turquoise Discus are sports and are the results of extensive line-breeding probably from different coloured Blue Discus fish by some American breeders. As far as the Seven Colour or Blue-Faced Discus are concerned, these are mainly Far Eastern tank-bred varieties. Their coloration is due to an early extensive feeding of certain hormones. As these colours will not appear in the young from such stock it must be said that the sale of such fish has no other purpose but to make a bit of extra money for those breeders who would otherwise have to sell these fish for what they really are—the cheaper and common Brown Discus fish. The Brown Discus fish is the one most often found in the tanks of dealers and hobbyists. It is perhaps easier to maintain and breed, but for sheer beauty it must always take second place to any of the other varieties and it is hoped that in the near future some dealers will find it as profitable to sell the much more beautiful and rare varieties of this genus.

The first conflict usually arises from the moment we decide to set up a Discus aquarium. Most hobbyists will have heard or read that these fish should be kept in a bare aquarium, but there are probably not many hobbyists who would want such a set-up in their living room. I also doubt whether mothers or wives would be enthusiastic about it—perhaps only the most understanding would be willing to tolerate such a "thing."

I feel that the deciding factor whether to keep these

fish in a so-called "clinical" environment or whether they should be kept in a decorated aquarium, should always depend upon what the hobbyist intends to do with his fish. If his main aim and ambition is to raise these fish in order to breed them, then he would be well advised to keep them in a "clinical" aquarium. But if the hobbyist only wants to display his fish as part of a nice room setting and wants something attractive to look at I can see no valid reason why they could not be maintained in a decorated aquarium.

On whatever set-up the hobbyist finally decides, it goes without saying that all the equipment should be of good quality and reliable. The aquarium to house the fish (which will attain a size of about seven inches when fully grown) can be as large as possible. But no aquarium smaller than 48 inches by 18 inches by 18 inches should be considered as their permanent home. For the "clinical" set-up the only other pieces of equipment needed are a heater and thermostat or heater/thermostat combined, a thermometer, a filter, an aquarium cover, a source of light and a bottom covering. For the bottom covering the hobbyist can use either a thin layer of a dark-coloured gravel (which must be siphoned out at regular intervals to be freed from accumulated dirt) or a sheet of matt-black perspex. The perspex is cut slightly smaller than the base sheet of the aquarium and is glued to the four sides of the aquarium with a silicone sealant. By using perspex rather than gravel, the bottom of the aquarium can be kept clean without too much effort. If desired, the hobbyist can also provide the fish with one or two plants. These should be planted in little plastic flower pots; they should be of an undemanding variety, fast-growing and able to withstand the high temperature needed by the fish. For best results I advise enthusiasts to plant a few bulbs of one of the *Nymphae* varieties in a plastic flower pot and within a very short time a good-sized plant will have developed. The large floating leaves will cut down some of the light and will give the fish some security and a place to hide when being disturbed. Such a "clinical" set-up has the advantage of being less work, easier to maintain and control and Discus fish—my Discus fish at least—seem as happy and healthy as I would wish them to be.

But, if it were decided to keep these fish in a decorated aquarium, we should aim to copy as closely as we can their natural habitat. As these fish are only found in places where an abundance of roots or branches from trees provide them with shelter, we can take it that a close link between the two exists, and hobbyists should aim to create such a scene by using the available bog-wood roots (obtainable from Everglades Aquatic Nurseries, Baunton, near Cirencester, Glos.). Only roots which are completely dead must be used; they should be thoroughly cleaned and kept in a boiling salt solution for at least one hour. If it is impractical to do this, then they should at least be

soaked in as hot a solution as possible for a few hours. This will kill all germs, bacteria, etc., which one would not want to introduce into one's aquarium. After the salt solution "treatment" the roots should be soaked in clean water, with as many water changes a day as time will allow, for about two weeks. By this time they will have absorbed sufficient water to make them heavy enough to stay at the bottom and will also no longer release large amounts of humic acids. There is no point in rushing this job; the more carefully these roots are prepared, the longer they will last and the safer they will become. Some of these roots look fantastic and any aquarium decorated with them will look very attractive. These roots should be considered to be the main decorating material for a Discus fish set-up. The gravel should be of a dark colour, lime-free and used in a thickness to support the plant life. Although stones or rocks are alien to their natural habitat, if they are used they should be small and free from sharp corners or edges. The aquarium should be planted with an undemanding and fast-growing variety of plants and the various Amazon Sword plants (*Echinodorus*) probably fulfil these requirements best. Also the use of some large floating plants is advisable to cut down the intensity of the light. As these fish seem to prefer to live in semi-darkness, it is essential for the hobbyists to provide the conditions. Enthusiasts will have noticed that Discus fish display their most brilliant colours in an unlit aquarium; surely this must mean something. As most aquaria receive their light from above, it is not surprising that these fish become dull and easily frightened and many hobbyists are completely ignorant about their magnificent beauty. I feel it is of great importance for Discus fish keepers to experiment with the arrangements of the lights. Difficulties will usually arise: when the fish are doing well and display themselves to the greatest advantage while the plants fade away. But to make the plants grow well by giving them the necessary amount of light will cause the fish discomfort. Hobbyists must try to achieve a balance to satisfy the needs of both: enough illumination for the plants, but also enough dark corners for the well-being of the fish.

Another and equally important point with which the enthusiasts must experiment when setting up a Discus fish aquarium is the installation of the filtering system. It has always been said that Discus fish do best in a "super" clean water and it was suggested that a power filter be used. A big power filter is required to keep the large volume of water reasonably free of suspended dirt particles, but such a power filter also creates a current and I have noticed that Discus fish do not take kindly to such a water. If the current is too strong, the fish seem to fight against it and as a result stay motionless in one place. But as soon as the power filter is switched off, they will start to glide gently through the whole of the aquarium. To overcome this

problem the return pipe must be installed so as to enter the aquarium in more than one place—two or even three points just below the water level all along the back side of the aquarium. If the power filter can be installed in this manner the return will create very little current and still keep the water crystal clear. I have also noticed that some hobbyists are not familiar with the function of the various filtering media. The most frequently used materials are Polymer wool or carbon. I also understand that most enthusiasts give their fishes a peat extract at fairly regular intervals to cause a black-water type of environment, while at the same time filtering the water religiously with carbon. This is rather pointless, for carbon will remove these expensive peat-extracts, as well as removing organic substances resulting from food decomposition and fish wastes; incidentally, it will also remove any chemicals or medicines added for the treatment of ailments and diseases, cloudiness, discoloration and smells. The only time a carbon filter should be used is when the hobbyist needs to remove any excess of substances as a result of a heavy peat filtration or for the removal of unwanted chemicals after treating the fishes for a disease.

Polymer wool is probably the most often used filtering material. It will keep only suspended matter back. It should be changed every week or two, or after cleaning in warm water, polymer wool can be used several times.

There are a great number of other filtering media available to hobbyists; some of them I have been using for many years and some are only "recent" discoveries, but all of them I have found to be of great help in making a sometimes difficult task that much simpler. Hilena's Depotfilter or Eheim's Ehfimech is a new concept type of ceramic filtering medium. Its advantages are that it can be used for a very long time (up to six months) before it has to be cleaned, and in theory will last for ever. Another suitable filtering medium for a Discus fish set-up is Hilena's Porenfilter or Eheim's Ehfisubstrat; this is a porous material on which bacteria will settle and break down biologically waste materials from the water. But without any doubt, peat is generally considered to be ideal as a filtering material for Discus. It will impart biological substances, it will soften the water and also lower the pH, and as far as I know is used by most serious Discus fish breeders all over the world.

The installation of my filtering system for my large Discus aquarium might be of some interest to some hobbyists and for those I will give a short description; it works well and some enthusiasts might very well want to try to copy it: I use an Eheim 476 power filter as well as a second 476 container with lid. The water from the aquarium enters the first container (without motor)—which is filled only with Hilena's Depotfilter filtering material—at the bottom inlet. A

short piece of plastic tubing is connected from the top outlet to the bottom inlet of the second container (with motor). The second container is usually filled with Hilena's Aktivtorf or Eheim's Ehfitorf Stark to create a certain water quality or with Hilena's Filtertorf or Eheim's Ehlfaser Mild to maintain the achieved quality of the water. The filtering material in the first container is cleaned every five to seven months and the peat is renewed every four weeks. The water from the aquarium passes through both containers and returns to the aquarium at three different points. I have used this system for many years and found it most satisfactory. The Eheim 476 power filter gives the required turnover but the placement of the three return points creates only the gentlest of currents and, as far as I can judge, my Discus fish seem happier now than when they were with the installation normally recommended.

Discus food. When young these fish will accept any given live food such as *Daphnia*, *Tubifex*, Bloodworms, Whiteworms and Glassworms; they will also feed on any good quality flake food. Another excellent food which is easily available is Oxheart and liver. I have for many years now been using a home-made food which consists of Oxheart and liver, Codroe, Spinach, TetraMin flakes and a Vitamin complex. "Different" kinds of these foods could be made by varying the ingredients but Oxheart should always be used as the main substance. All this is blended in a mixer and then frozen. Small pieces are easily cut off and are eaten by all my Discus fish. Even newly acquired fish which have never eaten such food will usually take to it without any difficulty. Fully grown specimens are a bit more fussy about their fare; they will not take *Daphnia* except perhaps only the largest kind and are also not too keen on dried flake food (although it is sometimes taken). But as there are a great number of suitable foods available, the feeding of Discus fish should no longer present any problems. They should be given a different food every time at least four to five times a day—and fish fed like that will reach sexual maturity earlier—in about one year. But if they can only be fed twice a day, their growth will be considerably

slower and maturity can only be expected at about two years. The feeding of all live foods must be done with caution since through them bacteria and disease can be introduced into the aquarium.

Finally, let me say a few words about Discus fish water. It has always been stated that these fish require a soft and acid water. This is certainly true if one wants to breed these fish, even though there have been some reports that they were successfully spawned in hard water (18° DH). These statements should be regarded as an exception rather than the rule. To induce a sexually mature pair to spawn, a hobbyist should try to provide water with a hardness of about 3°-6° DH, and the pH should be around 6. This water has proved to be the most acceptable one—to the fish—and if it can be provided it is usually only a matter of time before the fish are willing to perform the fascinating—and certainly worthwhile watching—act of spawning. But to raise these fish I can see no valid reason why they should not be kept in ordinary tapwater. I now raise all my young fish in standard North London tapwater and have never noticed any difference whatsoever between Discus fish raised in tapwater or soft water. The greater availability of tapwater makes the necessary and important water changes that much easier. It could even be carried out once a day—as I do with all my young Discus fish. But, in any case, the water must be changed at least once a week to maintain these fish in a healthy state and in a suitable environment. The addition of a Vitamin complex to the water (or direct to the food as recommended by the manufacturers), good feeding and a healthy environment should keep these fish free from disease—I have found them to be quite hardy—and their longevity will give the enthusiasts a great deal of pleasure for many years.

Although it is often said that the Discus fish is not a fish for a beginner, a beginner who is aware of their particular requirements and has the patience not to demand instant results, will find that the keeping of Discus fish is not much more difficult than keeping many other varieties of tropical fish.

WHAT IS YOUR OPINION? continued from page 385

the other pair 8 in. long. Both pairs were housed with swordtails, barbs, catfish, loaches, and gouramies and they never once attacked any of these fish. They even spawned in the tank. Thus, to my mind these fish were never too large or vicious, and the aquarists who wrote in disagreeing about large cichlids should try housing these interesting fishes for once in their lives."

For a future feature please send me your opinions on the following: 1. Under what conditions have you

kept and bred the sparkling gourami? 2. What is your favourite type of aquarium thermometer, and why? 3. What is the best brand of air operated outside filter? 4. Is the popularity of marines increasing? 5. What are the best conditions for *Nomaphila* (giant *Hygrophila*)? 6. As an aquarist, what would be your 'ideal' Christmas present? 7. What is the most useful tip you've gained from W.Y.O.? this year? I look forward to hearing from you.

MIDLANDS AQUATIC FESTIVAL

—1975—

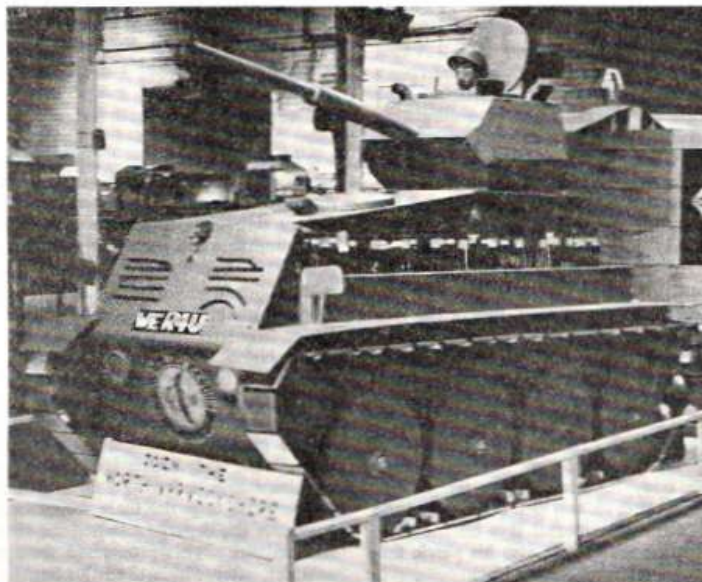
SATURDAY morning the 9th August came in at a modest temperature of 76°F, but it was early in the day, as yet, 8.30 a.m., in fact, when the first of the "Working Party" mustered at Bingley Hall, Birmingham, to prepare for the opening of the Midlands Aquatic Festival on Thursday 14th. A second "Working Party" had set out an hour or two earlier, to the lock-up premises where much of our Show Equipment is stored. It had to be loaded into a huge furniture van for conveyance to Bingley Hall in time to keep "Working Party" number one from taking it too easy whilst waiting for the equipment. Our "Gaffer" Hon. Secretary John Witts, and his Floor Manager Phil Jinks, had everything well organised and it all went like a well-oiled motor right through the day and well into the evening. By early afternoon, however, the thermometer had risen to nearly 90°F, and the order of the day, for the male members anyhow, was shirts off and no slacking.

One of the busiest persons there was Maureen Witts, John's Wife, whose prodigious tea-making did so much to alleviate our aching backs and dry throats. God bless you, Maureen, without you we could not have made it.

The two working parties consisted of the usual enthusiasts who turn up year after year to put on this eagerly awaited Midlands Festival. Each succeeding year sees one or two familiar faces missing, to be replaced by younger members full of enthusiasm, and strong young muscles, and they leave nothing to be desired. The combined muscle, enthusiasm, and organising skill of the longer serving members made such progress that by Tuesday evening the 12th August we were able to sit back and tidy up the loose ends in preparation for the grand opening on Thursday afternoon at 2.00 p.m.

On Thursday morning a small army of judges from

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Tilapia leucostica

AN UNCOLOURFUL BUT INTERESTING CICHLID

by David T. Payne

WHILST BROWSING in a dealer's shop recently, I came across four fish in a tank labelled *Tilapia leucostica*; they were all about 6-7 cm. in length. Questions in the shop brought forth the information that they were mouthbrooders, growing to some 16-17 cm., aggressive to all outsiders and not old enough to be sexed. Never having kept any *Tilapia* species before, I decided to purchase all four fish for the sum of 75 pence, on the assumption that I stood a good chance of getting at least one pair. Owing to the fact that I had not really gone to the dealers to buy fish, their first home was destined to be an 18 in. × 10 in. × 10 in. tank, furnished with fine gravel, rocks and a 4 in. clay flower pot with the entire bottom removed; this was on 3rd September, 1974.

The task of research now began and quickly ended as no reference was made in any of my books. A visit to the local library revealed a photograph and very scant details in "Cichlids," by R. Goldstein. The photograph at least established in my own mind that the fish I had purchased had been correctly named by the dealer.

They are not exactly attractive fish, being basically silver with irregular and indistinct darker areas on the sides; the fins are clear with some slight spotting on the anal, caudal and dorsal—not a fish to catch an observer's eye. All the fish appeared to have small ovipositors present.

On the morning of 8th September, two of the fish were observed in a great display of spread fins and head-to-tail thrashing inside the flower pot. Ovipositors were well extended, both some 1½-2 mm. long and off-white in colour. These two fish were now a completely different colour, having changed from their rather drab, passive dress into dark gunmetal blue-black. At this point the sexes were obvious, due to the much greater body thickness of the female and slightly broader ovipositor; it was also noticed that the extreme 1 mm. of the hard dorsal rays on the male were now a dull brick-red colour, also his pelvic fins and under mouth colour were almost black.

Much to my regret, I had arranged to go out this particular day and removed the other two fish before departing. Upon my return at about 6 p.m. both fish were found to be very pale and very nervous. Closer investigation revealed that the female had a distended brood pouch and, therefore, on this occasion, I had missed the actual spawning. It was decided to leave the pair together as they seemed to be quite peaceable. On 10th September, however, the male was removed partly because he was starting to display to the female and partly because the sight of the male feeding promoted the same instinct in the female and I was afraid she would consume the eggs. At this time the eggs could be observed through the transparent membrane in the brood pouch when the female shuffled them from time to time. They were almost spherical, 1½ mm. in diameter and cream in colour when compared to the size of the fish, they seemed enormous.

The male, in the meantime, had been placed with the other two fish and the following day (11th September) was observed frantically digging a fairly large depression in the gravel. Displays between the male and both the other fish occurred but were not of a lasting nature. On the day after this, it was evident that a spawning was imminent and fortunately on this occasion I was able to sit and watch.

Both fish were coloured as before and they were keeping the third fish firmly behind a slate in the tank. There occurred much displaying and brief swirling mouth biting. At this time it was noticed that the male appeared to be able to extend his ovipositor at will and sometimes it would almost disappear. Finally, the female passed very slowly down and up the depression in the gravel with a quivering motion going right through her body. After four or five passes, she began to release eggs, a few at a time, and as she turned to pick up the eggs the male would begin an identical pass over the depression when the female would nose his anal fin. This progressed for approximately 30 minutes, after which time the female retired behind

a piece of slate and the male lost interest. I had estimated that there were some 40 eggs laid and it was noted that some of these (approximately five or six) were much smaller than the rest. The female's mouth was much more distended than the first one. A decision was made to move this female into the tank with the first one and this was achieved by gently coaxing her into a submerged glass jug. The first female seemed to resent her presence and would move her around the tank by nose nudging and I began to think my decision to place them together had been a mistake. On 15th September, however, the second female was found to be eggless and was replaced in the other tank.

I was now left with the original female who had become very nervous and retiring. Finally, on 22nd September (14 days after spawning) four fry were seen in the tank, the parent was trying to regain them without success—she still had a mouthful. On the following day the whole brood (19 in all) were let out. They were approximately 6 mm. in length and accepted newly hatched brine shrimp eagerly while the parent was fed single large flakes of dried food. She would only take the brood back in her mouth when very alarmed. It was noticed, with interest, that she could eat flakes of food with the brood inside; does this mean she could have been fed during incubation? The brood were taken back during darkness only on the night of 23rd September. After this the female seemed to lose all direct parental instinct. On 30th September it was discovered that 13 of the fry had suddenly disappeared and the female was removed. The fry have accepted all foods (as do the adults) provided, of course, that it is offered in the right size.

By this time the male had spawned again with the egg-swallowing female on 28th September and her mouth and pouch were so distended that she could hardly move the eggs around. After this spawning it

was decided to move the other three fish to a 25-gallon community tank and observe their potential aggressiveness with other species. Once their initial fright had disappeared, they proceeded to examine their new surroundings; this seemed to upset a semi-adult pair of blue acaras who started to assert authority (they have never done this before). There was no real aggressiveness, just pushes and quick darts. The Tilapias appeared to accept the position and stayed clear of the acaras. The Tilapias have now lived quite peacefully for 10 days with fishes ranging from neons to an adult male *Cichlasoma festivum* and the male *Tilapia* has depressions dug in at least four places in the tank. Whether this peaceful position will persist remains to be seen.

It has now been established that the incubating female is able to eat flake food whilst holding a pouch full (very full) of eggs; she achieves this by sucking the edge of a flake through her barely open mouth and gradually working the whole flake in. This is followed by some time spent in sorting eggs and food out, which she seems able to do without any hazard to the eggs.

As previously stated, this is not a particularly attractive fish but in the five weeks I have kept them they have given me many hours of instructive pleasure. From my observations, three things seem to stand out:

1. Although normally spawning in a depression, this does not always happen as the flower pot in the first instance seemed to be a satisfactory substitute.
2. The female is able to eat whilst holding a pouch full of eggs or fry.
3. The male seems to be able to extend the ovipositor at will, almost telescopically.

In conclusion, the sexing characteristics seem fairly well defined, i.e., firstly the brick-red dorsal fringe only in the male and secondly the more pointed dorsal and anal fins in the male, this latter difference being much more pronounced than with most other cichlids.

M.A.F., 1975 *continued from page 391*

the Midlands, London, Bristol, Hampshire and Lancashire had combined to decide that the best tropical fish in the Show was a huge *Osporemus Gourami*, owned by Mr. Stan Woods of Redditch, and the best coldwater fish a beautiful nacreous Veiltail by T. G. "Tommy" Sutton of the promoting Society. A good entry of ten society tableaux saw the first prize go to North Warwickshire A.S., for their extremely fine "Churchill Tank" gun turrets and all. The trade also was well represented with support from Cornwall to London to Lancashire, and of course, the Midlands. The weather too, was kind to us having gone somewhat cooler than the 4-5 days of preparation, and we were very pleased indeed to welcome our visiting friends from London,

Manchester, Scotland, Hampshire, Bristol and Devon (who could enjoy an Open Show without them?).

Tropical entries were slightly down on the previous year, but to compensate coldwater entries were on the increase. Our concession to various Societies outside the Midlands area, to permit early removal of exhibits, did not bring the expected increase in entries and, in fact, cost us about 600 paying public due to early closing of the Show. Nevertheless, the Show was successful and we would like to thank all those who gave their support, including the *Aquarist & Pondkeeper*, Traders, Advertisers, Exhibitors, Visitors and the paying public, and last but not least, those hard working enthusiastic members and friends whose efforts made it all possible.

LES DODGE,
President, M.A.P.S., M.A.S.C.



OUR EXPERTS' ANSWERS TO YOUR QUERIES

READERS' SERVICE

All queries MUST be accompanied by a stamped addressed envelope.

Letters should be addressed to Readers' Service
The Aquarist & Pondkeeper, The Butts, Brentford, Middlesex, TW8 8BN.

TROPICAL QUERIES

by Jack Hems

I wish to construct an all-glass tank 48 in. by 20 in. by 15 in. What thickness and quality of glass do you recommend?

Plate or float glass at least $\frac{3}{8}$ in. thick.

I have a medium sized catfish which I bought under the name of *Sorubim lima*. Can you tell me something about this species?

Sorubim lima is popularly known as the spatula or shovel-nose catfish on account of the shape of its snout. It is a fast-growing and voracious feeding fish which, in its larger sizes, will clear a tank of guppies, platies, small tetras, and the like. It may well exceed 8 in. in the aquarium because it most certainly attains a much greater length in the wild state in the La Plata river system. It shuns a bright light but in a shady tank and after dark it is very active. Apart from the regular live food such as various worms, it should be given meat.

I have owned six *Aequidens pulcher* for the last four months. At the time I purchased them, they were roughly $\frac{1}{2}$ in. long. Now they are about 2 in. Is this rate of growth about right for their age? They are fed generously on live food and meat.

The rate of growth is about right. At a year to eighteen months, *A. pulcher* should reach full size, which is in the neighbourhood of 6 in.

I am a junior aquarist and have owned an aquarium for nearly a year. It was thick with a variety of plants until quite recently when most of the plants began to lose their foliage. The tank is 44 in. by 15 in. by 12 in. It is stocked with Australian rainbow fish, finger fish (which were very small when I purchased them) and various barbs. I should like to know why my plants are losing their leaves?

You did not mention the scientific or popular

names of the barbs you have in your tank, but I hasten to inform you that some barbs are avid eaters of plant life. The finger fish (*Monodactylus argenteus*) is not much of a plant eater in its smaller sizes, but as it increases in size so does its appetite for plants. Therefore, I think your finger fish is the chief culprit. If *M. argenteus* lacks natural greenfood, then you must supply it with frequent feedings of cooked table greens such as tender cabbage, turnip tops, kale or spinach.

I should like to top up my tanks with rain water. Should I aerate this water before use?

It is not necessary to aerate rain water before emptying it into an aquarium. Make certain, however, that it is clean and has been stored in a plastic pot, or wooden container.

I recently obtained two young *Tetraodon palembangensis* and wonder whether you know anything about this rather uncommon species which would help me to keep it in good health in my tank?

This puffer fish is quite easy to keep in a freshwater or a slightly saline tank. It is, however, something of a fin-nipper and should not be placed with flowing-finned or sluggish-moving companions. It reaches a length of about 7 in. and flourishes well on a diet of various worms, small water snails, small crustaceans, and meat. A temperature in the neighbourhood of 75°F (24°C) is as good as any.

I should like to know the temperature and food requirements of *Cynolebias bellotti*?

A temperature in the upper sixties to middle seventies (°F) is perfectly satisfactory for this fish for general maintenance and breeding. As for food, gnat larvae, white worms, live *Daphnia*, brine shrimps, young (small) water snails, and the like, should be on the menu.

I bought several stems of *Elodea densa* for my tropical tank on the strength of the advice I obtained from the pages of a book, the relevant paragraph of which stated that this plant would help to keep the water clear and wholesome and thrive well under fluorescent light. However, the *E. densa* I bought turned yellow and stringy within about a fortnight and then decayed right away. I have since been told that *E. densa* is only suitable for a coldwater aquarium. What should I believe?

I have never found *E. densa* to grow well, if at all, in very warm water. On the other hand it romps away at ordinary room temperature. *E. densa* grown at comfortable room temperature and then transferred to the lower range of a so-called tropical temperature flourishes very well indeed. After it has become used to a temperature of about 70 to 72°F (22°C) it will not object to a temperature in the middle seventies (°F). When you buy *E. densa* from a dealer it is best to see that it has been taken from a warm water tank.

My tropical community tank is placed close to a window so that the plants which grow well are not entirely dependent upon artificial light. Now, as we are going away for a fortnight can you tell me whether the fish will suffer without food?

The fish will not die of starvation if you feed them well on meat and livefood before you go away. If the tank is thickly planted, then the introduction of a few female livebearers in a rather advanced stage of pregnancy will provide the other occupants of the tank with fry as livefood.

Please tell me the size a tinfoil barb can attain in captivity? I introduced one into my 3 ft. community tank a couple of months ago and every day this barb appears to look larger than it was the day before.

You have a problem here that you can solve in two ways, (a) you get rid of the fish or (b) you provide it with a new and much larger home; for the tinfoil barb (*Barbus schwanenfeldi*) can attain a length of about 18 in.

I have bought some golden tetras (more white than gold especially on the top of the head) for my aquarium but cannot find any reference to this species in my books. Please can you tell me something about this fish?

The golden tetra is known to science as *Hyphessobrycon armstrongi*. Ordinarily it is a long-lived species and well-suited to a community tank housing similar sized peaceable fishes. It reaches a length of about 1½ in. It eats anything eaten by omnivorous fishes.

I illuminate my aquarium with ordinary tungsten lamps. I have observed, however, that

after the light has been switched on the temperature of the water rises to over 80°F (26°C). Without the electric light, the temperature keeps at about 70°F (24°C). Will this daily rise in the temperature harm the fish?

Firstly, a gradual rise or fall of a few degrees Fahrenheit harms very few fishes normally kept in the freshwater aquarium. Secondly, I think you will find that the temperature stays well below the eighties (°F) in the lower levels of the water. Do bear in mind that still or sluggish moving water in sunny countries is warmer at the surface during the daytime than it is after sundown. Fishes, therefore, have learnt to adjust themselves to a few degrees difference in temperature in the different layers of water.

Have you any information to give me on the red-finned barb?

Many fishes have more than one popular name and frequently one popular name is applied to more than one fish. However, the fish that I know as the red-finned barb is *Barbus camptacanthus* from West Africa. This fish attains a length of about 6 in. and has silvery sides flushed with red mingling with yellow, a shadowy to blackish horizontal band, red fins and two pairs of barbels. If the above description fits the fish you own or have heard about then it eats all the usual fish foods, alive or dried, and flourishes best at a temperature in the middle to upper seventies (°F).

I should like to keep some red-bellied newts in my tropical aquarium stocked with inoffensive fishes. What do these exotic amphibians require in the way of food and living conditions?

The Japanese or red- or fire-bellied newt will tolerate a wide range of temperature, but it is essentially an amphibian for the unheated tank. That is a tank kept at ordinary room temperature. I doubt whether it would live too long at a strictly tropical temperature. I have kept Japanese newts for years and my specimens are always overwintered in a tank kept in an unheated room. Their tank is divided into a swimming area and a bog area. The bog area is filled with peat and pieces of cork bark. When the weather turns really cold, and sometimes before, these newts leave the water and retire for long periods of time under the cork bark. During the warmer months of the year they are active among a tangle of *Elodea densa*. They feed on white worms, live *Daphnia*, wood-lice, small or chopped earthworms, anglers' maggots and tiny pieces of meat. They will take wood-lice, worms, grubs, maggots, meat, and the like, on land. Ordinarily, however, they feed in the water. The tank for Japanese newts should be provided with a close fitting glass or mesh cover otherwise they will climb the sides and escape. Take my advice and give these charming little newts a small tank to themselves.

GOLDWATER QUERIES

by Arthur Boarder

I am making a pond with a liner, 15 × 11 ft. and 3-2 ft. deep. I intend to construct a waterfall with Westmorland rockery stone with concrete joints. Do you think that the free lime from the concrete will be harmful to the fishes?

Whilst free lime in the water can be very harmful to fishes, I do not think that there is any need to worry if certain precautions are taken. See that as little as possible of the concrete is exposed to the running water and when it is set, wash it or scrub it well before letting water run over it into the pond. Your advantage will be that the pond is a fairly good sized one and so the concentration of free lime in so much water is not likely to be sufficient to do any harm. To make quite sure that no trouble could occur, why not incorporate some liner material between the rocks where the water will flow so that no concrete will be in contact with the water?

Are filters really necessary for coldwater tanks and if so which type do you recommend?

It is possible to keep coldwater fishes in tanks with no filters at all. It is now seventy-five years since I had my first fish tank, and with a few lapses of time I have had one or more ever since with never a filter of any description. During the intervening years I have had various tanks running for up to seventeen years without having to empty them completely of plants and water. You also ask if siphoning the mulm from the bottom once a month will be enough. I think that if a fair number of fish are in a tank it is important to give the servicing once a week. With regular feeding, especially in the warmer months of the year, it will be found that a fair quantity of mulm will form on the bottom. It is well to see that the base compost is lower at the front of the tank so that much of the mulm will collect there mainly caused by the actions of the fish. By clearing the surplus mulm each week and an occasional pruning of the water plants, it is possible to keep a tank running successfully for many years with no major change of water or plants. I am, of course, assuming that the correct amount of food is given at all times and that the tank is not overstocked with fishes.

The marginal plants have flourished well during the past two years and I wish to split them up so that the pond does not get too

crowded. When is the best time to do this and how shall I proceed?

Any time during spring and summer is all right for the dividing of these plants. The spring is the best time but later on will do as long as the work is not left too late, such as after July. When dividing water plants it is well to discard the old rather worn-out parts and use the newer growths, usually near the outside of the clump. You can be quite drastic with your discarding as young growths will get established quickly and soon make good specimens.

I constructed a concrete pond last year and it has had several changes of water since. I have now put some fish in it and find that there are a number of "Water Tigers" and beetles in the pond. Will these harm the fish? Also will you tell me the price of your book, "Coldwater Fishkeeping"?

The price of my book is £1.00, post free, from the *Aquarist and Pondkeeper* as advertised in that magazine each month, and available from the publisher's address. The water creatures in your pond are not likely to harm the average sized pond fish, but they could kill small fishes. The usual pests are water boatmen, water beetles and their larva and the larva of dragon flies. These pests can be netted from the pond and the easiest time to catch them is at night. A strong torch will show them up plainly when they come to the surface to breathe, and it is a simple task to catch them then.

I recently bought a telescopic-eyed moor, now it is turning gold. Can you give any explanation for this please?

I suggest that the water in which you are keeping the moor is warmer than that in which it has been kept previously. I can remember that many years ago I lent a moor to Nottingham Aquarist Society to make up an exhibition of fancy goldfish which they were putting on. When the moor was returned to me some months later I found that it had turned to bronze. I then found out that it had been kept in a tropical tank after the show. I doubt very much if your moor will turn black again. It can often be noticed that some moors have a distinct bronze colour to their lower parts.

I have two tanks, one is 28 × 12 × 12 in., and the other 42 × 12 × 15 in. high. How many fish will each hold?

Each inch of body length of fish needs 24 square inches of surface area and so the first tank will take 14 in. and the other 21 in. of body length of fish. Where a tank is 12 in. across all you need to do to find the allowed number is to halve the length of the tank and you have the correct figure.

I have five small goldfish in a tank and one fish is often chasing the others about. Why is this please?

It is probable that the chasing fish is a male, as this is the usual action of goldfish when in breeding condition. Watch for eggs as if no action is taken by you, any eggs laid could be eaten by the fish. Eggs are small beads of jelly about the size of a pin's head and adhere to water plants. If seen the plants with eggs should be transferred to another tank or the fish removed so that the eggs may hatch. If the water in the hatching tank can be raised to about 70°F, the eggs should hatch in two days or three at the most.

I have a small pond, 3 ft. 4 in. × 1 ft. 8 ins. × 2 ft. 1 in., in which I have bred common and edible frogs for three years. I now wish to keep fish and would like to know how many and which kinds?

Start with half-a-dozen common goldfish, about 3 inches long overall. I suspect that some frogs will come to your pond to breed next spring and so it might not be a good idea to try to keep any of the fancy goldfish with short bodies, such as fantails or veiltails. The reason for this is that slow swimming fishes could be caught by an unattached male frog and killed. The faster moving kinds of fishes are more likely to escape these attentions.

I have recently made a garden pond and stocked it with some Koi. I planted three water-lilies in containers and in potting compost. When the lilies formed some pads on the surface, the whole of the lilies' root system floated to the top of the water and the potting compost spilled into the water. Can lilies be planted in aquarium gravel and if not, what should be used? Can they be planted with equal success in large plastic flower pots, and can you give the names of the larger flowering water-lilies and what colours they are?

Many pond keepers will have had the same trouble with water-lilies planted in containers and not into a solid base compost in the pond. Even a large plastic pot which has had most of the compost seeped out of it can float to the top with the whole lily. When I have planted lilies in pots I have set the large pot on news-

paper and surrounded it with a thick base of concrete. This not only stops the lily from floating up but prevents the pot from falling over. However, I also had to secure the lily to the pot with plastic cord. The best medium I know for planting lilies is some old turf. The gravel you mention would have no nutriment and until the fishes supplied some the lily could be starved. It would take up too much space for me to give the names and colours of all the large flowering lilies and I suggest that you send for a catalogue from one of the many dealers who usually signify the sizes and colours of their plants.

I have recently built myself an outside pond. Can you tell me if the following fishes are hardy enough to stand a reasonably severe winter in the pond? They are: Goldfish, Comets, long-tailed Goldfish, Golden Orfe, Japanese Fantails, Golden Tench, Japanese Calico Fantails and Red-cap Orandas.

The Golden Orfe will stand any amount of cold as long as the water is pure. As for the other fish, most of them will be quite safe except any which have flowing finnage. Such fish may go through the winter safely if the weather is not too severe but in a bad time the fins could become affected with fin-rot or fungus disease. Also if any of the fish have been purchased fairly recently it would help you in your choice to know at what temperature they were kept before you bought them and any which have been in almost tropical conditions would perhaps be safer under cover for the winter.

I have a garden pond 8 ft. by 3 ft. Can you tell me how many water plants I need and why do goldfish die in a pond?

The number of water plants is not important. It is their size which will determine whether they can do their work or not. One rampant growing *Lagarosiphon major* could be all you need as it is a fast grower and in a month or two could be all that is necessary for your pond. One of the small types of water-lily could be used but it must be one of the *pygmaea* types. If you try to grow too many oxygenating plants in your pond you may find that some of the more vigorous ones will choke out the weaker growing ones. You could also find that by the middle of the summer you could not see a fish for plants. Fish in a garden pond do not die for no good reason. Goldfish can live for many years as long as the water is in good condition. It is when the water becomes polluted through either overstocking with fish or over-feeding, that trouble can ensue. In a pond which has clean water the fish will live through the winter safely although the pond may become frozen over. Reduce all feeding as the water cools down and you will be halfway to success.

PRODUCT REVIEW

The Schego M2K3 Air Pump

A large, high-output air supply unit incorporating two diaphragm pumping mechanisms activated by a common energising coil. The distributors claim, and have demonstrated, a capability of operating twenty-four airstones at a two-foot water depth.

The layout and construction of the pump have been carried out to a well-engineered robust design. A large energising coil drives the two operating-arm magnets through long sweeps to give about one-eighth of an inch of movement at each diaphragm. The diaphragm assemblies are of the usual pattern with the valve chambers being mounted on a central rigid supporting block which contains internal air passageways connecting the individual outputs to the common regulating valve. The diaphragms are made of a high-quality, flexible rubber. The whole thing is really well made and should prove to be very reliable. A mains on-off switch is built into the case and about a yard of supply cable is provided.

The distributors include a six-months guarantee and operating instructions are supplied by the continental manufacturers. These last are a little garbled in the translation to English, one classic being "pull off the mains plug" instead of "pull out . . ." A good layout diagram is given, together with step-by-step instructions for changing the diaphragms.

On test in my fish-house the pump ran a bank of thirteen aquaria, using fifteen filter lifts and two airstones in total, quite adequately. Operation is silent, and the pump does not generate the large mechanical vibrations often associated with big vibrators. The output regulating valve appears to be a bypass arrangement which returns unwanted air back into the pump body. In a multiple aquarium installation it can be screwed right in and forgotten, as each appliance supplied will need its own regulator or clamp anyway. This pump would also be ideal for marine aquarists and others wishing to create substantial turbulences or air-lifted water flows in a single, very large aquarium.

No power consumption figure is given, but I would think about ten watts would be correct. Size is approximately $6\frac{1}{2} \times 3 \times 2\frac{1}{2}$ ins., and the weight just under two pounds. A loop is fitted for wall mounting.

Price (at time of writing)—£14.50, plus V.A.T. at 25 per cent.

Distributed by Shirley Aquatics Ltd., Stratford Road, Monkspath, Shirley, Solihull, West Midlands B90 4EF. Telephone: 021-744 1300.

A. JENNO.

Phillips Fry Food for Livebearers, manufactured by Phillips Yeast Products Ltd., Park Royal Road, London, NW10 7JX. This new fry food is supplied in a plastic container but the weight of the contents is not given. I do not know the price at the time of writing.

Most aquarists know of the excellent range of fish foods manufactured by the Aquatic Division of Phillips Yeast Products Ltd. The range includes the high quality Phillips Superfood of which I think so highly and now use as the staple diet for all my adult tropical fishes. Until recently Phillips produced a fry food for only the fry of egglayers; their latest food, Fry Food for Livebearers, is a growth food specifically formulated to meet the needs of the fry of livebearers. By using both foods one can now successfully feed the fry of the majority of both tropical and coldwater fishes.

Phillips Fry Food for Livebearers is composed of liver and fish meals, skimmed milk powder, yeast, cod liver oil, insects, soya meal, high-protein wheat flour and highly nutritious freeze-dried egg, roe, shrimp, liver and spinach. The analysis of the food is: min. crude protein 55%; min. crude fat 5%; and max. crude fibre 3%.

The manufacturers inform me that special care has been given to the selection of the particle size of this new food to make it suitable for, and acceptable to, all young livebearers. I tested samples of the food on batches of fry of different sizes and found that the manufacturers' claim was indeed correct; also, the food spread well over the water surface permitting all babies to get their share—which they greedily did. Naturally, hungry healthy fishes will eat virtually any sort of food; and to test properly a growth food for the fry of livebearers one would have to conduct a series of controlled experiments over an extended period. Unfortunately I do not have the time, stock or facilities to evaluate fish foods in such an objective manner; however, the relatively high protein content of this new food, taken in conjunction with Phillips fine reputation in relevant fields, would indicate that Fry Foods for Livebearers should make an excellent food for appropriate baby fishes. The food should be fed very sparingly several times per day. The adage "little and often" would

appear to be appropriate for the feeding of the fry of livebearers—particularly bearing in mind the fact that guppies can digest a meal in a couple of hours.

I have no hesitation in recommending Phillips Fry Food for Livebearers to those who breed this group of

fishes; and indeed it would possibly make a useful second food for baby egg-layers which have outgrown Phillips Fry Food for Egg-layers.

B. WHITESIDE, B.A., A.C.P.

BOOK REVIEW

"Aquaria" by Jim Kelley.

A highly informative book intended for the beginner in the hobby, and one which is particularly suited to the younger aquarist. It is well written in a straightforward, step-by-step fashion which imparts all the basic information without frills, and this should prove easy to understand. The theories behind the various aquatic principles are touched upon but are not dealt with in any great detail, so that the book remains as a nice simple instructional system for the budding aquarist's first reading. The text is lightened by various illustrative diagrams, drawings and tables, and a number of colour photographs.

The author, Jim Kelley, was a very well-known aquarist and aquatic writer in this country some years ago, and was especially noted for his contacts with the hobby in America. The book represents his experienced appreciation of the problems which beset the beginner in the hobby, and the areas where instruction is needed.

The layout of the book is effective. All the main references are printed in heavy type in a marginal setting, so that any subject can be found fairly quickly by slowly flicking over the pages. It is printed on good quality paper which would appear to be reasonably waterproof.

My only criticisms are against Mr. Kelley's use of the rather artificial words "aquaristics" and "aquariology," which may be related to his American travels, and his recommendation of breeding traps for female livebearers without mention of the fact that practically all of those available commercially are so small that any decent-sized female suffers in them, and not infrequently dies or aborts as a direct result of this imprisonment. He also mentions glass wool as a filter medium when nowadays nylon is a much safer material for this purpose.

The book is a new edition of the original version first published in 1969. Published in February, 1975 by Knight Books, the paperback division of Brockhampton Press Ltd., Leicester. Price in the United Kingdom, 75p.

A. JENNO.

NEW LEGISLATION

General

BRITISH wildlife law has been further strengthened in the granting today (1 August, 1975) of the Royal Assent to the Conservation of Wild Creatures and Wild Plants Bill.

The Conservation of Wild Creatures and Wild Plants Act 1975 widens the scope of the law in two distinct areas; it gives protection to rare and endangered wild creatures and wild plants and it extends and clarifies the law relating to wild plants generally.

While it is accepted by all those concerned that conservation legislation is difficult to enforce—although in several notable cases persistent offenders have been successfully prosecuted under existing laws—it has also been realised that at a time when wildlife is increasingly threatened the new Act will have an important educational role in encouraging wildlife to be left in the wild for all to enjoy.

It is to the credit of the Botanical Society of the British Isles (BSBI), the Council for Nature (CfN) and the Society for the Promotion of Nature Reserves (SPNR) who have campaigned over many years and have worked hard to obtain greater legal protection

for wild plants, that this Bill has now been given the approval of Parliament. It is also a second triumph in as many years for the MP for Rother Valley, Peter Hardy, who steered the Badgers Act to its satisfactory conclusion in 1973, and who now, after drawing first place in the private members' bill ballot last October, has repeated his success.

Wild creatures

Under the new Act it is illegal, except under licence or in a few other specified circumstances, to kill, injure or take, or to have in your possession any of the following wild creatures: large blue butterfly, sand lizard, smooth snake, natterjack toad, and the greater horse-shoe and mouse-eared bats. It is also an offence to sell any of these wild creatures, even if they are dead, including specimens that are in the form of a skin or a skeleton. All these animals are now extremely rare in Britain and the reptiles and amphibians in particular have been declining rapidly so that we have reached the stage where collecting could be the factor which finally eliminates them. These protected wild creatures and all species of bat must not be marked or ringed as this is also an offence, unless a licence has been obtained from the Nature Conservancy Council.

VIEWPOINT

by A. Jenno

DURING my summer holiday at Brighton I was able to combine aquatic interest with holiday-making quite successfully. The Brighton Aquarium is world-famous. It was established in 1869 and was one of the scientific marvels of the Victorian age. It has since been modernised on several occasions in its long life and today still holds a prominent place among the country's leading public aquaria. The building now has a dolphinarium and Sea-lion and Penguin enclosures, but for all this it is still primarily an aquarium in the true sense with the tanks of fishes and other water-creatures forming the major exhibits.

The responsible aquarist is Miss Jackie Goulder, a young lady with tremendous enthusiasm and dedication. Besides being responsible for the welfare of all of the exhibits except the dolphins, which are treated separately, she also trains the Sea-lions and puts them through their paces in several public shows daily. Miss Goulder is a highly competent aquarist and has held down this very demanding job for the last three-and-a-half years, not by virtue of theoretical qualifications but due to a deep interest and consideration for the creatures in her charge. This enthusiasm for the subject is reflected by the displays. Nothing is flashy or spectacular and the emphasis is on good fishkeeping with the welfare of the inhabitants being of prime importance. The tanks are not overstocked, the water is clean, and each container has its own filtration system with auxilliary additions where necessary.

Of all the interesting displays the one which most impressed me was a large tank containing Rainbow Trout. Usually whenever I see these fish in aquarium conditions they are clustered around the air or water inlet to their tank trying to obtain sufficient oxygen for their needs. At Brighton they swim about normally in crystal-clear surroundings. Another large tank holds several full-size Lemon Fin Barbs in immaculate condition. To be able to keep such large fishes in a proper shoaling situation is far beyond the scope of most private aquarists, so this tank is a treat indeed. Several of the larger Gouramies, some Oscars and other large tropicals, were on show in various exhibits around the hall. Many of these have been donated by aquarists who have eventually been unable to keep up with increased size. Miss Goulder is always prepared to find a home for any large or unusual specimen that becomes too much for its owner's facilities, and in addition to these fishy acquisitions, the Aquarium is also something of a bird

recuperation centre. At the time of my visit a crippled Jackdaw and a young Seagull were being looked after by the staff behind the scenes.

On the marine side there are the usual large exhibits, Conger Eels, Turtles, and so on, but of especial interest to the hobbyist are three tanks of synthetic sea-water set up as decorative tropical marine environments populated by various common coral reef fishes, anemones and sea-horses. There are no small native marine exhibits, a sad omission I thought, but otherwise the range of species on show covered the fishy world very well.

Some weeks ago I set up a small marine aquarium in a glass tank of only about ten gallons capacity. The decor consists of some limestone rocks brought back from Lulworth Cove (by Weymouth) last year and various pieces of dead coral and some shells. A biological filtration system was included, using about two inches of unwashed coral sand, and the tank is lit by a twenty-five watt tungsten bulb for about fourteen hours daily. No heating equipment was included, so the water temperature varies with the ambient value in my fish-house, which has been as high as 84°F in the recent warm weather. After a two-week ageing period I bought a half-pound piece of "living rock" and obtained some seaweed, *Caulerpa prolifera*, from a friend. A population of Bristle worms, small transparent anemones, and various other tiny organisms soon spread from the living rock all over the tank. The *Caulerpa* grew and algae developed on the rock and glass surfaces. My next acquisitions were a Tube-worm and a small tropical Blenny (*Cryptocentrus* species?). These both settled in well and the Blenny in particular has provided much interest and amusement. My holiday in Brighton resulted in the addition of several Beadlet anemones, two small crabs, a shrimp, various other very small creatures, and some more seaweed which I have not identified.

I now consider this aquarium to be more or less fully stocked. Feeding consists of Liquifry, newly hatched Brine Shrimp, and crushed aquarium snails, which last the Blenny and the crabs particularly appreciate. The aquarium as a whole has settled into a very natural, stable state and I find myself watching this one small tank for more than any of the others and I have developed a great interest in the goings-on in this little artificial world. The point is, of course, that this is something anyone can try.

A ten-gallon glass tank is within everyone's reach and is relatively inexpensive to set up and maintain. One advantage of such a small container is that it can be crowded with rocks and coral quite easily and will look more natural than a larger tank with extensive glass surfaces visible. It will undoubtedly be easier to keep an invertebrate community in such a limited volume than it would be to house small fishes, but in my case anyway this is my main interest. I have a big hand-held magnifying glass and by employing this can study even the smallest creatures.

I feel that many prospective marine aquarists are put off by being told that they need a twenty-gallon (or more) sized container as a minimum, when all they want to do is to have a little mess-about, as I do, in the first place in order to get the feel of this branch of the hobby. It would also seem sensible to me for dealers who are hoping to start off new marine aquarists to keep a selection of suitable native species such as Beadlet anemones which could be sold at a low price and would so help newcomers to gain experience without great expense. Various tropical invertebrates and some small fishes could surely be kept in quite small water volumes with sensible feeding and water management, particularly now that the principles of biological filtration are so well understood. As far as my own small experiment is concerned, I will report on its progress again later.

I have had some interesting correspondence recently with readers who have been kind enough to offer me advice on points mentioned in this column. I am especially grateful to Mr. F. J. Ayres, who is the chairman of the Yorkshire Branch of the British Koi-Keepers Society, and his colleague and contributor to this magazine Mr. W. Zaczeniuk, who both wrote long detailed letters concerning my Koi losses in my garden pool. In particular Mr. Ayres stresses that Koi pools should be three or four foot deep and partially shaded, which advice is contrary to that usually given for goldfish pools, so we can see that Koi do need specialised treatment and are not just another fish for the ordinary garden pool. Mr. Ayres also brings up the old question of a dealer's obligation to quarantine fishes before sale, and points out that Koi benefit especially if this is done correctly. If it is not done then it is felt that the purchaser must do this himself before adding the new fish to an established pool, because in Japan breeding is apparently carried out on a natural basis, i.e., in semi-wild conditions, so that imported Koi usually have an assortment of parasitic organisms in and on their bodies when landed in England. To quote directly from Mr. Ayres' letter (with his permission):—

"Quarantining fish is an easy but messy process. The fish should be placed in a small quarantine pool without either plants or gravel. This pool should be kept fairly shaded and covered by netting to avoid

the fish jumping out. If possible, a small but gentle stream of fresh water should be used constantly. If this is impractical, then $\frac{1}{4}$ to $\frac{1}{2}$ of the water should be changed every day. After the Koi have had a chance to recover from their journey (2-3 days) they should be placed in a container of Dipterex at a concentration of 6 grams per pint for 5 minutes, then returned immediately to the quarantine pool. This treatment, which kills fish lice, anchor worms, skin and gill flukes and possibly some bacteria, should be repeated twice at weekly intervals. If, after two or three months, the fish is still in good health without missing or raised scales, bruises, sores etc., it may be placed in the main pool with reasonable safety."

Dipterex can be bought in small 28 gram packets at gardening shops, or the distributors are Bayer Agrochem Ltd., Eastern Way, Bury St. Edmonds, Suffolk. In a later letter Mr. Ayres states that the above average dosage must be accurate and the rate given applies *only* to Koi.

It would seem then that Koi are not exactly a beginner's fish and nor are they very suitable for the gardener who is not an aquarist, unless he has the benefit of experienced advice and assistance. We may be able to make a reasonable comparison between Goldfish and Koi with, for instance, Guppies and Discus in freshwater, or Damsels and Butterfly fishes in saltwater, and experience would seem to suggest that prospective Koi enthusiasts should join an organisation such as the B.K.K.S. in order to benefit from those who have already suffered and surmounted the problems which commonly occur to the uninformed.

I also had a most interesting correspondence with Mr. Keith Burr, who is a keen member of the British Killifish Association. Mr. Burr originally wrote to me about the specialised societies directory idea, which fell flat, and was then kind enough to answer some queries I had regarding Killies, and did, in fact, send me some eggs in the post with hatching instructions. In the course of time some did hatch and I now have my first true Killies growing up. Like my small marine involvement, these little fishes have proved to be a new interest, and I am hopeful of some small success. Mr. Burr is obviously very much a loyal member and asks me to mention that the B.K.A. is always open to new members interested in this rather specialised group of fishes.

Addresses for the above two organisations are—The British Koi-Keepers' Society, Mr. D. C. Davies, Membership Secretary, 137 Gayfield Avenue, Withymoor Village, Brierley Hill, Staffs. The British Killifish Association, Mr. P. Brown, Registrar, "Rushen," Elm Grove, Eccleston Park, Prescot, Merseyside L34 2RX.

Finally, readers may have noticed from adverts

Continued on page 403

THE PEPPERED CATFISH

A FAVOURITE OF LONG STANDING

by Jack Hems

THE SUBJECT of this article was among the first of the warmwater catfishes ever to be kept by the old-time tropical aquarium enthusiast. Indeed, it was about the only small tropical catfish with the exception of the pygmy *Corydoras hastatus* and the bronze *C. aeneus* commonly available to hobbyists in the early 1930s. For all that, the species was described for science by Jenyns as long ago as 1842 and thirty-six years later, Pierre Carbonnier bred it in Paris. (It is interesting to note that Carbonnier, well known for his interest in goldfish, bred the long-tailed paradise fish (*Macropodus opercularis*) in 1868).

Foremost amongst the desirable attributes of *C. paleatus* is its hardiness. It will tolerate a range of temperature of some thirty degrees (F). To be precise, from about 59°F (15°C) to 86°F (30°C). This, however, is only to be expected from a fish that lives in the natural state in southern Brazil and northern Argentina: areas of South America where climatic conditions range from very warm to cool.

As an inhabitant of a community tank, *C. paleatus* leaves nothing to be desired. It neither falls out with its own kind nor worries or makes a meal from smaller companions. Even guppy fry remain unharmed in its company. Its longevity (in the aquarium) is quite remarkable, that is for a small fish. In this it differs from some other species of the genus *Corydoras* that too frequently die (in my experience) in less than a year after purchase: and this for no apparent reason. As a rule, *C. paleatus* lives longer than five years; ten years is not unusual.

C. paleatus, popularly called the peppered catfish, is a member of the family *Callichthyidae* confined to South America and characterised by protective rows of horny shields, or plates, that cover the sides. The pectoral and adipose fins are furnished with single anterior spines. The eyes are moveable and roll independently of each other. There are two pairs of short maxillary barbels. The mouth is underslung. A large peppered catfish measures about 2½ to 3 in.

The sexes of small *C. paleatus* cannot easily be told apart. In well-grown fish, however, there are differences clearly visible to the trained or observant eye. Firstly, the female is the more heavily built of the two and when she is in breeding condition her full sides display a pink flush that is more evident lower



down than above. Secondly, apart from the male being smaller than the female, his pectoral and pelvic fins are more pointed.

The general coloration of *C. paleatus* is difficult to describe with any accuracy because it is made up of a sort of patchwork of irregular spots and blotches of yellowish green, muddy brown, brownish yellow, black and grey overlaid in parts with a sheen of metallic gold, green and blue. The grey fins are adorned with dark streaks and spots.

C. paleatus is, of course, like the overwhelming majority of its large tribe, a bottom frequenter. All the same, it does rise to the surface at irregular intervals: not for food (though it will learn to do this in imitation of its tank companions) but for reasons of respiration; for notwithstanding that the fish is essentially a gill-breather it also has a supplementary breathing system. This functions through the walls of the gut, which absorb the atmospheric oxygen taken in through the mouth. As mentioned above, then, though hurried dashes to the surface are made at irregular intervals for a mouthful of air and not specifically for a mouthful of food, if the water runs low on oxygen (a condition usually brought about by pollution or even excessive warmth) then the visits become more frequent.

The appetite for all kinds of food is great. It will sift the compost for anything eaten by non-faddy feeders: dried food, tiny pieces of meat, swallowable or chopped worms, floor-hopping *Daphnia*, and the like, and is on the go most of the time, day and night. That it is called a scavenger is really a misnomer. For clearly this fish, and many other catfishes, will not touch much, if any, spoiled food if better fare is available. And, indeed, *C. paleatus* will not eat filth. All this fish does is to clear up fresh left-overs. That is to say, the food middle- and upper-layer swimming

fishes have missed or have not been able to eat on account of the quantity introduced by their owner or anyone else. Hence the newcomer to tropical fish-keeping should learn how to feed properly and not believe anybody who says that catfish will keep a tank spotless and wholesome.

Assuming, optimistically, that a male and one or two females are ripe for spawning (apart from the bloated appearance of the egg-filled female there can be no doubt about the sexual excitement of the male and his intentions; these are demonstrated by his dancing, swooping and nuzzling movements) then breeding the species is not very difficult. As soon, then, as the fish show signs of spawning, they should be placed in the breeding tank. An 18 in. by 12 in. by 12 in. tank is large enough. A slight drop in the temperature after the fish are introduced into the spawning tank is recommended rather than the other way about. That is to say, if the fish have been used to a temperature of about 75°F (24°C) then a drop to 72°F (22°C) or lower almost always triggers off egg-laying. Egg-laying will take place at a range of from about 65°F (18°C) to 75°F (24°C) or thereabouts.

The water in the breeding tank should be hard and alkaline rather than soft and acid. This recommendation has been generally accepted by aquarists of repute for more than thirty years. The nuptial rites are interesting to observe. The female moves restlessly in all levels of the water followed by the male. The dancing and swooping is intensified. Now and then, the male or the female (or both) mouth parts of the glass, stones, and plants. This in order to rasp away strands of algae and clinging sediment. Then, of a sudden, the male halts, usually

on the bottom rather than among a thicket of plants, and turns on a side or onto his back. The female approaches and the pair present their ventral surfaces one to the other. After a moment or two, the female swims off with a few eggs pursed in her ventral fins. This performance is repeated over and over again and after every extrusion of eggs, the female sticks them to a previously cleaned surface. Spawning in this manner may continue on and off for several days. During this period, the parent fish should be kept well supplied with such things as shredded meat and whiteworms. For although they are not avid seekers-out and eaters of their own eggs, the fact remains that they are more likely to look for them and devour them if other food is not available. Moreover, to be on the safe side, it is advisable to remove the parent fish from their eggs when spawning is completed.

The eggs hatch in about a week and the largish fry make for the bottom where they hunt for nourishment. This is best provided in the form of micro worms, powdered flake food, and the like, until they are large enough to take chopped or whole whiteworms, minutely shredded meat and so on. Thenceforward growth is not amazingly fast but steady.

THANKS!

May I use your column once again to thank all your readers, both dealers and hobbyists, who so kindly wrote to me after the publication last month of my reply to Mr. Sandfield's letter. All letters sent to me will be replied to personally but please accept my apologies if, due to the large mail bag, there is some delay.

JOHN ADAMS, (Director), Ark Aquatic Centre.



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DEVELOPING COLOUR STRAINS IN TROPICAL FISH

by Bob Purdy

ONE OF THE prime factors in the popularity of tropical fish is, without doubt, the tremendous profusion of colour that has been made available. Every imaginable hue is found on one species or another enabling the aquarist to make a picture of living colour from his aquarium. In the wild, nature has produced such gems as neons, cardinals, discus and various dwarf cichlids from South America and from Asia comes the pearl, dwarf and thicklip gouramis as well as many numerous small barbs. All these fish are highly coloured and are all top sellers in this country.

The recent influx of expensive cichlids from the Great Rift Lakes in Africa has only been popular because of the vivid colours displayed by most of these fish. Some of them are so brightly marked that they equal, and possibly surpass, a lot of tropical marine fish which themselves are all noted for their superb markings and colourings. No ordinary aquarist is going to pay £15 or £20 for a rare specimen if it looks like a deformed herring but the same man will often part with a similar amount for a highly coloured discus. The aquarium trade is governed by the economics of supply and demand and today's demand is for brighter more colourful fish.

For many years now, breeders have been concentrating on producing bigger fish with longer finnage and brighter colours and nowhere have they been more successful than with the four most popular live-bearers, guppies, swordtails, platies and mollies. Another species which has been successfully cultivated is the Siamese Fighter (*Betta splendens*), some specimens of which are so brightly coloured they are quite breathtaking.

How is it possible to improve on nature with such magnificent results? The answer is relatively simple; a knowledge of genetics, a good stock to start with and an infinite amount of hard work, patience and dedication. If a comparison is made between today's broadtailed, highly coloured, male guppy and his drab, short-tailed, wild cousin the amount of hard work and patience which went into this transformation will be immediately apparent.

There are basically two different theories to account for the colours and patterns in wild fish. One school of thought believes the patterns and colours are a form of camouflage but this hardly seems possible in cases such as neons or cardinals. The other main

school of thought feels that colours and patterns play a large part in enabling the various species to breed only amongst themselves and go a long way in preventing cross-breeding with other similar species. As there are a number of discrepancies in this theory as well, it is far from totally convincing. Perhaps both theories are right, perhaps neither but what is obvious, however, is that the natural colourings and patternings of a fish are favourable characteristics for its survival. Such characteristics are genetically dominant factors and make the production of a fish of different colours and patterns to those of wild stock a most difficult process.

Very, very rarely, a fish of different colour does appear from wild stock; this type of fish is called a mutation and the odds against it turning up are quite enormous. When a colour mutation does occur in the tanks of a serious breeder a new strain can sometimes be fixed from it and eventually becomes available to the aquatic trade. Most, if not all, of our present day colour variations come from this type of mutation.

Mutations can and do occur in nature; most of us have heard of "white" blackbirds but when they do occur they are invariably killed off by their own species, sometimes even by their own parents. This kind of behaviour keeps the species a pure strain by ensuring the mutation does not live to breed and pass on its new characteristics to the next generation. This is part of nature's selective breeding programme which is primarily concerned with species survival and propagation and has no place for colour, grace or beauty, although these can often be side products.

When a colour mutation occurs in captivity, however, the aquarist can, with luck, raise it to maturity and then decide if it is a fitting basis for beginning a new strain. Not all mutations are attractive and in fact very few of them can be of use. Sometimes, to complicate matters, they can also be sterile. Three of the most common and striking mutations which can come direct from wild stocks are the yellows or golds (xanthic forms), the blondes and the albinos. These are all caused by varying degrees of one factor, that is to say, the amount of melanin or black pigmentation in the cells of the skin. All wild fish and, in fact, most living things contain melanin-carrying cells, or melanophores, in their skins. These are black or dark brown and effectively mask any other pig-

mentations in the cells underneath them. An interesting fact concerning melanophores is their ability to expand or contract, thus making the fish lighter or darker. This phenomenon has been experienced by most aquarists at one time or another as most fish when given a sudden fright will get lighter in colour, sometimes even turning colourless.

All wild stocks of fish, no matter what colours they carry, are termed greys and contain, what is to their own species, the normal number of melanophores. Once in a while a mutation occurs containing a lot less in number of melanophores than normal and this is termed the xanthic or gold form. The fish will look a lot more yellow than normal because the lack of melanophores allows the yellow or xanthic pigments to show through the skin. Examples of this type of mutation which has been fixed into true breeding strains are, amongst others, Gold Rams (*Apistogramma ramirezi*), Gold Severums (*Cichlasoma severum*), Naja's Golden Angel (*Pterophyllum scalare*) and several strains of guppy, platy and swordtail. An important fact worth noting is that, although a lot fewer in number, the melanophores contained in the skins of xanthic fish are usually a lot larger than normal.

In the blonde mutation the melanophores are once again a lot less in number but are this time the normal size for the species. These fish are lighter in colour than xanthic fish; some of them are still slightly yellow, while most of them are, as their name suggests cream or blonde. Three species of livebearers, once again, guppies, platies and swords all have true breeding blonde strains but this type of mutation is, so far, less common than xanthic or albino forms.

Albino mutations are individuals that completely lack melanophores and their most striking aspect is, without doubt, their bright pink eyes. The pink coloration is caused by uncovered blood vessels showing through the retina at the back of the eye. When these blood vessels are covered by melanophores the eye appears to be black and the amount of light reaching the sensitive areas at the back of the eye is greatly reduced. Because of the lack of melanophores in the eye, most albinos have very poor sight and some are quite blind; no albino appreciates strong light.

It is thought, by some people, that albinism is a complete lack of all colour pigmentations but this is not so. Albinism is just the total lack of melanin or black pigmentation. Albinos can and do carry all the other colour pigmentations such as red, blue and yellow and some quite attractive albino fish have been produced. A beautiful strain of hi-finned, lyre-tailed, albino swordtail has been successfully bred and some strains of albino guppies, although comparatively rare, are quite striking. Albinism is a fairly common mutation but in spite of this very few albino fish are offered for sale, the main reasons being the weakness of the fish and the difficulty in breeding them. One

exception that springs to mind is the Albino Tiger Barb (*Barbus tetrazona*) which in most cases is a strong and very colourful strain.

Once a mutation has occurred it is then necessary to resort to inbreeding in one form or another in order to fix a strain. To accomplish successful inbreeding a basic understanding of genetics becomes essential.

Genetics is the study of how characteristics are passed on from one generation to the next and is named after the very minute bodies which actually carry the characteristics on them and which are called genes. Without going into too much detail, genes are found within the cells of the body and are themselves carried on other inter-cellular structures called chromosomes. The number of chromosomes in a cell are fixed within any particular species and chromosomes are always found in pairs. The fact that chromosomes are always paired is important because the pairing is arranged in such a way that like characteristics are always brought together; for example, colour characteristics are always found on chromosomes which are next to each other.

Because all chromosomes are paired any individual has two complete sets of characteristics, one set from its mother and one set from its father. If and when that individual mates it only passes on one complete set of characteristics, its mate passing on the other set to give their offspring, once again, two complete sets. What happens is this: a cell inside the female is divided and each half takes with it one complete set of un-paired chromosomes. Each half now becomes an egg. Likewise, in the male, a cell divides and becomes two separate sperms each containing, once again, one complete set of un-paired chromosomes. When sperm and egg combine the two un-paired sets of chromosomes combine (pair up) and give the new individual its genetic blue-print of characteristics.

Mention was made earlier of a genetically dominating factor which can now be explained. If a fish has two similar colour characteristics, for example, a red factor on each of a pair of chromosomes, then the fish will quite naturally be red in colour. If that fish, however, has two different colour characteristics such as a red factor on one of a pair of chromosomes and a black factor on the other, one factor will dominate the other and the fish will show the dominant colour. In very few cases indeed will the fish be a mixture of the two colours. The dominant colour is called a genetically dominant factor. In swordtails (*X. helleri*), black is dominant to red and such a fish would be coloured black. The red colour characteristic, which would be dominated, is then called a recessive factor. A genetic code can be used to record characteristics and in this code black would be written as B and red would be written as r. Capitals are used for dominant characteristics and small letters are used to represent recessive ones.

A red coloured swordtail is written as rr, each letter representing the colour characteristic carried by one of the paired chromosomes, but a black coloured swordtail is either BB (two black characteristics) or Br (one black characteristic and one recessive red). It is impossible to tell if a black swordtail is carrying a red characteristic just by looking at it. If it was desired to mate a pure black swordtail (BB) with a pure red swordtail (rr) this can now be shown graphically as follows.

(1)
$$\begin{array}{cccc} & BB & X & rr \\ Br & Br & Br & Br \end{array}$$

As can be seen, the four characteristics, two from each parent, are combined in all possible ways and in this case produce offspring which are all identical and all obviously black in colour. As a further theoretical exercise a brother and sister from the brood can now be mated. This is one form of in-breeding and is called a sibling cross.

(2)
$$\begin{array}{cccc} & Br & X & Br \\ BB & Br & Br & rr \end{array}$$

It is interesting to note that there are now three genetically different types of fish in this second brood. One quarter of the brood is pure black (BB), half of the brood is also black in colour but carrying the recessive red factor (Br), and the final quarter of the brood is red (rr).

Using this knowledge of genetics and taking the Gold Severum as an example, it is now possible to trace the method of breeding used to produce this strain of fish. As far as colour is concerned the ordinary wild severum is considered to be grey and is written in the genetic code as GG, using capitals to indicate the dominant characteristic. The gold or xanthic form of this species has a lot fewer melanophores in the skin and consequently lacks the grey colour. It is coded as gg indicating a recessive characteristic which in this case is "lack of grey." Sometime in the past, the Gold Severum appeared in captivity and was raised to maturity. The parents of this fish probably carried one of the "lack of grey" characteristics each and the mating would be recorded graphically as follows.

(3)
$$\begin{array}{cccc} & Gg & X & Gg \\ GG & Gg & Gg & gg \end{array}$$

As one quarter of the brood is, in theory, all golds a possible pair can be taken from these and because neither will carry the grey characteristic G they will produce 100 per cent gold offspring. If however, as is often the case, only one or two golden fish are raised to maturity a parent-to-offspring cross is the best way to proceed. It is impossible to tell which of the grey youngsters are carrying the recessive factor g but it is obvious that both of the parents are. A parent-to-offspring mating is known as a back-cross.

(4)
$$\begin{array}{cccc} & Gg(\text{parent}) & X & gg(\text{offspring}) \\ Gg & Gg & gg & gg \end{array}$$

In this brood 50 per cent of the offspring are golden and it will not prove too difficult to raise at least one good pair to maturity. A predicament could arise in the original brood if both the parents died before the offspring could be raised to maturity and there was only one or two golden fish of the same sex. A grey fish would have to be chosen from the brood to mate with the best gold and providing the grey fish carried a recessive factor g the next brood would be the same as 4. Because it is impossible to differentiate between the grey fish in the first brood a fish could be chosen which had no recessive g factor and the result would be as follows.

(5)
$$\begin{array}{cccc} & GG & X & gg \\ Gg & Gg & Gg & Gg \end{array}$$

As the offspring of this mating would be all grey the inexperienced aquarist might well give up in disgust. All that is now needed is to back-cross one of the offspring to the golden parent to produce 50 per cent golds or, if once again this is not possible, a sibling (brother-to-sister) cross will give 25 per cent golden offspring as in 1.

Once a strain has been fixed by in-breeding it then becomes necessary to bring in "fresh blood" in the form of an unrelated fish. This type of mating is known as out-crossing and is essential because prolonged in-breeding can produce a number of undesirable characteristics such as smallness, weakness, deformities of fins or body and lack of immunity to diseases. At this stage there are no unrelated Gold Severums available and therefore an ordinary grey has to be used. The results, of course, will be exactly the same as in 5 and the same methods of back-crossing or sibling-crossing must be used to retain the strain of golden fish.

After the strain has been fixed, another method used to ensure its continuity is that of line-breeding. Two pairs from one brood are mated and their offspring are kept separately and are in-bred for two to three generations. The two lines are then recombined to form two new lines; the recombining is obviously a form of out-crossing using the fact that after two or three generations the fish are only distantly related. Line-breeding is probably the better method of perpetuating a strain but it doubles the number of tanks required and if the strain under culture is a livebearing one, necessitating the segregation of males and females, the number of tanks required to run two lines can be in excess of one hundred and fifty.

Apart from the need to stick rigidly to the genetic breeding programmes outlined it is also wise to apply other common-sense rules to facilitate the production of a strong healthy strain. Any fish that are weak, sick, deformed or small must be ruthlessly culled unless they are absolutely indispensable to the breeding programme and if they are used it will take a great

Continued on page 411

Geophagus surinamensis

AND A SUCCESSFUL SPAWNING

by R. E. and I. M. Bebb

IN THE June issue of the *Aquarist* there was published an article on the cichlid *Geophagus surinamensis*, in which the authors assumed from the shortage of published information that these fish are difficult to breed.

We have a pair of *Surinamensis* which we have successfully bred. Ours were purchased about two years ago, mistakenly as *G. jurupari*. We did not know at the time that they were a pair, as it was impossible to spot any difference between them. They were put into a 54 inch tank with other large fish, including a couple of large tinfoil barbs. However, they developed the habit of digging up the undergravel filter which made it desirable that they be found a new home, and they were moved to a 36 in. by 8 in. by 10 in. tank of their own.

This tank was set up with fine gravel to enable them to easily sift through it for food, and some rocks and a flowerpot to provide hiding places. They promptly took up residence one at each end, digging and piling up the gravel until their homes were to their liking. They constantly squabbled over the centre portion of the tank, darting out from their hiding places and whirling round in a tight circle in the middle of the tank. We also noticed them locking jaws and pulling each other around, which raised our hopes that they were, in fact, a pair.

The larger of the two, which turned out later to be the female, always got the worst of these encounters so to prevent further damage they were separated by a glass divider. After about three weeks of separation we noticed that they were right up in colour and that their breeding tubes were down. They were allowed back together and started sparring up to each other, the male occasionally shaking himself from side to side.

A few days later we returned home to find the flowerpot covered with large white eggs, the parents taking it in turns to stand guard and fan water over them in typical cichlid pattern. On the third day after the spawning, the eggs disappeared and we assumed that they had been eaten until we saw the shells still in place. The female was hiding behind a rock and was being bullied by the male, so we

decided to separate them again.

The female refused to eat and kept making chewing motions, so we hopefully suspected that she might be mouthbrooding. Our suspicions were confirmed five days later when we saw her spitting fry towards the male on the other side of the glass. He promptly tried to dig under the divider, but succeeded only in making a small hole. This was, however, big enough for some of the fry to get underneath and he took these in his mouth. We assumed that he had eaten them but we misjudged him.

About a week later the parents were removed to an identical tank and again separated. Ten days after separating them the female was seen making runs over a rock, and next morning the rock was covered in eggs. These, of course, became fungused and were eaten. However, about ten days later she again started making runs over the same rock, and the divider was removed. After two or three days of mild quarreling the pair spawned on the female's chosen site.

Unfortunately, we did not witness the actual spawning. Again, the eggs disappeared after three days, and the parents are currently brooding the young. They appear to be taking turns to look after their offspring, as each is eating on alternate feeds and we have observed them apparently passing the fry to each other.

Our first brood, numbering about 150, is coming along well, and the young *surinamensis* are as easy to please regarding food as their parents. Flake, chopped *tubifex*, brine shrimp and tinned cat food are all eagerly taken, although the young are more ready to rise to the food than are their parents. The fish live and spawned in our local tapwater, which is medium hard and slightly alkaline, and seem to be doing well in it. Our female is now about five inches long, and the male about four and a half inches.

We would be delighted to supply any further information to anyone who wants to have a try at breeding this delightful species, and if they would like to send an S.A.E. with their enquiries to 26, Bailey Crescent, Poole, BH15 3HA, or phone Towngate 2418, we will do all that we can to help them.

The Cold Marine Aquarium

THERE ARE quite a few sea fishes from our coast that are suitable for keeping in a cold marine aquarium, and one of the most interesting is the plaice, for it is a perfect example of a species that has adapted its body to its living conditions. No one is quite sure when this first occurred, but it must be many thousands of years ago.

The form of adaptation in the plaice is from a normal upright fish form to a deeper form vertically, in order to lie and swim on its left side so that it can exploit the sea bed. In this position its left eye would be useless, so it migrates over its head to the right side, and at the same time the mouth alters its shape to one that can grasp objects more easily on its left side, thus enabling it to feed on the bottom. These changes all take place before the larval plaice is more than two or three months old.

An adult female plaice produces anything up to a quarter of a million eggs very few of which survive

similar ones internally, and during the next three weeks these are almost completed so that at 60 days old the young plaice is as shown at 5, and is swimming flat on the bottom. Its length then is little more than half an inch, the upper surface (the right side) has darkened and has a few spots, while the left side, now underneath, has taken on a whitish colour. It now feeds on small worms and crustaceans.

For the rest of its life the plaice remains on or near the bottom, feeding on large creatures such as cockles and other shellfish as it slowly grows. At one year old it is over 2 in. long, and it reaches about 5 in. in its second year. The longest one recorded was 33 in. long, and this was estimated to be about 40 years old. Around Britain the average size reaches 15 to 18 inches or so.

For the aquarium I prefer to catch a really small one, about one or two inches long, and at one time had a fine tank containing three such plaice. The

THE PLAICE

by *Bill Simms*

through all the various stages of growth to become adult because they form part of the food of all sorts of sea creatures. The eggs float singly in the sea and are carried by ocean currents almost everywhere, and take anything from eight to seventeen days to hatch, according to the water temperature.

For about eight days the larval plaice live only on the yolk sac that has been absorbed into the stomach, but after that they begin to feed on microscopic floating life such as diatoms and the first larval stages of shellfish. Drawing 1 shows their shape after hatching, and 2 is their development at eight days old.

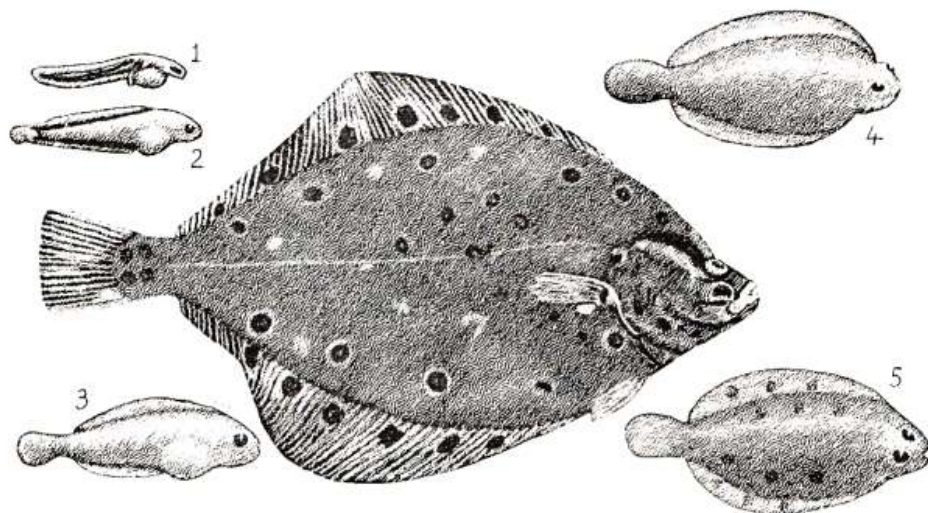
From then on the baby plaice grows very slowly, but its body deepens from its shape at 20 days old, when it is 3/8ths in. long (shown at 3) to thirty days old, when it is very little longer, but considerably deeper vertically. Up to this stage it still swims upright, with an eye on each side of the head.

Then the great change begins, for by the 40th day the left eye has moved to the head top (shown at 4) and the tiny plaice begins to eat small crustaceans and to move towards a lower strata of the water. While these external changes are taking place there are

tank was 24 in. long, with a bottom of sea sand carried home wet in a polythene bag. When it had settled down in the tank I found that I had captured two feather-plumed worms, as well as many smaller creatures. This is important, for the life in the sand helps to keep everything healthy. The sea water, also, was brought home in polythene bags—four strong ones—and I went to a lot of trouble to see that it did not warm up too much on the way home, because heat can kill smaller sea creatures.

Five small rocks, each with some seaweed anchored to it, were installed in the back corners, and the effect was fine. The three small plaice were caught with an ordinary shrimping net which I scraped along a flat sandy bottom under 2 ft. of water at the low tide mark. I caught dozens of shrimps as well but they were kept separately—for my tea.

One of the essential points about a cold marine aquarium is to keep it cold, and I managed this by placing the tank out of doors against a north-facing wall of the house for the summer. During the winter it was brought indoors to a bedroom window. While it was out of doors I built a large canopy from perspex



to cover it so that no rain could enter the tank. In this position I never found the temperature to rise above 66°F.

A difficulty in feeding my small plaice at first was soon overcome, for I found that they would take chopped-up mussels, which were easily obtained. Later on I was able to get very small cockles and these were dropped in the tank to act as a live store, but what a lot they ate! At one time I was unable to visit the beach for some weeks, so I tried some shredded white fish flesh. Some was eaten, but far better was chopped-up freshwater shrimps, obtainable from a nearby stream. At one time I used brine shrimps, but found them a little bit small.

For nearly two years I kept those small plaice well and happy, and during that time was able to observe

their colour changes. At first they were placed on evenly coloured sand, and they became drab, with hardly any spots showing. Later I introduced some patches of fine gravel, with plenty of variety in its colouring. Within a week or two each fish had developed lovely markings, and once again they were difficult to see on the gravel. I have noticed that plaice from different districts, with different ground colours, always manage to alter their colour to suit the background.

If you are near enough to the coast to make some regular visits, an aquarium such as this is easy to fix up, and there is no shortage of young plaice—provided you are persistent, and dredge for them at the low tide marks.

COLOUR STRAINS

continued from page 408

deal of patience to eradicate these traits at a later stage. In fact, many promising strains can be lost through in-breeding producing unwanted characteristics which prove too stubborn to move.

Gold, blonde and albino strains are essentially the easiest to produce because the change from the normal is sudden, obvious and complete; the genetics of the breeding programme are clear cut and a good strain can be fixed within four to six generations. Other colour strains can be a lot harder to produce and fix as the differences are gradually formed over many generations going through many different stages before a pleasing end product is reached. At this

stage the work of fixing the strain will begin and can be most difficult because of the continual appearances of throw-backs to previous forms.

All things considered, the aquatic hobby is just at the beginning of producing many colourful and beautiful strains of fish. In forty years or so the guppy, platy, swordtail and molly have taken on a tremendous number of new forms and colours and during the last ten or fifteen years remarkable advances have been made with many egg-laying species such as gouramis, angels and barbs. Without diminishing in any way the efforts of many breeders who have so far given us an abundance of new colours and shapes it can be said that there is far more to come than has already been produced.

PRODUCT REVIEW

S.P. Air Pumps

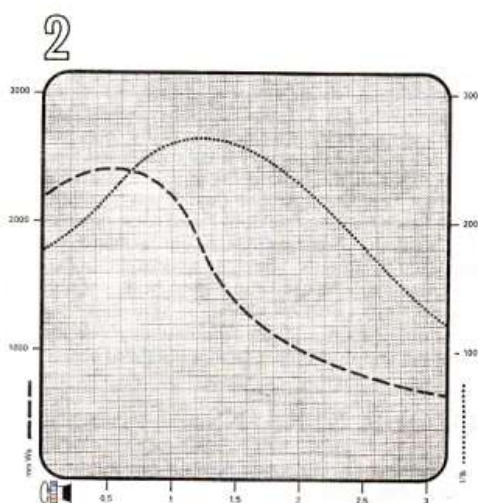
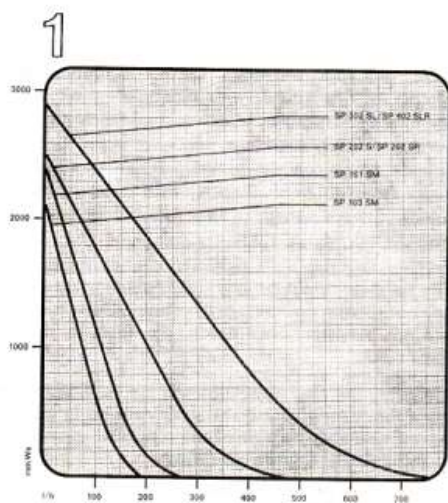
A range of four diaphragm-operated air producing mechanisms of increasing sizes which, when incorporated with adjustment options give a "family" of six pumps.

Figure 1 shows the output characteristics of each model, the relationships illustrated representing output pressure (measured as the amount required to balance a head of so many millimetres of water) against output volume (in litres per hour). It can be seen that as larger water depths need to be overcome, so the available output volume reduces. This fact is of course common to all pumps and should be taken into account, especially so where very deep aquaria are to be supplied.

All four diaphragm mechanisms are typical of the prevalent modern design. The energising coils are

are built into aluminium-alloy cylinders with plastic end caps.

Apart from size and consequent increase in air output, the other differences between the pumps are in the methods used to regulate the output air. The two smaller pumps, the SP 103 SM and the SP 161 SM, both have a built-in gadget called an "oscillating moderator," which is basically a screw mechanism which allows the end of the operating arm carrying the magnet to be moved nearer to, or farther away from, the energising coil. This action produces varying amplitudes in the operating arm movements, and hence alters the air output. Figure 2 shows this action in terms of the number of turns on the adjusting knob. It is interesting to note that maximum output does not apparently occur at the full screw adjustment, and that the relationship is not linear. Of the other pumps, the SP 202 S and the SP 302 SL are not fitted



mounted axially to the operating arm and there is no direct mechanical contact to produce unwanted noise or vibration. The diaphragms and their valve chambers are situated off-centre of, and below, the operating arm and the output air connections protrude from the valve chamber casings. The first four pumps in the "family" are housed in rectangular heavy-plastic cases with transparent undersides, while the two larger ones, the SP 302 SL and the SP 402 SLR

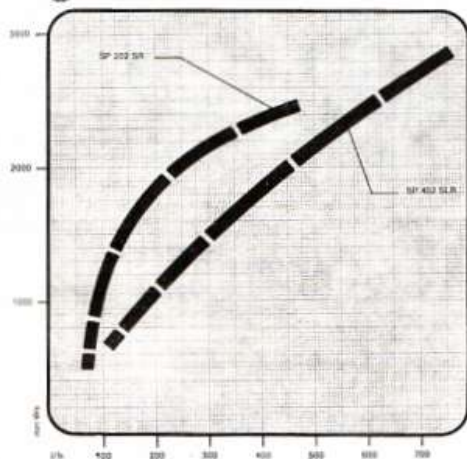
with regulation and so just work flat out at all times. Their output can be controlled by external fittings. The SP 302 SL has a mains supply on/off switch. The remaining pumps, the SP 202 SR and the SP 402 SLR both have electrically operating regulators, rotary potentiometers which decrease the power available to the energising coil. Figure 3 shows their characteristics.

Figure 4 shows the manufacturer's recommenda-

tions regarding which pump should be chosen for aquaria of various capacities (in litres), and for both fresh- and salt-water situations. These are naturally only given as a rough guide and do not take into account the container shape or the number of appliances to be supplied with air, and would seem to me to

Some years ago I used one of these, of an older pattern but essentially the same pump, to supply all the air for eight medium-sized aquaria in a small upstairs room. I also have a model similar to the SP 103 SM, the baby of the range, which has been working in my garden shed for over two years, supplying air to a

3



4

	Süßwasser fresh water eau douce acqua dolce agua dulce Zuswasser situation	Seeswasser sea water eau de mer acqua marina agua marina Zuswasser situation
— 50 L	SP 103 SM	SP 161 SM
— 75 L	SP 161 SM	SP 202 S/SR
— 100 L	SP 202 S/SR	SP 302 SL/402 SLR
— 200 L	SP 302 SL/402 SLR	SP 302 SL/402 SLR
— 300 L	SP 302 SL/402 SLR	2xSP 302 SL/402 SLR
— 500 L	2xSP 302 SL/402 SLR	3xSP 302 SL/402 SLR

be a little overdone in order to cover all situations. One hundred litres is about twenty gallons.

The pumps are all very well constructed, quiet in use, and remarkably free of vibrations. Diaphragms are ozone-resistant and are guaranteed for six months use. All models except the smallest, the SP 103 SM, have input air filters which use easily-replaceable nylon wool in small containers fitted into the cases. Mains cables are of good length and are fitted with continental two-pin plugs.

On test the pumps worked well and lived up to expectations completely. Both methods of output regulation were smooth to use and had good range. The two large metal-cased pumps are particularly recommended for the aquarist with several aquaria.

small pool and occasionally to buckets and other containers. This has never yet needed repair.

Prices (at time of writing):—

SP 103 SM — £3.24
 SP 161 SM — £4.50
 SP 202 S — £7.50
 SP 202 SR — £10.44
 SP 302 SL — £13.92
 SP 402 SLR — £16.74

All above excluding VAT, which is at the 25 per cent rate. Spare parts are available.

Distributed by John Allan Aquariums Ltd., Eastern Industrial Estate, Bury St. Edmunds, Suffolk IP32 7AB. Telephone 0284 5051.

A. JENNO

B.K.K.S. NEWS

The British Koi-Keepers' Society are looking forward to seeing as many old and new members as possible at their popular stand at the Aquarium Show at the Royal Horticultural Society Old Hall, Vincent Square, London S.W.2. on Friday, Saturday

and Sunday, 24-26 October 1975.

A meeting, open to all interested, will also be held in the New Hall, with interesting talks, slides and discussions at 2.30 p.m. on Sunday, 26 October.

OBITUARY

The death of Captain L. C. Betts, M.B.E., on 11th August, 1975 has taken from the leadership of the British aquarists hobby an outstanding and well-known personality whose work, especially for the fancy goldfish-keepers, has made a lasting impact. As early as 1936 he was writing articles for "Water Life" and two booklets in the "Water Life" series published in 1937 and 1938 were from his pen. During the war he seemed to become involved in many difficult campaigns, but in the last phase when the Germans were driven from Belgium, he managed to keep a few goldfish in his quarters! After the war he was well known as a writer, speaker, breeder and judge of goldfish. When the F.B.A.S. was resuscitated "Goldfish Betts" was there to help. When pet traders reorganised he was a good adviser. But the project closest to his heart was to form a club of goldfish fanciers and to raise the quality of the fishes bred. His close association with the late Dr. R. J. Affleck led to the formation of the Goldfish Society of Great Britain. Bob, who proved to be the foremost British ichthyologist specialising in research into the anatomy, embryology, genetics, diseases and general raising and feeding of goldfish, although a writer and teacher, was introvert. The partnership with the extrovert, ebullient Len was the perfect balance. Len was the man to whip up enthusiasm, gain recruits and loyalty by sheer-personality. He was very sociable and lectured to clubs, judging many cold water shows. The Goldfish Society of Great Britain was founded in 1948 with Capt. Betts as chairman. Subsequently he became Vice-President and then President. After studying large numbers of goldfish lent by G.S.G.B. members, the Society was ready in 1950 to produce its first goldfish standards booklet. To the scientific knowledge provided by Bob, Len was able to add his outstanding knowledge of ideal fish and the judging thereof. The basic principles, enunciated in the first set of G.S.G.B. Standards, have stood the test of time through two revisions up to 1972. Len at the time was a Port of London Authority river officer especially concerned with anti-pollution measures in the tidal waters of the Thames. He cajoled and generally bullied offenders into conforming with the spirit of the regulations. Much progress has been made with the cleansing of the Thames since he retired, but due credit should be given to his work in those early days. His job called for a knowledge of the oxygen, bacterial and chemical content of water and of course with the treatment of sewage effluent. This led him to become a leading advocate of biological filtration for aquaria and ponds. He was full of drive, imagination and initiative. An example was his idea that G.S.G.B. members should lend good showy fancy goldfish for stocking one of the pools in

the Festival of Britain Exhibition with a stipulation that a notice should be displayed indicating the G.S.G.B. participation. Len, of course, could pop in during the day while on one of his trips up the Thames in order to keep an eye on the fish and, to feed them. Came the closing of the Exhibition when Len and I attended on the stipulated day to collect our fish and to return them to the G.S.G.B. member owners. There was consternation when we found that the pool was empty and the fish sold to a dealer! Fortunately Len had a contract with the Festival Authorities to indemnify us substantially for the loss of these "high quality pedigree fish". The compensation was a welcome addition to G.S.G.B. funds in those early days. In 1950 he wrote "We are leading no crusade unless it be an appreciation of the goldfish as a fish and the necessity for knowledge if we are to progress. So let Tolerance, Friendship and Good Humour be our watchwords." He would like that to be his message to his successors—the present day goldfish enthusiasts.

MORRIS CLUSE,
President, Goldfish Society of
Great Britain.

BRITISH DISCUS ASSOCIATION

The B.D.A. has recently been formed to cater exclusively for *Symphysodon discus* and its related species, to increase and share our knowledge of this beautiful and demanding family of fish.

The Association is open to all with an interest in discus fish, from the meanest amateur to the experienced professional breeder.

We are trying to arrange meetings in various parts of the country and all members are provided with a list of the names and addresses of all other members to encourage a regular exchange of news and information.

It is obvious from the "small ads" in the *Aquarist* that more and more people are breeding this once impossible fish; many of the young fish so produced are doomed to an early death in unsuitable community tanks, and this can only discourage many aquarists from keeping them.

Discus keepers are not an exclusive elite; anyone can keep and breed discus if they will only take the trouble to learn something about them first. This is where the B.D.A. comes in. Why not drop a line to Mr. F. W. Ashworth, 41 Pengwern, Llangollen, Denbighshire, N. Wales and find out more about us. A stamped addressed envelope would also be appreciated.

Our next meeting will take place at 2.30 p.m. on the 19th October at the Richmond Community Centre, Sheen Road, Richmond, Surrey.



THE AXOLOTL TALE

by Andrew Allen

FUNNY looking beasts. The axolotl caused quite a stir when unveiled before a blasé Paris of 1865, a Paris grown bored with the bizarre. The novelty remains: today kids from beau quartier and bidonville giggle uncertainly at the grotesque little monsters behind glass walls in the Jardin des Plantes.

No, axolotls don't look quite right (just as the spelling of their name is perpetual torture). The tiny legs are too weak for the thick nine-inch body, movements are inelegant, proportions unbalanced, the three pairs of gills too feathery. And sometimes there are albinos; staring pink eyes and toilet paper gills seem obscene features on the face of an amphibian. This is a beast whose symmetry has gone haywire, a gross sport transfixed as a giant, inflated tadpole.

Enough anthropomorphism. The axolotl still tantalizes and offends aesthetic sensibilities conditioned to clean lines and elegant movement in other newts, but now scientists know just what makes the creature tick. And the tale is purest factual magic.

The urodele genus *Ambystoma* is rich in species throughout north and central America. Most of the species are familiar salamanders with familiar habits. But a strain of neoteny runs through the group, like lunacy in a fated human line.

Neoteny is that condition where larval animals delay metamorphosis to the adult, spend their lives in a juvenile form, attaining a precocious sexual capacity

that permits them to breed without "growing up." Like lunacy in history, neoteny has played a major role in evolution, greater than one would expect of a metabolic aberration. Without neoteny, mankind would probably not be here; aeons ago precocious sexual maturity freed the ascidian larva from its sedentary parent and set it on the royal road to becoming, an active vertebrate. Humans bear considerable resemblance, both physical and mental, to juvenile apes; this is suggestive of neoteny. Returning to amphibians, Crowson has suggested, admittedly against the anatomical evidence, that the entire Urodela could have originated from neotenus tadpoles of primitive Anura (frogs and toads).

Whether the origin of urodeles was neotenus or no, neoteny occurs frequently in the group today. Occasionally tadpoles of our native newts grow into giant neotenus larvae. Some species live solely as tadpoles; they breed as tadpoles, no treatment will induce them to change into adults. We have no idea what the adult form would look like, it was discarded long ago (the blueprint may still live on in the historical record of the genes). Examples in this category are *Amphiuma means* from the U.S., and that remarkable cave denizen, the olm *Proteus anguinus*, from deepest Yugoslavia. But for flexibility of neoteny, axolotls take the prize.

Two ambystomids have been dubbed axolotls,

namely *Ambystoma tigrinum* from the U.S. and *Siredon mexicanum*. Both the Tiger and Mexican salamanders exist as normal adults, the former in nearly every American state. They hunt on land, hibernate on land, return to the water each spring to court and lay their eggs. Those eggs hatch into tadpoles. In some places the tadpoles develop on into little salamanders; elsewhere they live year after year in the water, grow large, court and spawn underwater as giant larvae. Axolotls have been born. They live and reproduce as an independent population, in some sort of dynamic equilibrium with their normal aquatic-terrestrial cousins. Sometimes the axolotl stage may be a rare, abnormal phenomenon. Or it may be the dominant phase, as in the lakes around Mexico City where it exists in numbers sufficient to guarantee a niche on the local menu, a reputedly succulent speciality.

Why such flexibility? Why do the tadpoles grow up in some places, remain axolotls in others? We know that if their ponds dry up the axolotls metamorphose into adults able to leave the water; if this did not happen they would bake to brittle parchment. Neoteny is much more common in cold high altitude waters than down on the plains. It is rare in coastal districts. It is practically universal in certain lakes of Mexico, Wyoming, Colorado; water and animals from these places contain very low Iodine titres. All these samples from a rag-bag of facts puzzled early scientists; today we know what controls normal amphibian development, and the facts move into their appointed places.

Development from egg to adult is programmed in the genetic message. And the thyroid gland calls the tune, orchestrates the sequential expression of genes to give different patterns of structure changing constantly with time. Under ultimate control from the brain, this gland produces the hormone thyroxin which acts on target cells throughout the larva to cause change. Levels of thyroxin rise constantly, and under its influence new structures are formed and old ones destroyed, giving an ordered progression to the young adult. Remove the thyroid and metamorphosis will stop dead; inject thyroxin and the tadpole will metamorphose explosively into a pip-squeek mini-newt.

Taking Tiger salamander tadpoles into the lab, we discover that temperature affects ability of target cells to respond to hormone; cold causes an extreme slowdown. Maintain an axolotl in Iodine free water and it will remain an axolotl; add Iodine and it will change to the adult. Iodine constitutes an essential part of the thyroxin molecule, which is a halogenated tyrosine derivative. So in the absence of environmental Iodine there is a thyroid failure, and in the absence of thyroxin development cannot proceed, new genes are not called into play.

Where metamorphosis is caused by the drying of ponds control stems from the brain. In watery times the brain inhibits production of thyroxin from the thyroid; the tadpole remains aquatic and can exploit aquatic food sources. As the ponds dry, competition for food increases and it is advantageous to be a salamander on land; accordingly the brain, via thyroid stimulating hormone produced in the pituitary gland, instructs the thyroid to secrete more thyroxin so that fast metamorphosis follows. Here the axolotl condition is an ecological strategy, allowing the animal to take full advantage of aquatic and terrestrial environments depending upon which is the more profitable.

For beasts of such exotic origin and unusual biology, axolotls fare surprisingly well in this country. Most are sufficiently hardy to spend the year in outdoor pools in southern England, overwintering beneath the ice. Indoors requirements are simple; they need only a large aquarium with six to eight inches of water plus a small island. The aquarium should not be exposed to the sun, and water must be kept scrupulously clean. Artificial heating is superfluous. Axolotls will thrive on a similar diet to large aquatic newts, namely earthworms, raw meat, enchytraeids, dipteran larvae and other gleanings from the pond. Eggs will often be laid at circa 65°F, hatching in about three weeks into miniatures which will wolf *Daphnia* and small enchytraeids.

Don't expend valuable inspiration on artistic aquarium design: axolotls are clumsy enough to uproot and mangle elegant plants. And be careful about company: fluorescent gills are tempting targets for many piscine and reptilian nibblers, while axolotls are bumbling carnivores that attack smaller fish, newts, and their own tasty progeny.

There is no need to waste money buying from commercial dealers. Many herpetologists breed surplus stock, and would be willing to give, sell or exchange. A request in *The Aquarist* could help, and I have noticed axolotls offered for exchange in the newsletter of the British Herpetological Society. Remember to establish exactly which species is involved, and something of the creature's history and origin. Source and prior treatment can affect hardness and probability of metamorphosis under different régimes.

Growing familiarity with the axolotl does not lead to contempt. The mysteries of its condition evaporate before cold empirical reason, but wonder at this neotenus tale remains. The facts of developmental endocrinology are every bit as fascinating as former romantic eyewash about this so-called Peter Pan of the newts. And if we think it bizarre, remember that beauty and bizarritry (!?) are meaningless words to the axolotl. It survives.

CHANGING WATER IN THE MARINE AQUARIUM

by Steve Foley

THIS question is one of the most frequent asked me as a dealer and, unfortunately, one that is impossible to answer straight off.

To understand why this is so, we must consider why it is necessary to change water at all.

A newly-set-up marine aquarium, whilst lacking favourable and necessary bacteria, is pollutant-free and, assuming that the salt mix used is a good one, will contain all essential salts and trace elements required to sustain all marine life. However, once fish and other marine creatures are introduced, food must be added to feed them and this leads to pollution, directly in the form of uneaten food, and, indirectly, as fish droppings and urine. Also there are the other body wastes and carbon dioxide passed into the water. Now whilst bacteria are able to feed on these wastes and create relatively harmless substances as the end products, we will eventually end up with high concentrations which will become harmful and although not always lethal to fish, will often prevent delicate organisms such as invertebrates and plants from flourishing. Also, marine life in living will absorb vital trace elements from the water as well as the foodstuffs and when all the particular "food" elements are removed, the water will be "flat" and unsuitable for further continued well-being.

At this point, the addition of trace elements to replace those that have been removed will be of benefit, assuming, of course, that the trace elements added are the same as the ones removed. Unfortunately, since no one at present knows exactly all the trace element requirements of all the marine creatures, we will immediately realise that trace element additives can, at best, contain only small amounts of substances which have been found to be removed most frequently by test set-ups. This being the case, it is possible that the continued use of a trace element additive could not only result in a system being devoid of some elements necessary to sustain many of the creatures in the system, but also may result in the build-up of others which are being added faster than they are being removed.

Research has shown that trace elements contained in marine algae can be vastly different being present as several thousand parts per million in one, and none, or very little in another. Consequently, to

sustain a creature, say, containing vast quantities of element x, we must add a trace element additive containing x and not y. Since I have just pointed out the difficulty of this manoeuvre where we have a community aquarium under consideration, we have but one alternative—a water change. This results in the removal of waste products and the introduction of a new supply of trace "food" elements in the correct proportions.

Now that we have established the need for a water change, we must return to the basic question of how often? This depends upon size of aquarium, how many fish, how often fed and with which foodstuffs, type of filtration and even lighting. A tank with strong lighting and consequently good algae growth will remove many waste products, such as nitrates and carbon dioxide, and in return will provide oxygen which will further assist the system to stay acceptable. The harvesting of algae and its removal from an aquarium may also delay water change, but the real benefit may only be slight.

In practice, a water change of about 15 per cent to 20 per cent every four weeks would serve to keep practically all life forms happy but, of course, most systems will go much longer than this. I, personally, feel that frequent partial water changes are a must if fish and other forms of marine life are to be kept successfully which, of course, must include their breeding and rearing. It is my firm belief that at least 50 species of coral fishes could be bred in captivity if only people with a little money and time would try.

The smaller the system, the more frequent the water change. Certainly, where money is no object, weekly partial changes would be an advantage. Since 5 gallon salt packs, at reasonable cost, are readily available, there is no real problem to water changes. A useful tip to remember when mixing water in readiness for a water change is to dissolve the salt in half the water required to give the correct sp. gravity; for example, dissolve a 5 gall. pack in 2½ to 3 galls. of water. Later, when required, fairly warm fresh water can be added until the correct sp.g. is reached, which should also give the correct temperature as well with a little practice.

Try changing your aquarium water a little more often and see what a difference it makes. I think you will be pleasantly surprised.

Junior Aquarist

BEGINNERS' CORNER

by Bill Simms

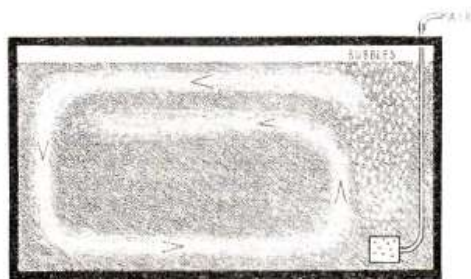
(2) AIR AND WATER

THE aeration of water in any aquarium—cold, tropical or marine—does increase the oxygen content of the water, but it is not a panacea for all troubles, nor will it alter the mineral content of the water to any degree. An aerating stone connected to an air pump through $\frac{1}{8}$ in. tubing will deliver a constant stream of fine bubbles that rise and push the water upward where the bubbles are rising.

If the aerating^a stone is placed at one end of the

produced in the water, get first bite at the apple. The rising stream of bubbles from the stone helps to discharge some of this gas into the atmosphere, and then there is more room for the oxygen in the atmosphere to enter the water surface.

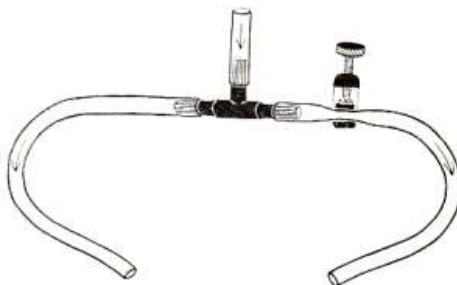
Cloudy water of the grey variety (there is a green cloudiness that I will deal with another time) is always the result of too much decaying matter—often excess food—that is encouraging the too-rapid multiplication



AERATION CURRENTS

tank, as shown in the drawing, it will induce a circular current in the water, thus bringing bottom water to the top, and along the surface. There the water will absorb oxygen from the atmosphere, which probably does more good than the bubbles do in the water. A gentle current that is moving steadily is best, and so there is no advantage in having such a furious stream of bubbles that water is being splashed into the aquarium cover. Use a clamp on the tubing to moderate the flow. These can be obtained in metal or plastic, and are often useful.

When unclean food and decaying vegetable or animal matter is in water it produces a gas that replaces the oxygen, because there is only so much room between the water molecules, and the bad gases, being



T PIECE + CLAMP

of harmful bacteria. This bacterial population consists of untold millions of creatures visible only through the highest powered microscopes—except in quantity, when their presence is shown by the greyness of the water.

In extreme cases two aerating stones at the same end of the aquarium will produce a better circulation of the water, and, together with a drastic cut-down of the food quantity, can restore the water to clarity in time. Use a T piece to separate off two streams of air, with two stones. When the aerator is first switched on it is usual for one stone to deliver more air than the other. Fasten a clamp on the tube of the stone that is too free, and cut down its flow until both stones release equal amounts of air.



from AQUARISTS' SOCIETIES

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

A TABLE show was the main item at the July meeting of the Goldfish Society of Great Britain. The table show for pairs of fishes born last year attracted a record number of entries, the winner being K. Speaks with a pair of Bubble Eyes, and W. Leach with a pair of Bristol Strubunkins.

While the show was being judged by D. Dudley, the membership was invited to fire questions at a panel. The panel of three including A. Sutton, M. Cluse and K. Speaks dealt satisfactorily with the questions asked.

IN July the Dunmow & District A.S. held two meetings. At the first Derek Lambourne was the speaker on the F.B.A.S. 'Aqua Talk—G is for Catfish'. The members who attended were very interested even though they may not have kept catfish themselves. The second meeting was given over to an inter-society competition and quiz with S.L.A.D.A.S. The results were as follows: class B: 1 and 3, D. Edwards (S.L.A.D.A.S.); 2, D. Henman (D.A.D.S.); 4, D. Durrant (S.L.A.D.A.S.); Class E: 1, K. Adams (S.L.A.D.A.S.); 2, D. Durrant (S.L.A.D.A.S.); 3, R. Thoday (D.D.A.S.); 4, B. Meech (D.D.A.S.); Class F: 1, D. Edwards (S.L.A.D.A.S.); 2, G. Wickham (S.L.A.D.A.S.); 3 and 4, R. Thoday (D.D.A.S.). The Best Fish in show was shown by K. Adams (S.L.A.D.A.S.) and S.L.A.D.A.S. won the table show competition with 21 points to 9 points.

AN interesting and instructive talk was given by Mr. A. Bullock—General Secretary of the Koi-Keepers Society to the Hastings & St Leonards A.S. in July. Members of Hexhill A.S. who were invited to attend this interesting talk were also present.

The first meeting in August consisted of an 'Open Forum' with a quiz given by Mrs. Adams, aided by some very good drawings of plants and fishes. The evening ended with the results, and comments by the Judge—D. Baker, of the table show, as follows: Class D: 1 and 2, Mrs. Adams; 3, Mrs. French, Class S: 1 and 2, Mrs. Adams; Class E: 1 and 2, Mrs. Adams; 3, Mrs. French, Class P: 1, Mrs. Coleman; 2, Mrs. Adams, 3, Mrs. French.

THE Chairman of Mid-Sussex A.S. Mr. Robin Johnson, on opening the August meeting, mentioned that there was quite a gathering of aquarists and friends, who came from both Mid-Sussex A.S. and Brighton A.S.

During the evening, those present were entertained by Mr. David Soper (vice-chairman) with a slide show of his recent trip to the Equatorial Zone of America, which was organised by Keith Barraciough of King British.

The slide show consisted of both the Aquatic side of life in the Amazon and its many tributaries and, the way of life of the people in the area. Anyone interested in joining the club is welcome to attend a meeting as a visitor. Further information may be obtained from the Secretary, Mr. B. Slade, "Sandown," Holney Road, Arnyre. Tel.: H. Heath 53747.

WINNING society at the Portsmouth A.S. Inter-Club Show was Gosport A.S. with 29 points, second, Southampton A.S. with 16 points, third Havant A.S. 15 points, and joint fourth were Bracknell A.S. and Newbury A.S.

with 12 points each. During the show there were five films showing (Green Plants, the Kingfisher, The Sea, The Origins of Weather and the Unknown Delta). The other Societies attending the Show were Basingstoke A.S., Kingston A.S., Rochampton A.S., Petersfield A.S., Littlehampton and Bognor A.S., Haslemere A.S. and Pines A.S. Results of the twelve classes were: Class B: 1, Gosport; 2, Havant; 3, Rochampton; 4, Newbury. Class C: 1, Gosport; 2, Bracknell; 3, Havant; 4, Kingston. Class G.H.: 1, Basingstoke; 2, Southampton; 3, Newbury; 4, Gosport. Class D: 1, Gosport; 2, Newbury; 3, Kingston; 4, Havant. Class J.K.: 1, Southampton; 2, Gosport; 3, Newbury; 4, Portsmouth. Class F: 1, Southampton; 2, Bracknell; 3, Gosport; 4, Kingston. Class H: 1, Rochampton; 2, Basingstoke; 3, Havant; 4, Southampton. Class O-T: 1, Southampton; 2, Bracknell; 3, Kingston; 4, Littlehampton and Bognor. Class L.M.: 1, Havant; 2, Bracknell; 3, Kingston; 4, Newbury. Class U: 1, Gosport; 2, Petersfield; 3, Newbury; 4, Littlehampton and Bognor. Class V: 1, Basingstoke; 2, Gosport; 3, Portsmouth; 4, Kingston. Class W: 1, Gosport; 2, Havant; 3, Haslemere; 4, Newbury.

THE Spalding and District Aquarist Club were pleased to welcome Mr. Eric Allen, former chairman of the British Koi Keepers Society, at their August meeting. Mr. Allen showed slides of Koi, his own method of concrete pond construction, filtration and water-changing systems. These were followed by the Japanese scene with views of ponds, bridges, lanterns, filtration and Koi spawnings. The advantage of water filtration with such large fish as Koi were explained and some discussion on the purchase, quarantine, feeding and care of Koi concluded the meeting which was thoroughly enjoyed by all. Arrangements were made for a visit to see the Koi ponds of Mr. Allen at a later date. The Club are very pleased to welcome new members to their meetings which are held on the first Thursday of every month at 7.30 p.m. in Fulney Church Hall, Spalding. The General Secretary is Mrs. P. Piggott, 10 Austendyke Road, Weston Hills, Spalding, Lincs. Tel. Spalding 4114.

DUE to the change in venue the Loughborough & District A.S. open show was much more successful this year and attracted nearly double the entries. The results were as follows: Male Betta Splendens: 1, Mr. and Mrs. Redfern (Hinckley); 2, R. Elliott (Corby); 3, C. Brown (Loughborough); 4, G. and M. Allen (Independent). A.O.V. Anabantids: 1, G. and M. Allen (Independent); 2, Mr. and Mrs. Chamberlain (Leamington A.S.); 3, R. A. Cleaver (Coventry); 4, R. Harlow (Derby Regent). Small Characins: 1, R. Elliott (Corby); 2, S.M.L.N. (Nuneaton); 3 and 4, G. and M. Allen (Independent). A.O.V. Characins: 1, B. and F. Hirst (Coventry); 2, G. and M. Allen (Independent); 3, D. and C. (Northampton); 4, Mrs. N. Richardson (Loughborough). Small Cichlids: 1, C. Jackson (Leicester Aquarist); 2, D. W. Harding (Leicester Aquarist); 3, D. Smith (Leicester Fishkeepers); 4, Mr. and Mrs. Redfern (Hinckley). Angel Fish: 1, G. E. Beaumont (N/A); 2, G. and M. Allen (Independent). A.O.V.

Cichlids: 1, Mr. and Mrs. Chambers (Wellingborough); 2, Mr. and Mrs. Campbell (Corby); 3 and 4, R. Neal (Independent). Small Barbs: 1, Mr. and Mrs. Chamberlain (Leamington A.S.); 2, R. Elliott (Corby); 3, Mrs. D. Cruickshank (Ealing A.S.); 4, B. Jeffs (Jones and Shipman). A.O.V. Barbs: 1, Mrs. D. Cruickshank (Ealing A.S.); 2, W. E. Neville (Grantham); 3, Mr. and Mrs. Chamberlain (Leamington A.S.); 4, B. Chapman (Long Eaton). Corydoras and Brochis: 1, Mrs. D. Cruickshank (Ealing A.S.); 2, D. Green (Jones & Shipman); 3, R. Harlow (Derby Regent); 4, I. Fuller (Uttoxeter). A.O.V. Catfish: 1, B. C. Roberts (Solihull); 2, T. A. Cruickshank (Ealing A.S.); 3, Mr. and Mrs. Campbell (Corby); 4, G. Taylor (Loughborough). A.V. Swordtails: 1 and 3, M. Rowe (Loughborough); 2, Mr. and Mrs. Chambers (Wellingborough); 4, R. Harlow (Derby Regent). A.V. Platy: 1 and 2, L. W. Poole (Banbury); 3, G. D. Lindsey (Loughborough); 4, L. Somerville (Loughborough). A.V. Molly: 1, Mr. and Mrs. Chambers (Wellingborough); 2, L. W. Poole (Banbury); 3 and 4, Mr. and Mrs. Crew (Wellingborough). A.V. Guppy: 1 and 3, Mrs. L. Humphreys (Corby); 2 and 4, Mr. and Mrs. Crew (Wellingborough). A.O.V. Livebearer: 1, A. Onslow (Loughborough); 2, 3 and 4, S.M.L.N. (Nuneaton). A.V. Loach: 1, W. E. Neville (Grantham); 2, R. A. Cleaver (Coventry); 3, S. Elliott (Corby); 4, R. Elliott (Corby). Livebearer (Pairs): 1, Mrs. Humphreys (Corby); 2 and 3, S.M.L.N. (Nuneaton); 4, Mr. and Mrs. Redfern (Hinckley). Egglayer (Pairs): 1, Mr. and Mrs. Chamberlain (Leamington A.S.); 2, G. D. Lindsey (Loughborough); 3, R. Neal (Independent); 4, W. and S. (Banbury). A.V. Raboras: 1 and 2, M. J. Nightingale (Tamworth); 3, H. Bostock (Loughborough); 4, W. and S. (Banbury). A.V. Danio and W.C.M.M.: 1 and 3, R. Elliott (Corby); 2, S. Bostock (Loughborough); 4, Carole Roper (Loughborough). A.V. Egg-laying Toothcarp: 1, B. and F. Hirst (Coventry); 2, Mr. and Mrs. Crew (Wellingborough); 3, Mr. and Mrs. Redfern (Hinckley); 4, D. W. Harding (Leicester Aquarist). Egg-laying Broods: 1, Mr. and Mrs. Crew (Wellingborough); 2 and 3, M. Marsden (Corby); 4, R. Humphreys (Corby). Livebearer Broods: 1, W. E. Neville (Grantham); 2, S.M.L.N. (Nuneaton); 3, Mr. and Mrs. Redfern (Hinckley); 4, L. Somerville (Loughborough). A.O.V. Tropical: 1, Mr. and Mrs. Chamberlain (Leamington A.S.); 2, R. Elliott (Corby); 3, C. Jackson (Leicester Aquarist); 4, Mr. and Mrs. G. Hayes (Hinckley). A.V. Single-Tail Goldfish: 1, 3 and 4, Mr. and Mrs. James R. Amos (Bristol); 2, Mr. and Mrs. Crew (Wellingborough). A.V. Twin-Tail Goldfish: 1 and 4, Mr. and Mrs. James R. Amos (Bristol); 2, G. Castell (Leamington); 3, G. and M. Allen (Independent). A.O.V. Goldwater, Pond or River fish: 1 and 2, S.M.L.N. (Nuneaton); 3, D. W. Harding (Leicester Aquarist); 4, B. Chapman (Long Eaton). Challenge Shield: Awarded to Wellingborough for the society with most entries. Challenge Shield: Awarded to Corby A.S. for the society with most points. Trophy: Awarded to R. Elliott of Corby A.S. for the Best Fish in Show, with a Pencil fish.

IN July the first leg of an Inter-Club Show was held at Horsforth A.S. The three clubs involved being Aireborough A.S., Horsforth A.S., and Swillington A.S. The shows are on the basis of a normal show schedule split into three with each club having a home fish. Result of first leg: Swillington A.S. 27pts., Aireborough A.S. 5pts., Horsforth A.S. 4pts. The Swillington A.S. results were: Guppies: 1 and 2, A. and R. Hislop; 3, T. Tiffany.

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Breeders (Livebearers): 1, J. Abbott; 2, P. Hislop. Breeders (Egglayers): 1, T. Seaman; 2 and 3, S. Nichols. Catfish and Loach: 2, T. Tiffany. Cichlids: 1, D. Stead; 3, A. and R. Hislop. Rasboras, Carps and Minnows: 1, J. Parkins; 3, D. Stead. The Swillington A.S. meetings are held on the first and third Tuesdays in each month at John Smeaton's School, Barwick Road, Leeds 14, starting 7.45 p.m. Anyone wishing to come along will be more than welcome.

THE East London Aquatic and Pond-keepers Association are keen on increasing the membership, and anyone interested in fish breeding or keeping fish in just one tank or pond will be made most welcome. The meetings are held on the first and third Friday of every month at Ripple Road School, Ripple Road, Barking, corner of Suffolk Road. Further information about the Association is obtainable from D. Flack, Romford B62594.

RESULTS of the Fancy Guppy Association World Guppy Championship and International Guppy Show recently held in Bizenham were as follows: Delta Male: 1, Mr. and Mrs. Grenhalgh (N.W. Lancs); 2, H. Vinnal (London); 3, D. and B. Phillimore (Edmonton); 4, R. Fowler (S. London). Long Dorsal Veil: 1 and 2, R. Fowler (S. London); 3, D. and B. Phillimore (Edmonton); 4, K. Haynes (S. London). Short Dorsal Veil: 1 and 4, R. Fowler (S. London); 2, D. Glen (Manchester); 3, Mrs. J. Croft (Birmingham). Fantail: 1, J. Mathews (Birmingham); 2, Mr. and Mrs. Brock (S. London); 3, D. and B. Phillimore (Edmonton). Top Sword: 1 and 2, A. Charlton (Manchester); 3, Mr. and Mrs. Purdy (Birmingham); 4, K. Lee (Edmonton). Bottom Sword: 1, 3 and 4, W. and R. Myers (S. London); 2, D. Glen (Manchester). Double Sword: 1, R. Fowler (S. London); 2 and 3, K. Lee (Edmonton); 4, W. and R. Myers (S. London). Original Veil: 1, R. Fowler (S. London); 2, D. and B. Phillimore (Edmonton); 3, B. Beacham, Snr. (Birmingham); 4, Mr. Swain (Manchester). Pintail: 1, R. Clarke (Radlett). Dove-tail: 1, Mrs. Collingbourne (Radlett); 2, B. Beacham, Snr. (Birmingham); 3, Mrs. J. Croft (Birmingham); 4, J. Mathews (Birmingham). Coffer Male: 1, 2 and 3, W. and R. Myers (S. London); 4, P. Jinks (Birmingham). Roundtail Male: 1, K. Lee (Edmonton). Speartail: 1, R. Clarke (Radlett). Lyetail: 1, I. Crankshaw (N.W. Lancs); 2, K. Lee (Edmonton); 3, C. Beer (Birmingham); 4, W. and R. Myers (S. London). Superba: 1, D. Glen (Manchester); 2, J. Mathews (Birmingham); 3, B. Beacham, Snr. (Birmingham); 4, C. Beer (Birmingham). Wedgetail: 1, D. and B. Phillimore (Edmonton); 2, D. Curry (Edmonton); 3, B. Beacham, Snr. (Birmingham); 4, J. Hutchings (N.W. Lancs). Natural (Female): 1, K. Lee (Edmonton); 2, 3 and 4, W. and R. Myers (S. London). Scallop: 1 and 3, W. and R. Myers (S. London); 2, D. and B. Phillimore (Edmonton). Coffer (Female): 1, R. Fowler (S. London); 2, R. Clarke (Radlett); 3, K. Lee (Edmonton); 4, D. and B. Phillimore (Edmonton). Metro-pollant: 1, 2 and 3, D. Tait (Birmingham); 4, D. and B. Phillimore (Edmonton). Roundtail: 1 and 3, R. Clarke (Radlett); 2, R. Fowler (S. London). A.O.V. (Female): 1, D. and B. Phillimore (Edmonton); 2, W. and R. Myers (S. London); 3, Mr. and Mrs. D. Mathews (N.W. Lancs); 4, K. Haynes (S. London). Colour (Male): 1, K. Haynes (S. London); 2, W. and R. Myers (S. London); 3, Mr. Collingbourne (Radlett); 4, R. Clarke (Radlett). Colour (Female): 1, J. Crankshaw (N.W. Lancs); 2, R. Francis (Birmingham); 3, K. Lee

(Edmonton); 4, D. and B. Phillimore (Edmonton). Ladies (Male): 1, Mrs. D. Tait (Birmingham); 2, Mrs. D. Mathews (N.W. Lancs). Ladies (Female): 1, Mrs. D. Tait (Birmingham). Junior (Male): 1, 3 and 4, 1. Mathews (N.W. Lancs); 2, L. Phillimore (Edmonton); Junior (Female): 1, 1. Mathews (N.W. Lancs); 2, L. Phillimore (Edmonton). Breeders (Males): 1, D. and B. Phillimore (Edmonton); 2, K. Lee (Edmonton); 3, R. Fowler (S. London). Breeders (Females): 1, W. and R. Myers (S. London); 2 and 3, J. Hutchings (N.W. Lancs); 4, R. Fowler (S. London). Breeders (Matched Pairs): 1, R. Fowler (S. London); 2, D. and B. Phillimore (Edmonton); 3, J. Hutchings (N.W. Lancs); 4, F. Joyce (S. London). Master Breeders: 1, K. Lee (Edmonton); 2, D. and B. Phillimore (Edmonton); 3 and 4, H. Vinnal (S. London). Advanced Master Breeders: 1, H. Vinnal (S. London); 2, K. Lee (Edmonton). Grade 1 (Males): 1, H. Vinnal (S. London). Grade 1: 1, D. and B. Phillimore (Edmonton); 2, R. Fowler (S. London). Best in Show: Roundtail Female: R. Clarke. Best Male: Roundtail Male: R. Clarke. Best Female: Topword: A. Charlton. Best Breeders: Breeders (Pairs): R. Fowler. Master Breeders Trophy: K. Lee. Calgary Trophy: 1, S. London 101pts.; 2, Edmonton 64pts.; 3, N.W. Lancs 33pts.; 4, Birmingham 28pts.; 5, Manchester 10pts.; 6, Radlett 10pts. E.G.A. World Guppy Championship: 1 and 3, K. Lee (Edmonton); 2, D. and B. Phillimore (Edmonton).

THE annual show of the Blackpool and Fylde A.S. attracted an entry of 470 exhibits, and the results were as follows: Common Goldfish: 1, C. Whitsey (Accrington); 2, B. Dawson (Heywood); 3, Mr. and Mrs. Wolstenholme (Blackburn). Shubunkins: 1 and 3, Mr. and Mrs. Wolstenholme (Blackburn); 2, B. Newport (Runcorn). Koi Carp: 1, S. Walsh (Accrington); 2, Mr. and Mrs. Wolstenholme (Blackburn); 3, B. Simmons (Blackpool). A.V. Goldwater: 1, G. Harvey (Sandgrounders); 2, C. Whitsey (Accrington); 3, D. Harvey (Sandgrounders). A.V. Twintail Goldwater: 1, Mr. and Mrs. Wolstenholme (Blackburn); 2, C. Whitsey (Accrington); 3, S. Walsh (Accrington). Livebearers (Swordtails): 1, Mr. and Mrs. Muckle (Sandgrounders); 2, Miss M. Barton (Blackburn); 3, J. Cornforth (Bradford). Platies: 1 and 3, J. Ridley (Heywood); 2, A. P. Squirrell (Wythenshawe). Mollies: 1, Master J. Emmerson (Castelford); 2, Mr. and Mrs. Poulton (Northwich); 3, J. Ridley (Heywood). Guppies: 1, 2 and 3, Mr. and Mrs. Poulton (Northwich). A.O.V. Livebearers: 1 and 3, A. Onslow (Loughborough); 2, P. Walsh (Blackburn). Characins (to 3in.): 1, M. and N. Rimmer (Sandgrounders); 2, Mr. and Mrs. Stock (Farnworth); 3, Miss S. Goddard (Macclesfield). A.O.V. Characins: 1, J. Ridley (Heywood); 2, P. and H. Batchelor (Loyne); 3, Mrs. P. Ridley (Heywood). Small Anabantids: 1, D. Garr (Wythenshawe); 2, P. Jones (Wrexham); 3, J. Taylor (Merseyside). Large Anabantids: 1, A. Hopwood (Wrexham); 2, C. Norton (Sandgrounders); 3, Mr. and Mrs. A. Goddard (Macclesfield). Fighters: 1, Master Emmerson (Castelford); 2, J. Taylor (Merseyside); 3, T. Davies (Heywood). Minnows: 1, R. J. Stephens (Blackburn); 2, P. and H. Batchelor (Loyne); 3, Mrs. O. Barlow (Blackpool). Danios: 1, P. Wrench (Northwich); 2, P. Walsh (Blackburn); 3, Mrs. I. Burton (Blackburn). Rasboras: 1, Mr. and Mrs. K. Crowley (Middleton); 2, K. Smith (Middleton); 3, A. Onslow (Loughborough). Labeos, Sharks, Foxes: 1, Mr. and Mrs. Baldwin (Sandgrounders); 2, D. Shaw (Loyne); 3, Mr. and Mrs. R. Houghton (Southport). Barbs (to 3in.): 1, R. and A. Johnson (Hyde); 2, Mrs. Emmerson (Castelford); 3, B. Wilson (Merseyside). Barbs (over 3in.): 1, Mr. and Mrs. Holmes (Castelford); 2, G. Bond (Sandgrounders); 3, A. Bickerstaffe (Blackburn). Toothcarps: 1 and 2, K. Kryger (Wrexham); 3, A. Manser (Sandgrounders). Dwarf Cichlids: 1, Mr. and Mrs. Holmes (Castelford); 2, Mrs. A. Johnson (Hyde); 3, Miss H. Johnson (Hyde). Angels: 1, A. Manser (Sandgrounders); 2, C. and K. Davies (Northwich); 3, Mr. and Mrs. Muckle (Sandgrounders). A.O.V. Cichlids: 1, Mr. and Mrs.

Vernon (Retford) (Best in Show); 2, D. Mason (Farnworth); 3, J. Ridley (Heywood). Corydoras: 1, Mr. and Mrs. Baldwin (Sandgrounders); 2, Miss M. Burton (Blackburn); 3, Mrs. P. A. Taylor (Merseyside). A.O.V. Catfish: 1, P. and H. Batchelor (Loyne); 2, R. High (Blackpool); 3, Mr. Mulla (Merseyside). Loaches: 1, Mr. and Mrs. Muckle (Sandgrounders); 2, P. Hinchey (Loyne); 3, Mr. and Mrs. Burton (Blackburn). A.O.V. Tropical (not listed): 1, P. and H. Batchelor (Loyne); 2, C. Everson (Sandgrounders); 3, R. Atherton (Grimwood). Marine, Tropical or Native: 1, D. Lightbown (Blackburn); 2, K. Smith (Middleton); 3, Miss Hunt (Independent). Pairs (Livebearers): 1, C. Norton (Sandgrounders); 2, Mr. and Mrs. Poulton (Northwich); 3, C. Everson (Sandgrounders). Pairs (Egglayers): 1, A. Oldham (Wythenshawe); 2, S. Barrett (Wythenshawe); 3, Mr. and Mrs. Muckle (Sandgrounders). Breeders (Livebearers): 1, G. Bond (Sandgrounders); 2, A. Manser (Sandgrounders); 3, K. Houghton (Southport). Breeders Egglayers (Hard): 1, S. Hooton (Sandgrounders); 2, Mrs. O. Barlow (Blackpool); 3, A. P. Squirrell (Wythenshawe). Breeders Egglayers (Easy): 1 and 2, J. Ridley (Heywood); 3, Mrs. M. Ward (Middleton). A.V. Livebearers (Junior Class): 1 and 2, M. and M. Rimmer (Sandgrounders); 3, F. Ridley (Heywood). A.V. Egglayers (Junior Class): 1, D. and A. Hayes (Loyne); 2, D. Houghton (Southport); 3, S. A. Taylor (Merseyside).

THIRTY members attended the August meeting of the Gloucester A.S. and heard a very interesting lecture given by Mr. L. Griffiths, vice-chairman of the Society, on Goldwater Fishkeeping. Results of the monthly table show—Rasboras: 1, 2 and 3, F. Timmins; Joint 4, R. Jarvis; 4, Master M. Freshney.

DURING July the Association of Midland Goldfish Keepers had the pleasure of hearing an excellent talk by Mr. L. G. Emery, of Bath. A brief history of the Bristol Shubunkin was given, followed by a resume of Mr. Emery's early days in the hobby and an outline of how he set about building up, and establishing, his well known strain of Bristol Shubunkins.

OFFICERS elected at the Dunmow and District A.S. annual general meeting were as follows: President, M. Pearson; chairman, I. Farlow; secretary, B. Meech, 338 Coggeshall Road, Braintree 25156; treasurer, D. Smith; vice-chairman, A. Cordell-Smith; show secretary, R. Thoday; social secretary, P. Roche. At the same meeting the awards for the previous years club competitions were presented as follows: Highest Pointed Members: 1, R. Thoday; 2, P. Roche; 3, I. Farlow; 4, E. Mifsud. Mini Furnished Competition: 1, E. Mifsud; 2, I. Farlow; 3, B. Meech. Rearers Competition: 1, E. Mifsud; 2, P. Roche. Breeders Competition: 1, 2 and 3, B. Meech; 4, P. Roche. The Any Other Variety Competition: 1, P. Roche. The Achievement Award: 1, E. Mifsud. The Best Fish of the Year: E. Mifsud. Meetings for the coming year will be held in St. Marys Church Rooms, Church End, Dunmow, fortnightly. Visitors, friends and new members are always welcome.

TABLE Show results at the August meeting of the Llanwit Major A.S. were as follows: Class C: 1, Master J. Edwards; 2, G. Lewis; 3, B. Lloyd; 4, R. Newton. K.O.: 1, Master J. Edwards; 2, Master R. Davies; 3, G. Lewis; 4, J. Thomson. While the judging was in progress members were entertained with an any questions evening which proved to be extremely interesting by the number of questions asked on various aspects of fishkeeping.

THE Midland Koi Association put on their first show stand at the Midlands Aquatic Festival in Birmingham. It was certainly a success in that some new members were enrolled and also the fish on the stand spawned. To anyone who may be interested in joining, membership fees are £1.50 per family and meetings are held on the third Saturday of each

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visit the B.A.F. at Belle Vue on Sunday, 12th October. New members will be welcomed and enquiries should be made to D. Tovey, 28 Northolt Road, Carterton, Oxon.

THE Ealing and District A.S. have since March enjoyed a number of varied activities, including a Ladies' Party, a dance, and a coach trip to Brighton on the day of their Open Show.

Among the aquatic activities, two legs of Irvine and Mills Knock Out trophies, and classes H JX, C, E, F, and G, K, L, were on the table. The annual miniature furnished aquarium table show was also competed for. A very good set of slides depicting coral reef fishes were hired from the B.M.A.A. and on the following meeting Mr. J. Harvey of Fins and Wings showed how to set up a successful marine aquarium. Among certain members the marine interest seems to be growing.

Mr. G. Howes of the British Museum of Natural History spoke on evolution and variation in fishes, with special reference to the explosive variation, mutation and speciation now taking place in the Cichlids of the Rift Valley, particularly Lake Malawi. The astounding colour variations in the Malawi species were, he said, signs of much greater changes taking place "further in." (Genetically).

The question of preadaptive variation was discussed and its possibly mutational causes along with the thorny question of which comes first, form or behaviour. He showed the amazing variation in structure of marine genera and mentioned the very great numbers in which most marines exist. This pointed up the terrific responsibility on the shoulders of mankind, the dominant intelligence of this planet, to see that these myriad lives continue to exist in perpetuity.

THE Lincoln and District A.S. is having a Bring and Buy Sale on the 20th October at the Liberal Club, St. Swithins Square, Lincoln and the meeting will commence at 7.45 p.m. approximately and the usual 15 cent will apply. The secretary is Mrs. S. Woodliffe, 36 Richmond Road, Lincoln LN1 1LQ.

RESULTS of the third open show of the **Castleford A.S.** were as follows: Guppies: 1, Mr. and Mrs. Binns, Scunthorpe Museum; 2 and 3, Masters D. and C. Kirk, Castleford. Platies: 1, Mr. and Mrs. Brett, Retford; 2, Mr. and Mrs. Clayton, Immingham; 3, Mr. Mooney, Stockton. Swords: 1 and 2, Mrs. Tyson, South Humberside; 3, Mr. and Mrs. Smith, Horsforth. Mollies: 1, Mr. Shay, Hartlepool; 2 and 3, Mr. Carrick, Scarborough. A.O.V. Livebearers: 1, Mr. Blundell, Doncaster; 2, J. A. Whiteley, Airboro; 3, Mr. and Mrs. Feasey, Doncaster. Small Characins: 1, Mr. Watts, South Humberside; 2, Mrs. G. Frisby, Hull; 3, Mr. and Mrs. Snowden, York and District. Large Characins: 1, Mr. and Mrs. Roberts, Doncaster; 2, Mr. Shay, Hartlepool; 3, J. A. Whiteley, Airboro. Rasboras, Danios and Minnows: 1, Mr. and Mrs. Chester, Retford; 2, Mr. Blundell, Doncaster; 3, Master S. White, Retford. Small Barbs: 1, Mr. and Mrs. Green, Castleford; 2, J. Kirk, Castleford; 3, Mr. and Mrs. Kennington, South Humberside. Large Barbs: 1, Mr. and Mrs. Cohen, Doncaster; 2, Mr. and Mrs. Tyson, South Humberside; 3, Mr. and Mrs. J. Riley, Leeds Post Office. Dwarf Cichlids: 1, J. Kirk, Castleford; 2, Mr. and Mrs. Brett, Retford; 3, P. Northrop, Bridlington. Large Cichlids: 1, Mr. and Mrs. Vernon, Retford; 2, Mr. Shay, Hartlepool; 3, G. White, Scunthorpe and District. Angels: 1, C. Carrick, Scarborough; 2, Mr. and Mrs. Caldwell, Scunthorpe Museum; 3, N. Blenkin, Bridlington. Malawi Cichlids: 1 and 3, T. Hope and Sons, Hartlepool; 2, Mr. and Mrs. Holmes, Castleford. Fighters: 1, Mr. and Mrs. Green, Castleford; 2, Mr. and Mrs. Rawlins, Castleford; 3, I. and S. Toyne, Sheaf Valley. Small Anabantids: 1, Mr. and Mrs. Holmes, Castleford; 2, Mr. and Mrs. Chester, Retford; 3, Mr. and Mrs. Tyson, South Humberside.

Large Anabantids: 1, Mr. and Mrs. Cohen, Doncaster; 2, M. Morgan, Castleford; 3, Mr. and Mrs. Green, Castleford. Toothcarps: 1, Mr. and Mrs. Marshall, Blackburn; 2, G. White, Scunthorpe and District; 3, Mr. and Mrs. Richardson, Scarborough. Loaches and Botias: 1, J. Cornforth, Bradford; 2, A. Clark, Castleford; 3, Mr. and Mrs. Binns, Scunthorpe Museum.

Sharks and Foxes: 1, J. Kirk, Castleford; 2, Mr. and Mrs. Beaumont, Pontefract; 3, Master P. Sugden, Bradford. A.O.V. Cats: 1, Mr. and Mrs. Scott, Castleford; 2, W. Brundell, Doncaster; 3, Mr. and Mrs. Holmes, Castleford. Corydoras: 1, W. Blundell, Doncaster; 2, Mr. and Mrs. Emmerson, Castleford; 3, J. Hope and Sons, Hartlepool.

Egglayers (Pairs): 1, Mr. and Mrs. Holmes, Castleford; 2, Master S. White, Retford; 3, Mr. and Mrs. Myatt, Huddersfield. Livebearers (Pairs): 1, J. A. Whiteley, Airboro; 2, Mr. and Mrs. Feasey, Doncaster; 3, N. Blenkin, Bridlington. A.O.V. Tropical: 1, Mr. Ballard, Hull; 2, P. Northrop, Bridlington; 3, J. Kirk, Castleford.

Junior Egglayers: 1, Master J. Emmerson, Castleford; 2, Masters D. and C. Kirk, Castleford; 3, Miss S. McBride, Airboro. Junior Livebearers: 1, Master J. Emmerson, Castleford; 2, Masters D. and C. Kirk, Castleford; 3, M. and T. Holmes, Castleford. Novice: Masters D. and C. Kirk, Castleford; 2, Mr. Easton and Durn; 3, Mrs. Steer, Horsforth. Ladies: A.V.: Mrs. Emmerson, Castleford; 2, Mrs. Green, Castleford; 3, Mrs. G. Frisby, Hull.

Breeders (Livebearers, 1-10): B. Jackson, Doncaster; 2, J. Abbott, Swillington; 3, Mr. and Mrs. Cohen, Doncaster. Breeders (Livebearers, 11-20): 1 and 2, Mr. and Mrs. Feasey, Doncaster. Breeders (Egglayers, 1-10): Mr. and Mrs. Fletcher, Doncaster; 2, Mrs. Toyne, Sheaf Valley; 3, A. Waddington, Barnsley. Breeders (Egglayers, 11-20): 1, Mrs. Scaman, Swillington; 2, Mr. and Mrs. Fletcher, Doncaster; 3, G. Parkin, Keighley. Shubunkins and Fancy Goldfish: 1, J. S. Hall, Airboro; 2, Mrs. E. Asquith, Castleford; 3, Mr. and Mrs. Hopkinson, Darfield.

A.O.V. Coldwater: 1, Mr. Reed, Workson; 2, J. S. Hall, Airboro; 3, G. Starrs, Scunthorpe and District. Plants: 1, 2 and 3, Mr. and Mrs. Roberts, Doncaster. The *Aquarist* Gold Pin was awarded to Mr. and Mrs. D. Scott, Castleford for the best fish in Show. The exhibitor with the most points was Mr. T. Holmes. There were 490 entries.

A VERY successful first half-year has been enjoyed by the Amersham and District A.S. The activities included a bring and buy evening, discussion on cutting the cost of fishkeeping, judging competition and many speakers. Also there have been away matches against High Wycombe A.S. and Aylesbury A.S. The society were congratulated on their stand at the Amersham Community Centre Exhibition in June, and as in the past were able to have a stall at the Amersham Round Table fete in July. The summer season was completed with a car rally. Forthcoming events are: 15th October Mr. Sellick on the "Colouration and communication in fish". 16th October away match with High Wycombe; 5th November Group discussion and home match. Visitors will be welcomed at the club meetings.

THE first anniversary of the **North Wilts A.S.** will be celebrated with an Exhibition of Tropical and Coldwater Fish on the 26th October at Ridgeway School, Wroughton. It is hoped by this means to attract new members, although the present membership is quite strong.

The N.W.A.S. meet at Ridgeway School, Wroughton every second Tuesday.

MEMBERS of the **British Killifish Association** from all parts of the country converged recently on Treberfydd in South Wales for a fascinating lecture on killies by Dr. Alfred Radda from Vienna. During the past year many new species of killies have been made

available to Mr. John Parker the B.K.A. Species Controller. Also available to the B.K.A. and the general public is a new publication "An outline of Killie Keeping" by A. J. Wright the B.K.A. Technical Editor at a cost of 45p. and p. paid. It is regretted that due to continued inflation the enrolment fee has had to be increased to £4 for U.K. members with proportionate increases for overseas. Further information can be obtained from the Secretary, W. Devison, "Australis," 2 Shaw Road, Tipton, West Midlands DY4 7QA on receipt of a stamped addressed envelope.

RESULTS of the Portsmouth A.S. Open Show were as follows: Class Aab: 1, Portsmouth A.S.; 2, Carassius Club; 3, Gosport A.S. Class Acd: 1, A. Atkinson. Class Ade: 1 and 2, J. Salt; 3, K. Atkinson; 4, A. Dean. Class B: 1 and 2, D. Mackay; 3, R. Adams; 4, H. Armitage. Class Ca: 1, H. Armitage; 2, M. West; 3 and 4, T. Grant. Class C: 1, 2 and 4, M. West; 3, S. Crabtree. Class Db: 1 and 3, J. Pollard; 2, D. Mackay; 4, E. Salt. Class D: 1, J. Yupe (Best Fish in Show); 2 and 4, A. Curtis; 3, R. Adams. Class E: 1, R. Adams; 2, E. Salt; 3, Mr. Tuckwell; 4, D. Mills. Class F: 1, J. Yupe; 2, W. West; 3, D. Mackay; 4, V. Hunt. Class G: 1, H. Armitage; 2, J. Howard. Class H: 1, W. Crockford; 2 and 3, J. Pollard; 4, R. W. Streeley. Class J: 1, J. Armitage; 2, H. Armitage; 3 and 4, D. Mackay. Class K: 1, R. Onslow; 2, H. Armitage; 3, W. Crockford; 4, B. West. Class L: 1, J. Pollard; 2, R. Adams; 3, H. Armitage; 4, B. West. Class M: 1, 2 and 3, B. West; 4, H. Armitage. Class O: 1, R. Smith; 2, W. West; 3, J. Stillwell; 4, W. Crockford. Class P: 1, R. Smith; 2 and 4, J. Wyatt; 3, J. Stillwell. Class Q: 1, 2 and 3, Wyatt; 4, J. Stillwell. Class R: 1, R. Onslow; 2 and 3, J. Stillwell; 4, W. Crockford. Class S: 1 and 2, W. Crockford; 3 and 4, J. Stillwell. Class T: 1, D. Mackay; 2, W. West; 3, R. Onslow. Class Uad: 1, E. Binstead; 2, D. Mackay; 3, V. Hunt; 4, W. Crockford. Class Ubc: 1 and 4, E. Binstead; 2, W. Crockford; 3, R. Bockett. Class V: 1 and 3, J. Pollard; 2, J. Yupe; 4, V. Hunt. Class Wac: 1, D. Stokes; 2 and 4, R. Streeley; 3, E. Binstead. Class W: 1, J. Yupe; 2, E. Binstead; 3, D. Stokes; 4, V. Hunt. Class Xb-M: 1, 2, 3 and 4, F. Willis. Class Xo-T: 1 and 4, W. West; 2, R. Onslow; 3, S. Crabtree. Class Xu-W: 1, A. Dean; 2, W. West. Class Z: 1, Miss Ryder; 2, J. Yupe; 3, R. Shirley; 4, J. Stillwell. Highest Total Points, Tropical: H. Armitage. Highest Total Points, Coldwater: E. Binstead. Highest Total Points, Club Member: J. Stillwell.

THE **Kingston and District A.S.** are holding a "Bring and Buy" evening on Thursday, 20 November, at 8 p.m., to which all are welcome. The venue is Elm Road School, Elm Road, Kingston, Surrey.

The Society meets every first and second Thursday of the month, and would welcome any new members. The secretary is Mrs. M. West, telephone 01-549 3385.

NEW SOCIETIES

A NEW Society has been formed at Nottingham, called **The Queen of the Midlands**. They meet on the third Friday of each month, at 8 p.m., upstairs, at the Peacock Hotel, Mansfield Road, Nottingham. Anyone will be made most welcome. Enquiries should be sent to: D. R. Forster, 7 Hill Drive, Bingham, Nottingham, NG13 8GA.

A NEW society has been formed in Mexborough and will be known as the **Mexborough Aquarists Club**. The meetings are held fortnightly at the Hope Club every other Wednesday evening. For further details please contact the secretary, D. Harris, 14 Ruskin Avenue, Mexborough, Yorks. Tel: evenings MEX 5426.

SECRETARY CHANGES

North Staffs A.S.: J. C. Ankers, 555 Etruria Road, Basford, Stoke-on-Trent, Staffs.

Dunmow and District A.S.: B. Meech, 338 Coggeshall Road, Braintree, CM7 6EH. Tel: Braintree 25158.

Huddersfield T.F.S.: D. Brook, 9 Bankfield Park Avenue, Taylor Hill, Huddersfield, HD4 7QY.

AQUARIST CALENDAR 1975

2nd-4th October: Spalding and District Aquarium Club are taking part in a three day Festival in the South Holland Civic Centre. Spalding members' fish will be on show and a club member will be in attendance during the Festival. For further details please contact the show secretary, Mr. M. Barnes, 32 Winsoner Road, Spalding or the secretary, Mrs. J. Piggett, New Holme, Austendyke Road, Weston Hills, Spalding 4114.

3-5th October: German Livebearer Association Open Show, Breeding Pairs only. Further details and application forms from DGLZ, 11 Intern, Leistungsschau, Herr Hans Kröger, Gluckstrasse Weg. (Schule am Buis) 2000, Hamburg 53, West Germany.

4th October: East London Aquatic and Pondkeepers Association Open Breeders' Show. Schedules available from M. Pearson, 42, Parkway, Ilford, Essex.

4th October: Haslemere and District A.S. first Open Show, at the Haslemere Town Hall, Bridge Road, Haslemere, Surrey. Schedules and further details from show secretary, D. Langford, 7 Collyers Crescent, Liphook, Hants GU30 7DA.

5th October: Eboracum Aquarists Open Show to be held at Nunthorpe Grammar School Hall. Enquiries to show secretary, Mr. A. S. Atkinson, 14 Bewley Street, Bishopthorpe Road, York.

5th October: Second Open Show of the Scunthorpe and District A.S. at the North Lindsey College of Technology Annex, Cole Street, Scunthorpe. Schedules are now available from L. Burr, 6 Saxby Road, Scunthorpe, South Humberside.

5th October: British Killifish Association Open Table Show and annual general meeting at the Mons Hotel, Liverpool. Details from Colin Turner, secretary, Liverpool B.K.A., 88 Heath Road, Runcorn, Cheshire, WA7 5TG.

5th October: Kent Association of Aquarist Societies. Show secretary: T. A. King, 57 Marchion Avenue, Deal, Kent.

11th-12th October: British Aquarists' Festival, Belle Vue Zoological Gardens, Manchester. Details from G. Cooke, Spring Grove, 33 Field Hill, Batley, Yorks.

12th October: Ilfracombe and District A.S. Open Show at the Ilfracombe Junior School, Princess Avenue as last year. Details from Mrs. S. Lipscomb, 8 Foxbeare Road, Ilfracombe, N. Devon.

12th October: Vauxhall Motors A.S. open show. Schedules from A. D. Philip, show secretary, 15 Hollybush Road, Luton.

18th October: Chelmsford A.S. first open show at Broomfield Community Centre. Enquiries and schedules to R. Fountain, 10 Brograve Close, Chelmsford, Essex.

19th October: The Midland Aquarist League Inter-Society and Part Open Show, Bulkington Parish Hall, Bulkington, Nr. Nuneaton. Details: Mr. P. Underwood, 59 Warwick Road, Kenilworth, CV8 1HN. Tel: 59280.

26th October: Doncaster A.S. Open Show Brodsworth Miners Welfare Hall, Welfare Road, Woodlands, Nr. Doncaster. Benching 12-24.

28th October: North Wilts. A.S. are staging an exhibition of coldwater and tropical fish at Kidgey School, Wroughton.

1st November: Lecture illustrated with slides by Mr. A. Lawson on his 1974 visit to the goldfish breeders of Japan. Venue is Friday Hill House, Simmonds Lane, Chingford E4, and commences at 7 p.m., admission is free. Organised by Chingford and District A.S. and Walthamstow and District A.S. on behalf of the Essex, North and East London Aquarist Association. For further information please contact A. Chandler, 233 Forest Road, Leytonstone, London, E11 1LE. Tel: 01-539 3422

2nd November: Blackburn Aquarist & Waterlife Society Open Show, Windsor Hall, Blackburn. Details to T. Burton, 21 Henry Street, Rishton nr. Blackburn BB1 4JJ.

2nd November: Hartlepool A.S. annual open show, Longcat Hall, Seaton Carew. Schedules later from show secretary, M. Sheedon, 35 Spurn Walk, Hartlepool, Cleveland.

9th November: Halifax A.S. Open Show, Forest Cottage Community Centre, Cousin Lane, Hingworth, Halifax. Schedules from D. Shields, "Cobblestones", Gainsel, King Cross, Halifax. Phone: Halifax 68116.

9th November: Glossop A.S. open show at Adult Education Centre, Talbot Street, Glossop, Derbyshire. Show secretary, Mr. S. Turner, 56 Arundel Street, Glossop. Tel: Glossop 3409.

16th November: Bradford & District A.S. annual open show at the East Bowling Unity Club, Leicester Street, Wakefield Road, Bradford, 4 (same venue as last year). Details from show secretary, D. Sogden, c/o 18, Southmere Crescent, Great Horton, Bradford, BD7 3NP.

16th November: Walthamstow and District A.S. Open Show, Sunday, at Mission Grove Annex, Warner Road, Walthamstow, E17. Open to public at 3 p.m. Schedules from A. Chandler, 233 Forest Road, Leytonstone, London, E11 1LE. Tel: 01-539 3422.

22nd November: Fur, Feather & Aquaria Show, King's Hall, 39 Lower Clapton Road, E.5. Schedules and further details from show secretary, Sybil Hedges, "Koi Korner" 150 Ashburton Avenue, Seven Kings, Ilford, Essex, IG3 9EL. Telephone 01-590 3239.

22nd November: Goldfish Society of Great Britain, Conway Hall, Red Lion Square, Holborn, London W.C.1.

30th November: Horsforth A.S. open show at the New Civic Hall, Bradford Road, Pudsey. Show secretary: C. Corns, 15 Thornleigh Grove, Leeds S59 8QR Yorks.

6th December: Federation of British Aquatic Societies Annual General Meeting, Conway Hall, Red Lion Square, Holborn, London, W.C.1. 2.30 p.m.

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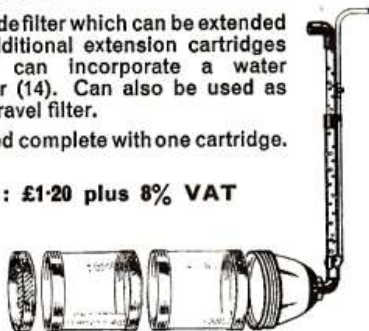
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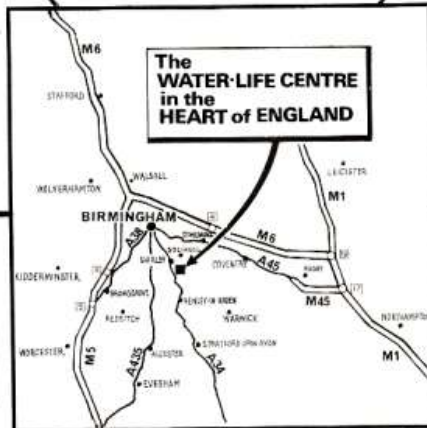
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