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Editorial

TO anyone who has spent any time overseas it will be an appreciated fact that in this country we enjoy water supplies of great purity. From the aquarist's viewpoint it is exceptional rather than commonplace for the cause of aquarium troubles to be traced to unwholesome water delivered from the mains. Nevertheless, we do sometimes hear of fish losses that are most difficult to explain without suspecting some water contaminant of a chemical nature as the likely cause.

In a report on the pollution of water supplies, the Royal Society of Health has expressed concern to the Ministry of Health over the extent to which copper from pipes is affecting domestic water. Severe corrosion of copper pipes is reported as occurring particularly in the west of England, and copper contents in the water from the pipes sufficient to discolour cooking vessels have been found. This suggests that aquarists who use such water for their aquaria may be exposing both fishes and plants to harmful concentrations of copper unwittingly. In view of this report, which must be regarded as an authoritative one, it seems that aquarists in some areas, living in newly built houses with copper piping installed, may have cause to consider whether their domestic water is entirely suitable for their own use, without pausing to ponder its use in aquaria.

REFERENCES to Monaco have reached epidemic proportions in the world's literature of the past few weeks, and we might here spare a thought for the significance of the Principality to the aquarist. It is, of course, the site of a magnificent marine biological laboratory, with public tanks exhibiting the beauties of Mediterranean sea life. It was founded by a former Prince of Monaco who was a keen marine biologist, and to this centre scientists and visitors from all over the world have journeyed to take advantage of its wonderful facilities. The investigations made there have contributed immensely to biological knowledge, and the economics of fisheries in the area owe no small debt to its existence.

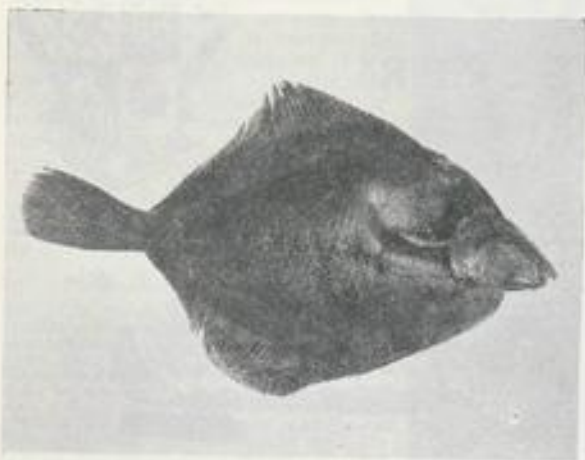
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Light Intensity and Pigmentation

by N. E. PERKINS

Photographs by LAURENCE E. PERKINS



THE following account relates to an odd specimen of an otherwise common marine species, the plaice.

The point for the aquarist to bear in mind, however, is not what species it is but what the facts have to offer regarding the physical effect of light (and possibly other rays) on the body surface of living fish. The illustrations show an adult female plaice of about 12 ins. length having equal pigmentation, including the characteristic orange spots, on both sides of the body, and in order to appreciate the significance of this it might help if we outline the normal development of this species.

The plaice (*Pleuronectes platessa*) produces roughly half a million pelagic eggs, which hatch in from nine to 18 days according to temperature. The young are symmetrical and similar to the young of other more normal-shaped fish. At three weeks, when they still measure less than half an inch, they begin to deepen, the height increasing relatively faster than the length. After the thirtieth day the left eye begins to migrate upwards and forwards until after another ten days it appears in front of and above the right eye. The fish now commences to swim and rest on what is really its left side, and the swim bladder, developed during the larval period, deteriorates and finally disappears. Such pigmentation as may exist on the left side now breaks up, leaving that side the characteristic bluish-white.

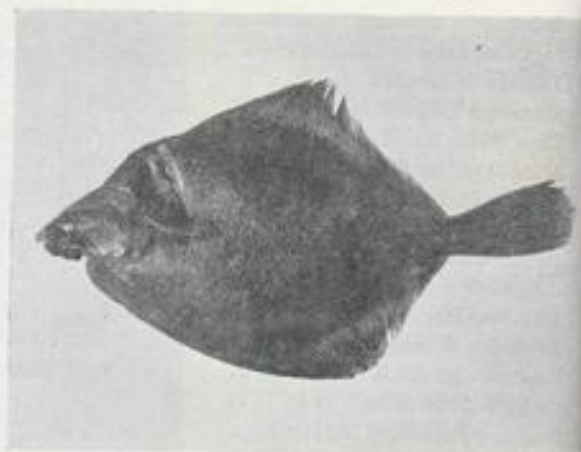
The food of the young larval fish consists mainly of small crustacea (copepoda) though larval molluscs, etc., may augment the diet. After metamorphosis, the food changes to various worms and small shrimps, and a further change is made as maturity is reached, when the diet is found to consist mainly of cockles and mussels.

Now we come to the specimen in question. Here we have a mature female plaice, fully pigmented on both sides of the body, and since the creature is dead we have to conjecture the cause of this phenomenon. It would be logical to assume that both sides of the body had continued to receive equal amounts of light, but this would mean that the fish swam and lived in an upright position as does the bream. Therefore, what we now have to decide is: does the specimen show in any way features which support this view? It might be expected that the use of the mouth whilst the fish swims and lives on its left side would develop abnormal characteristics in this area and this is borne out in fact. Normal plaice have the teeth most developed on the blind side, and the mouth opening is also twisted in this direction. The photographs illustrate this point.

Our specimen, however, has a mouth well balanced and suited to a vertical swimming position, and moreover, the teeth, which are poorly developed, are equally disposed. This dentition also points to a different type of diet, which may well have been the case since the angle of approach to food would be completely reversed, and the seizure of such creatures as cockles may well have proved impossible. Of course, it might be thought that the eyes tend to show a normal mode of swimming for the plaice since both are on the same side of the head, but it must be borne in mind that this movement normally occurs before the fish heels over and is genetically controlled, whilst such organs as the mouth (which is a muscular mechanism) might well be affected by usage—much as a tradesman's hands point to his craft.

Experiment with the Flounder

This case provides an extreme illustration of the necessity of light in the formation of pigment in fishes and it might be useful to remember that many experiments have been carried out upon fishes with just this point in mind. One such experiment was undertaken with a flounder, where the fish was kept in a glass tank having also a clear-glass bottom. By a system of mirrors light was caused to play upon the fish from both sides. The fact that it took over a year to produce pigmentation on the left side might lead one to suppose that other rays which do not lend themselves to mirror reflection may also play a part in this process. (Incidentally, these fish show a marked ability to change colour and colour pattern to suit their surroundings, and here again innumerable experiments have been carried out to prove that they were able to camouflage themselves.)



Photographs on this page show the two sides of the abnormally pigmented plaice. Top of page, blind underside (note that the mouth is not twisted); above, upper surface of plaice. Pigmentation of the two sides is nearly equal



Left and centre, views of the mouth of the abnormally pigmented plaice. Note that it is not twisted as it is in a normal plaice (right picture) and that as seen in the centre picture a set of small teeth is present in the inner margin of the mouth; normally teeth are developed on the blind side (outer margin) only

own on a black-and-white squared bottom they can produce a good generalised imitation sufficient to mask their whereabouts!

Fully pigmented specimens of the Pleuronectidae are found from time to time whilst types with partial pigmen-

tation on the underside are reasonably common. This phenomenon is surely worth continual investigation for it may well be that at some time this type may increase and begin to form a new variety of fish, modification occurring to adapt the type to its different mode of life.

The Hart's Rivulus (*Rivulus hartii*)

by JACK HEMS

THIS interesting and not very well-known fish from Trinidad and Venezuela is one which should appeal to many discerning newcomers to the tropical fish-keeping hobby, for, while it is not possessed of vivid colours, it is distinctive in appearance. It is also a good subject to keep and breed in a small aquarium, say, one measuring about 14 ins. by 8 ins. by 8 ins. and maintained at a temperature of about 75° F. though a rise or fall of about eight degrees in either direction will not harm the fish in any way.

The species is not one which swims aimlessly about all day long. It prefers to take up a position in the plant life, not necessarily hidden from view, and there stay quiescent for what seems like hours on end. But in actual fact, it changes its position every little while, and is always ready to take a thin strip of juicy red meat or washed liver, or wriggling earthworm, from its owner's fingers.

Perhaps the reason why I am so fond of this fish is because it is quickly tamed and looks so knowing. There is one thing, however, that the aquarist must guard against, and that is the alacrity with which the fish can leap straight out of the water and through any small aperture left between the cover glass or lighting hood and the aquarium frame. He always keep the tank properly covered, or else Mr. or Mrs. Hartii may come to an unhappy end on the floor.

R. hartii has a body ideally suited to speeding through the water, and rising above it; for it is almost torpedo-shaped, with the dorsal and anal fins set close to the rounded, fan-shaped tail fin. It is said that in its natural haunts, the fish travels from one pool to another, moving over the ground by short wriggling movements, and short leaps. The fish does not attempt to travel overland unless the ground is wet enough to enable it to travel in comparative ease.

The aquarium environment which suits the species best is one of old, soft, clear water and semi-shade. Many years ago, I kept and bred fine specimens of this fish in a tank covered with peat alone (no covering of sand) and planted with a tangle of *Nitella* and *Sagittaria natans*. In these conditions, the fish used to spawn with unfailing regularity right through the summer months and into the autumn.

The female does not lay all her eggs at one time; she deposits two, three or more of them every day or so for about a fortnight. Then, after a short rest, the performance

is repeated all over again. The actual spawning act takes place in thickets of plant life growing either near the surface of the water, or close to the compost. Sometimes eggs are deposited in drifts of piled-up sediment. The male follows or drives the female to the spawning ground, then, side-by-side, the couple shake their bodies and tremble with excitement; in those few moments, the eggs are laid.

The parent fish do not worry any more about the eggs, they are as quickly forgotten as they are produced. And the young hatch out and dart about under their parents' noses without ever appearing to come to any harm. I suppose a few do vanish inside the parents' large mouths. But the aquarist can seldom keep track of the fry, for as the eggs which make up each batch are deposited on different days, and as each batch is produced at short intervals, young fish of all sizes are always to be seen playing in the vegetation.

The fry are quite large when they hatch out (incubation takes from nine to 14 days) and though they should be given microscopic live food (Infusoria) at the start of their free-swimming lives, they will grow quickly even if they have nothing more exciting than powdered dried food to assuage their vigorous appetites.

Young *R. hartii* are an all-over muddy-olive colour, but as they mature, they become brown on the back, shading to light olive on the side, which in turn is adorned with brick-red spots arranged in orderly horizontal rows. The dorsal and anal fins are yellowish, sprinkled with tiny red markings; the caudal fin is bright yellow in the base darkening towards the posterior edge, which then passes to yellow. Some specimens have more black or more yellow in the caudal fin than others; and the light and temperature of the water will also affect the coloration of the fish. The female's colours are more subdued than the male's, and she has a shadowy to plainly discernible dark spot, a characteristic of most members of the genus, in the dorsal fin.

Fully grown, *R. hartii* average about four inches in length. The species has a life span of upward of four years, and, given normal treatment, that is, good food, and hygienic conditions, the species keeps remarkably free from illness or definite disease.

Starting a Tropical Aquarium—5 by AQUARIUS

SIGNS of trouble in an aquarium are when the water takes on a milky hue or smells badly. There is always a slight smell to any tank, but this is a natural planty smell which is soon recognised for what it is, and nothing unpleasant about it is noticed. Conditions may be ideal until feeding is commenced.

More tanks are upset by this than by any other cause. It should not be so but most beginners put food into the tank too often, and then they wonder why the water turns foul and the fishes fail in health. Healthy fishes are usually actively swimming about and sucking at the sides of the tank, the sand at the base and the leaves of the water plants. Only when fishes are seen to be doing this should they be fed. If fishes are mouthing at the surface of the water it is absolutely useless to feed them; they are not likely to take any food under such conditions and the addition of even a little food will only upset things more.

Tropical fishes have better appetites than coldwater fishes as the whole process of digestion, etc., is quickened by the warmth. This means that the food is used up more quickly than if the water was cooler. The fishes can then eat at more frequent intervals, and although one feed a day may be all right for coldwater fishes this is not enough for healthy tropicals. The more active the fishes the more often must they feed, and if food is not available the fishes may become weakened. Often aquarists complain of certain fishes developing into bullies, but this is often due to the fact that the fishes are not getting enough food. Nothing is more likely to make a fish into a bully than the fact that it has to fight for its food among other hungry fishes.

A feed three times a day is a good plan as long as too much food is not given at a time. Food can be digested and voided by a healthy fish in a few hours if the temperature of the water is just over 70° F., but the same fish may take three times as long to void the food at a lower temperature. Again it must be realised that the larger the fishes the more food do they require. Another point to remember is that although a fish may need a certain amount of food to just keep it healthy, when it is breeding and forming eggs or young it must have more food.

A feeding ring should always be used in the tank as this prevents the dried foods from spreading all over the base. By concentrating the food it is far easier to see when it is cleared up. The amounts of food to be given at each feed will depend on the number and size of the fishes. The morning feed can be a little larger than the evening feed. Mid-day feeds are necessary if all the morning food was soon cleared up and the fishes are obviously looking for more.

For all kinds of tropicals it is essential that the diet should be as varied as possible. It is of course possible to have a standard mixture of dried foods always available, but this must be varied by adding some form of live food whenever possible. Some kinds of fishes will eat hardly anything but live foods, and if these are kept with other fishes of a different variety it may be that they get insufficient of the correct foods and may soon suffer in health. The ideal way to feed is to give dried food in the morning and live food each mid-day. It is not always possible to find enough live food for one meal a day, but if this can be done the health of the fishes will benefit.

Do not forget that garden worms are one of the best forms of live food for your tropicals; I know of very few which would refuse them. The average tropical can not cope with a whole garden worm, and so they must first be mashed or cut up very finely. Worm shredders are available for this purpose, and for larger fishes a few worms

can be placed in a small container and chopped up with a pair of scissors.

Other live foods are: *Daphnia* (water fleas), *Tubifex*, white worms (*Enchytrae*), mosquito larvae, glass worms, gentles (fly maggots), and for large tropicals, frog tadpoles. I consider that some of these are safer foods than others, but a lot will depend on which you are able to get most easily. The white worms are in my opinion the easiest to cultivate and the safest to use. They are taken by most fish and I have never found any ill effects from using them. They will live in a tank for at least 24 hours; after this time they may die but are not likely to cause any pollution for another 24 hours. If only a few are given at a time no trouble is likely to occur. If one has to leave the fishes all day it is a good plan to give some white worms in the morning so that a supply of food is available until your return.

Daphnia are a live food which appears to be relished by nearly all fishes, and as they can live many days in a tank if not eaten they are very suitable for feeding most fishes at all times. Often an ailing fish will take *Daphnia* when it will ignore any other type of food, and so the value of this food cannot be over-estimated. *Tubifex* is a food I always regard with a certain amount of suspicion, as it is well known that these worms live in mud. It is fairly obvious that if fed to the fishes soon after they have been collected they must contain some of this mud, which can harm the fish. On the other hand they are a good food for most fishes as long as they are left under running water for a few hours so that the mud can be cleared from their systems.

I have heard of many losses among tropical fishes through feeding with freshly collected *Tubifex*, and so care must be taken. If too many are given at a feed some may burrow into the sand and remain alive for some time. They are not likely to do any harm and will soon be eaten when the fishes are hungry. Glass worms, the larvae of an insect, are often procurable in ponds when *Daphnia* are not in evidence, and they make a good food, especially in the winter months when many other live foods are not available. Gentles should always be broken before being fed to small fishes. Frog tadpoles should only be given to large fishes such as cichlids.

Many dried packeted foods are on the market and a few of some of these will soon show which are the most preferred by your fishes. A good stand-by which can be easily made up oneself is Bemax, ground oats and dried shrimp. Few tropicals will refuse this food, and it contains most of the necessary vitamins, etc., for the health of the fish. Make sure that the food is sifted so that there is no dust to remain uneaten and foul the water. The fine stuff can be used for feeding young fish. Remember that fishes are nearly all very greedy and will always go for the larger pieces. The very small can then be over-looked or washed to the back of the tank where it can cause trouble.

Most fishes will eat a certain amount of vegetable matter which they can get from the water plants. Some will even eat the green algae which form on the glass and plants. When fishes are kept which prefer vegetable matter do not forget to supply this if there is not sufficient of the right type already in the tank. Finely chopped lettuce or water cress leaves can be given, but do not over-do this or the water will become filled with Infusoria and soon smell.

Feeding tropical fishes is a fine art, and you will never be successful with tropicals until you thoroughly understand this question. More things can go wrong through over-feeding or feeding with unsuitable foods than through any other reason.

Cape Water Hawthorn

(*Aponogeton distachyon*)

by T. C. CLARE

THE Cape water hawthorn is, in my opinion, one of the most satisfactory water plants there are. Although a native of the Cape of Good Hope, it is as hardy as a dog's bone. Flowers appear from the end of April or the beginning of May until the last weeks of October, with some times a few weeks off to recuperate in the middle of summer, when the water lilies are at their best and other floating aquatics naturally take second place; and it is as easy to grow as the daisies on the lawn. The illustration attached to this short note was taken of part of a group of my plants after the first frost had finished the neighbour's dahlias last autumn.

It has a most unusual flower, pure white with conspicuous black stamens. The leaves are olive-green, and in a good plant nearly two inches across. It grows from a tuber about the size of a tulip bulb, and does best in a good water-ly compost: good loam with either a little coarse bone



T. C. Clare

Flowers and strap-like leaves on the pond surface



A group of flowers of the Cape water hawthorn

Photo:

Laurence E. Perkins

meal or well-rotted manure added. A single tuber needs an eight-inch pot, or other container which will hold an equivalent amount of compost, as it forms plenty of offsets and ultimately makes quite a good clump. Depth of soil is not of primary importance as the tubers should be only just covered; but I would advise a minimum of six inches.

From a pondkeeper's point of view the plant has two great advantages. It will grow equally well with four inches or four feet over its crown, and it flowers freely in sun or shade. The ones in the photograph lie between a row of tall silver birches on the south side, and the shrubby bank of an island on the north, and only get about an hour's evening sun daily. They are also sweetly scented, but as few owners are likely to get down on their knees to smell the flowers, this is of little importance.

In my experience over 15 years, the Cape water hawthorn is not subject to any disease, but in spring the earliest leaves are frequently eaten by the common pond snail if there are a lot about. This is unlikely to happen in ponds which carry a good quantity of submerged oxygenating weeds, as the pests are more likely to stay on the weeds than climb the long stalks of *Aponogeton*. For those with ponds having a natural mud bottom, I must say that the plant seeds very freely, and unless they can be pulled up, can in time become a nuisance.

For the purist, the name of the plant was taken from Sanders' *Encyclopaedia of Gardening*, but if they prefer to call it *Aponogeton distachium*, neither I nor any nurseryman will object. If ordering plants, get the nursery to send them as early as possible in spring after mid-April. They transplant well at any time, but will give of their best in the first year with a long growing season.

Microscopy for the Aquarist—18 by C. E. C. COLE

It is difficult to realise sometimes that to many people the actions you take or the deductions you draw are not obvious—they need explaining. This was forcibly brought home to me when I was asked the question, "How can I tell what I am looking at?"

I must have looked completely blank, for the questioner continued—"I mean, when I'm looking through a microscope at anything, how can I tell whether a particular mark is just a mark, or whether it is a dent, or a bump? How do I know whether a bristle, for instance, is pointing upwards or downwards, and whether or not a surface is flat?" What I told him I have amplified somewhat and set down here in the hope that it will help anyone else who is not certain about such things.

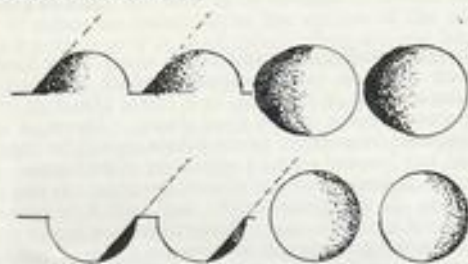
Let us deal first with transparent objects, which are almost always illuminated with light rising from beneath

the stage. Microscopists accustomed to using high powers never rack down to focus an object—they place the objectives nearer than in focus and slowly rack upwards. With our very low-power objectives it is immaterial whether we rack up or rack down—the chances of crushing object or slide are extremely remote. Nevertheless, the time will come when we will want to use high powers—so, why not start racking up now until it becomes second nature?

The objective is too near the specimen then, and we begin to withdraw it slowly. Suddenly a part of the creature comes into focus. This must be the part farthest away from the object glass—the lowermost plane, as it were. Immediately we make a further movement of the focusing adjustment, this lowest part becomes less clear, and another plane is in focus. Any object can be considered a collection of planes of infinitesimal thickness.

We continue the withdrawing movement of the objective until we eventually rise above the thickness of the specimen.

If the surface is flat all that contained in the field of view will be in focus at the same time, although owing to minor imperfections in most objectives there may be a slight degree of fading out round the edges of the field. With a curved surface the highest portion of the curve—that nearest the objective—will be in focus last. A bump or nodule on the surface will focus as follows: first the circumference of the base will be in focus, followed by successive layers of the bump until the highest point is reached. The bottom of a dent will be seen first, with a gradual widening of circumference until the normal surface is reached. A bristle is pointing downwards if the point is the first portion of it to become plainly visible. It is pointing upwards if the base is first in view.



Bumps and dents as seen with oblique lighting

Headstanding Fish

THE headstander (*Chilodus punctatus*) is quite often offered for sale by the larger dealers, but the price (about 20 shillings) puts it into the expensive class. The fish on sale are usually about two inches or a little more, and very attractive with their quaint habit of almost standing on their heads. Some writers refer to their way of taking up a downward angle of 45 degrees but, personally, I think it is much nearer to vertical. They literally stand on their heads. This is not to say they cannot swim on an even keel, they can and do and at speed.

The body is rather elongated with large (carp-like) scales, the upper portion being a greenish grey and the lower portions white. From mouth to tail a black line runs, passing right through the eye. The sides, which are compressed, have rows of dark dots not unlike those of *Barbus oligolepis*. German sources suggest that this fish can, on occasion, give off a peculiar sound, but this appears to have escaped other keepers of this grand fish from Central America.

Headstanders must always be given ample swimming space. They are really wonderful jumpers and very hard to catch in a tank, although normally they prefer to hide away or sun-bathe at the surface. Although they have a small mouth they eat just about anything and give their owner no headaches on that score. A fairly high temperature of 76°-82° F. is best, with fairly soft, filtered water. I have heard of no spawnings in Britain but isolated results have been reported abroad with a pH of 6.6, soft peaty water and large tanks.

Spawning is said to have taken place over weighted *Riccia*, the eggs being transparent and about 2.5 mm. in size. They quickly grow fungus and take six days to hatch at 77° F. with hardness about 4° (DH). Females are larger and plumper and it is said that the dark line and dorsal spot disappear when spawning is due. The fry are difficult and will not go out of their way to find food, so that they have to be kept almost swimming in it. Brine shrimp and Infusoria

All these pointers on translation of what appears in the field of view only obtain if the upward-racking technique is used. They apply in reverse if we rack down to focus anything.

Now for above-stage illumination, as described in last month's article. This is invariably used for the closer inspection of opaque articles or creatures. Here we are sometimes aided by shadows, for opaque specimens always throw them. Darkly coloured creatures are less helpful in this direction, for although the shadows are there they cannot be made out. The more oblique the light, the longer the shadows, of course.

From a mark on the surface no shadow can be thrown. A bump will cast a shadow on the side furthest from the light, but owing to the fact that the image is reversed it will seem on the nearer side. With shadows a dent will appear very different from a bump. The shadow will be inside the circumference, on the side nearer the light (appearing on the far side).

Oblique lighting of any kind is discouraged by many microscopists, who maintain that owing to diffraction effects the images seen may not be very accurate portrayals of the objects. Nevertheless, it seems that sometimes this method is the only one possible which will have the effects required. With really microscopic subjects that are semi or completely opaque, direct overhead lighting loses all contrast. Indeed it may be necessary in such cases to direct a beam of light from almost a right angle to the objective. It seems to me that a method which shows us things that cannot be revealed in any other way has points in its favour.

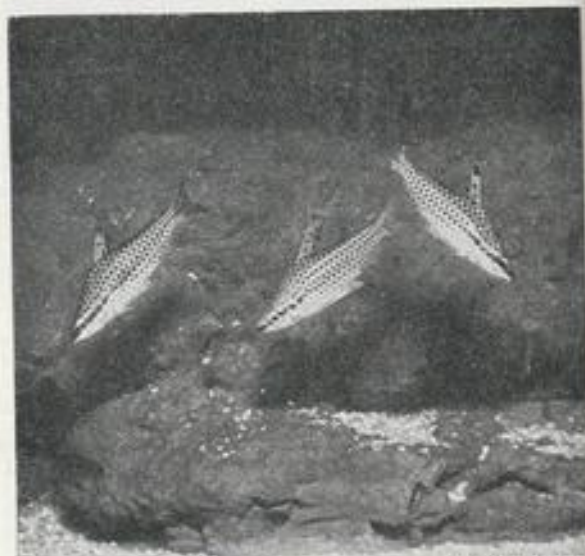


Photo:

Laurence E. Perkins

Our front cover picture this month shows a trio of headstanders in characteristic pose

are suitable. However, very few aquarists have spawned this fish so we have much to learn. For example, a Swedish fancier hatched the eggs in two days.

This fish lives about four years, but some foreign sources suggest it is tender and hard to keep. This is not true in Britain, or at least in the north, where the soft, peaty water seems to be to its taste. Headstanders are peaceful fish but should not be exposed to bullying varieties.

Rodney Yorke

THE AQUARIST

Pearl Danio

(*Brachydanio albolineatus*)

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

FAMILY:—Cyprinidae, from Greek *kyprinos*—a kind of carp.
SPECIES:—*Brachydanio*—from Greek *brachys*—short, and a native name, *albolineatus*—from Latin *alb*—white, and Latin *lineatus*—marked with lines, or streaked.

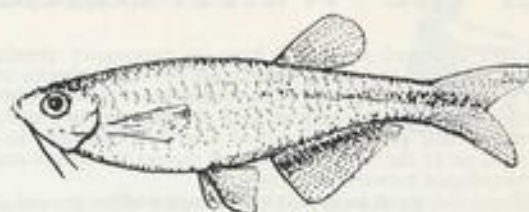
A NATIVE of Burmese waters, *Brachydanio albolineatus* is one of the older favourites of aquarists, seen in most tropical aquaria of pre-war years. Like many another favourite, however, it disappeared throughout the long war years, until 1944, when by some means or another a friend of mine procured a quantity, and lost no time in distributing them to a few likely breeders. Within 12 months, V1's and V2's notwithstanding, London had its full quota, as did the Midlands, and a few places north. Of recent years its popularity seems to have waned a little, owing, no doubt, to the importation of new and rarer characins, dwarf cichlids, and the like, but to me and many others it still holds great appeal.

Nor is this surprising when one considers points in its favour. It is hardy, active, gentle to other species, easily fed, not hard to breed, and schools well when a number is kept together. In addition it possesses beauty of shape and colour. One writer describes them as "swimming in open areas, looking like living opals." This is a fairly accurate account, for in bright light they certainly flash back opalescent hues, provided that they are in good condition. If out of sorts, however, they lose their sheen, and become just pale-looking fishes mooning around the aquarium.

Fortunately, this seldom occurs, and can usually be put right by liberal feeding for a period with live foods such as *Daphnia*, May-fly larvae, tiny pieces of worm, etc. A similar procedure should be followed when it is desired to bring the fishes into top condition for breeding. Temperature, which should normally be in the region of 70°-75° F. can be raised for the breeding period to 80°-82° F.

There will be no difficulty in distinguishing the sexes when the female is filled with roe, for her shape at such times is, or can be, almost that of a gravid female guppy. Ready for spawning before the male she will often make advances to him, occasionally without success.

There are various methods of providing a breeding tank



for pearl danios. The main objective in every case, of course, is to save as many eggs as possible from the attention of the breeding fish. The eggs are large for such a small fish, extremely hyaline, and non-adhesive, dropping to the bottom of the aquarium. Thus a dense mat of weeds completely covering the bottom seems a good idea, but too often this is insufficiently compact to prevent the fishes from wriggling into it. Likewise a double layer of pebbles or a glass tube mat is not ideal.

When breeding and raising these fishes in quantity a few years ago, I made a basket of perforated zinc, slightly enlarging the mesh at the bottom, and suspended it in the aquarium, which had been filled the previous evening to a depth of six inches with fresh tap water. About one and a half to two inches of water entered the basket.

One male and a selected female were placed together in the basket, and driving almost always began without delay. This was a furious chase—the eye had difficulty in following the movements of the fishes except when they began circling round each other at somewhat lessened speed in one or other of the corners of the basket. I cannot say with certainty, of course, that no eggs were eaten during the spawning drive, but 400-500 were saved every time by rolling through the holes at the bottom of the trap, and at least three in four were fertile. How could I know this?

Well, the tank was glass-bottomed, devoid of plants, compost, or dirt, and high enough to enable me to put my head beneath the angle-iron shelf and use a hand lens to check results. Spawning over, it was simplicity itself to lift out the basket and allow the spent fishes to swim out of it into the stock tank.

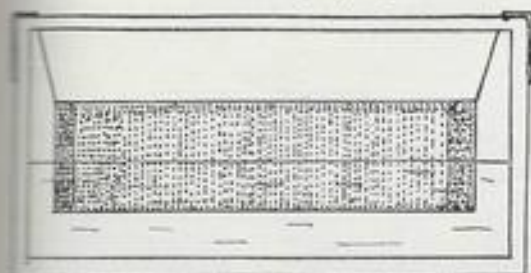
At a temperature of 80° F. or slightly over, the eggs hatched in from 48 to 72 hours, the fry lying on the tank bottom feebly wriggling at first, but soon making sudden, short, jerky journeys about the tank. As their strength increased the egg sacs were finally absorbed, the swim bladders expanded, and the fry were ready for external food.

This was provided in the form of water thick with green, free-swimming algae, and a new culture of Infusoria. With plenty of such food, growth was rapid and spreading out into other aquaria became essential. It was noticeable that growth rate and vigour was accelerated immediately the fry were thinned out or transferred to larger quarters.

New-hatched brine shrimp and *Daphnia*, *Cyclops* nauplii, micro worms, tiny mosquito larvae, were all avidly consumed. Temperature was maintained in the eighties for two to three weeks before being gradually reduced to the normal 72° F. I must admit that I derived great satisfaction at that time in possessing many hundreds of these fishes—they looked extremely handsome swimming actively in shoals about the aquaria.

As they grew, there seemed to develop two colour shades—one much paler than the other. Isolation of each shade revealed that the colour was variable and seemingly controlled by the fishes, for having moved a number of the darker into a tank of their own, two shades were again noticeable within a matter of hours, or days. This has

(Continued at foot of next page)



Spawning trap used by the author, consisting of perforated-zinc basket suspended about two inches below the water surface in the aquarium

In the Water Garden in MAY

by ASTILBES

ANY informal pond will have its appearance greatly improved by having some good flowering species of bog plants near by. The formal pond is unsuitable for this planting, especially as many will be made in a lawn. Straight-sided ponds with stone flags are best left unplanted, or at the most a few dwarf species of alpine can be introduced between the stones.

Where the pond merges into the surrounding ground it is possible to plant with such a variety of specimens that there is almost always a show of colour near the pond. If another part of the pondside can be arranged as a rockery the colour from the flowers will give a splendid reflection in the water. The bog garden should always be placed at the lowest part of the pondside so that any water overflowing from it will soak into the bog. Some ponds are constructed with a margin of shallower water around the sides. This enables the pond gardener to set many interesting plants, and this method of construction also prevents cats from fishing in the pond proper.

Where the bog garden is at its wettest it is advisable to plant only those kinds which are at home in such conditions. Many of the plants recommended for planting in the shallow part of the pond can also be placed in the bog. Most of the rushes and reeds do well in such places, and the water iris delights in such a position. Many of the other types of plants will do better where they are not exactly in water, however shallow. Most of the primulas will delight in a damp position, but should not actually be in the water. The same applies to the various kinds of *Mimulus*.

There are several types or varieties of *Primula* which are suitable for the pondside. *Primula japonica* and *P. sikkimensis* are especially suited, and if a good clump can be established they will give a wonderful show for a fairly long period. The best results will be obtained on ground slightly higher than the water, but near an overflow will do well. A good depth of decayed leaves should be spread over the soil and the primulas will delight in such conditions. Some primulas can be divided quite easily at this time of the year but others are best left until they have flowered. The species *P. denticulata* is a very showy one, with fairly large purple balls of flower. This plant can be divided by pulling the heads apart.

Most primulas require a good rich compost for them to give of their best, but good drainage must also be provided. Just because they like damp conditions does not mean that they should be continually in very wet places. If they are and the soil becomes too sour the plants will fail. Some kinds of *Primula* seed does not keep too well and so it is a good plan to sow soon after the seed is gathered. The well known John Innes Seed Compost is suitable, but care must be taken to ensure that the seed is not buried too deeply. Only its own depth of sandy soil should be placed over it, and as this seed is so small it is far safer to leave it uncovered. If the surface of the soil is left fairly rough the seed may be sown thinly on top, and then a gentle pressure with a flat piece of wood will settle the seeds in and no actual covering will be needed. When some primulas shed their seed around on the soil many seedlings appear, although they only fell on the top of the soil.

Do not forget the newer varieties of *Mimulus*, as instead of the well-known yellow colour there are some with large brown and red blotches, also red varieties which although perhaps not quite as hardy as some of the more common kinds, are well worth growing for their startling shades. *Mimulus* Red Emperor is a fine variety, and a packet of mixed large-flowering strain will give a good display. Although some pondside plant seeds can be sown direct

into the soil where they are to flower it is far better to sow the seeds in pans under cover, where they can be watched and cared for in the early days. Damp soils are usually colder than dry ones and so it is important that slightly warmer conditions are available to encourage germination.

The common forget-me-not should not be ignored, as although rather small the flower is very pretty. Some of the newer introductions will give flowers of larger size and brighter colours than the common kind. *Myosotis* royal blue, a fine dark colour, and *M. alpestris* Victoria are good kinds.

The Balsam is a good specimen for a really damp position and the variety *Impatiens Holstii* Hybrids is a good one for a situation where it can have plenty of room. It is, however, not hardy, and frosts will soon put paid to it. The seed should be sown in warmth and the seedlings hardened off before they are planted out. They will, of course, last only one season in the open but cuttings can be taken to over-winter if you have a greenhouse.

A plant which will look well near the edge of the pond but not in a very wet position is the aquilegia, the old-fashioned columbine. The large spurred hybrids are truly magnificent, and if planted near enough to the water to give a good reflection they can hardly be beaten. Try one of the newer varieties such as A. McKana's Giant Hybrids and you will be charmed with their splendour. See that their flowering quarters are well raised above the wet soil and they will do well and last for many years.

The day lilies or *Hemerocallis* are very good for a position where they do not have to be disturbed, and in time they will make a dense mass from which many fine flower spikes are sent up. *H. flava* is a good variety, but with all types be careful not to plant among tender subjects as the day lilies can become rather out of hand in a constricted space. But where they have almost unlimited room they will flourish year after year and give a succession of flowers.

You may have seen the giant *Gunnera manicata* growing at the water's edge in public gardens, but do not be tempted to plant one of these if you have a small pond and garden. The leaves of this plant somewhat resemble a giant rhubarb leaf and can reach the size of eight or nine feet across. On the other hand, if you are the fortunate possessor of a small lake or very large pond I know of no finer plant to add to the grandeur of the water's edge than a *Gunnera*.

If any fresh underwater plants are required now is a good time to introduce them, but do realise that if there are already many well-established plants there the new introductions will have a hard task to get well rooted. Always see that the new plant has a good clear space in which to grow and all should be well. Among the best underwater oxygenating plants are: *Egeria densa*, *Lagarosiphon major*, *Elodea canadensis*, and *Ceratophyllum demersum*.

Pearl Danio

(Continued from preceding page)

always remained a little of a mystery to me, although I have seen it advanced that the shade of colour is an indication of sex. I have placed this argument or theory with that very old one that a spiked dorsal in a goldfish is an indication of a male.

Pearl danios in first-class condition are often seen in fish exhibitions, but show to greatest advantage in a furnished aquarium.

AQUARIST'S Notebook



by

RAYMOND YATES

EVEN the most hardened hobbyist gets quite a kick out of viewing new and unusual specimens, and I am no exception. Unfortunately, most of the fishes which one sees in this classification are either too dull and drab or too large to be of commercial interest to dealers. One such fish is *Raiborichthys altior*, two specimens of which I saw recently after their arrival from Denmark.

About two inches long, they look rather roach-like, or perhaps like a headstander on an even keel. The pale pink of the fins is the only colouring, so this fish seems unlikely to become an aquarium favourite. The spotted sleeper (*Dormitator maculatus*) is not often seen, probably because it

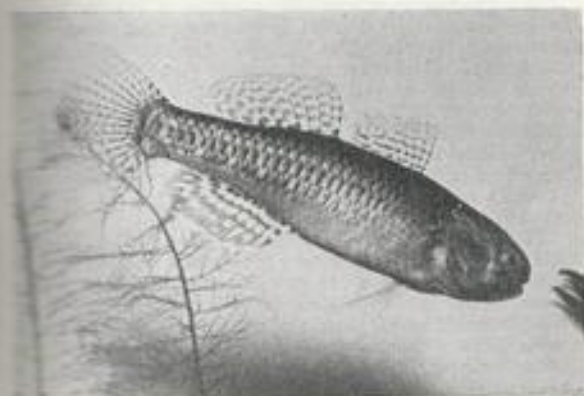
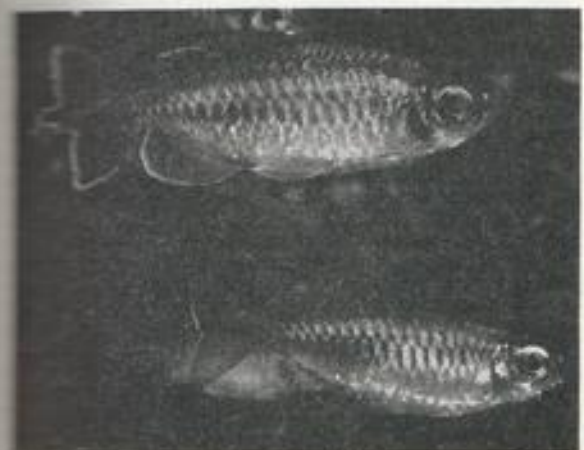


Photo: Laurence E. Perkins
Sleeper fish (*Dormitator maculatus*)

lacks colour (unless your specimen is one which shows up well-defined bands). Resting for long periods, sometimes rather mermaid-like, on its tail, it looks like a rather larger relative of *Mogurnda mogurnda*, but is without the colour of the latter. The eye is similarly opaque. This is no fish for the community tank. *Telmatherina ladigesi* is also not for the community tank. It gets along quite well with other fishes, although the males are constantly making passes at the females, but this fish is really hard to keep



Phenacogrammus interruptus

unless your tank water is very soft, the pH high (about 7.8), and sea salt is added.

A newcomer which is popular is *Phenacogrammus interruptus*, the Congo tetra. Only the male attracts the eye, with his flowing dorsal, unusual tail fin and vivid colouring. These fish are best seen at an angle of 45 degrees to the viewer, but they catch the light and show off their dazzling colours in almost any position except head-on. At two to three inches long they are superb, but have a disposition very much like that of the Buenos Aires tetra (which they resemble), so small, weak fish may not be safe with them. They do not bother with plant life. The lamp-nosed fish (*Barilius christyi*) is most attractive but it has a tendency to a disease rather like dropsy. A friend of mine had a dozen of these fish and all went well until suddenly several fish began to swell up alarmingly; scales stood out and black patches appeared on the belly. Death followed within two to three days. Only one fish survived, although it developed the symptoms. In this case the swelling went and the fish became normal again and is still with us.

Black sharks (*Labeo bicolor*) are all too rarely seen, partly because their price is still high and partly because of their habit of chasing other fishes. However, looking in a community tank the other day I noticed five *bicolor* sharing the tank with dozens of other varieties. The only fish the black sharks chased were each other, and this they did consistently. Perhaps this is the answer: limit their chasing tendencies to their own species. Paradise fish rarely give trouble if three or more are kept together in a community tank.

The new "black angels" which appeared some time ago have not been a great success, mainly because they proved lacking in stamina. Most of them were very small fish, and small angels are always risky "buys." Most aquarists I have met who have seen this variety are not keen, and much prefer the ordinary type of angel. It has not caught on, and no doubt the high price coupled with the weakness



Lamp-nosed fish (*Barilius christyi*)

of the fish has been a contributory factor. I know of one person who sold eight small black angels to a purchaser (an expert) for five pounds, but within a week or two only one single fish survived. Where these fish are kept a background of red-coloured rockery helps to show them off.

The piranha is not in every collection, but it remains an interesting fish. Although so very, very fond of a protein diet it is not beyond a light vegetable meal occasionally. It seems to prefer to chew up *Cryptocoryne* and large *Sagittaria*; plants like *Vallisneria* and Indian fern are ignored.

The craze for chlorophyll seems to be dying down and we see little of it in dealers' advertisements nowadays, although one dealer did advertise that all his plants contained chlorophyll! Perhaps a neat way of saying that he didn't keep the parasitic fish fungus in his tanks. A well-known Midlands lecturer used to remark that "The goat that reeks on yonder hill has fed all day on chlorophyll." As far as animals are concerned chlorophyll serves no purpose whatever if eaten, nor has it any deodorant powers, although a closely related substance has. Actually, this chemical represents to the plant very much what haemoglobin does for animals in the blood. It is also a pigment and accounts for the green colour of most plants, although other plant pigments are found, as in the red algae and in some bacteria. Plants which cannot manufacture their own food have no chlorophyll and live on the living tissues of other plants, or on animal matter. Plants with no chlorophyll can stand very bad conditions and it is worth mentioning that the brighter and cleaner the tanks, the less likely are they to be encouraged. Fish fungoids are quite happy in concentrations of sulphuretted hydrogen which prove fatal to other aquarium inmates.

Chlorophyll is essential in the process of photosynthesis just as much as is light, and if either is missing it will not take place. All things being equal light is changed into a form of chemical energy, and with the aid of water and carbon in the form of carbon dioxide sugar is formed. Water is very important to most plants, as it makes up the larger part of the plant tissues just as in animals. Between 75 and 90 per cent. of the plant is water, so that dehydration is an ever-present risk. This dehydration actually takes place in part when chemicals are added to the tank water, because these make some change in the specific gravity of the water. Normally, the plant cells are rigid or turgid with water, a fact which helps to hold the plant upright. If the surrounding water becomes a denser liquid than that of the plant, an osmotic change takes place and the weak liquid tends to move into the stronger. Dehydration in this form is what happens when chemical cures "kill" the leaves. It will be seen from this why salt is such an enemy to aquarium plants.

Fishes are never happy in bare tanks, and large fishes find such surroundings very trying indeed. Any tank should have a layer of gravel and, if plants are impossible, at least one or two pieces of rockwork to provide shade or a hiding place and give a feeling of security to the fishes. Fishes can get very scared in bare tanks, and in such circumstances will not eat and are liable to dash about madly, injure their noses or even jump out if this is possible. Small fishes with nowhere to hide are very nervous if larger fishes are sharing their tank, and this nervousness does not abate with time. Switching off a light panics fishes much more than switching on. After dark the loud splashes which are heard are almost always the smaller fishes escaping from real or imaginary fears.

One of the foremost popular writers on natural history of today is Mr. Chapman Pincher, whose books make

fascinating reading. In his book *Spotlight on Animals* he makes many interesting points on fish life of an unusual nature. He refers to the fact that although the majority of fishes and all bullets are streamlined, the fish is blunt forward and pointed in the rear whereas a bullet is pointed at the front, the back end being blunt. A pointed nose (as in the bullet) only lowers resistance at speeds faster than sound and a bullet travels at approximately twice this speed, say 1,500 m.p.h. Few fishes swim faster than about 25 m.p.h. so the necessity of a pointed nose does not arise. Interesting details are given of the effect of a moving bottom on fishes. The point here is that in swift-flowing streams the bottom appears to move to the fish, and the fish therefore makes just sufficient effort in forward movement to keep the bottom stationary. This is probably one reason why many fishes seek the quieter edges, where the current is less swift.

Mr. Pincher mentions the question of resting periods and refers to a nurse shark at Sydney Aquarium which swam ceaselessly for six years, a total distance estimated at 200,000 miles. Fishes in the main experience the same tastes as man—sweet, sour, bitter and salty. Emotion often overcomes hunger for long periods and a fish which is frightened will not eat. Quite a few aquarists have noticed this. Some unusual aspects are considered in relation to the effect of the pull of the moon on living tissue, brain particles and nerve cells, in those instances where fishes react to the moon at stated intervals.

Fishes should always be handled with wet hands as otherwise slime removal eventually means that the fish becomes waterlogged as a result of osmosis, and dies. Many fishes returned to rivers by anglers die merely because the fisherman, through rough handling, has made it possible for the lower density pond or river water to join forces with the body fluids of the fish. I can recommend this book to all readers.

Everyone knows that you'll catch more mice in traps with a piece of kipper than with cheese but few hobbyists realise that tropicals are also very partial to this food. Most fish are very apathetic when offered raw (white) fish such as plaice, cod or hake but there is no doubting that they find kippers very tasty indeed. If you are lucky enough to get a portion of roe as well they will be in seventh heaven. Try it.

Fungus is not so deadly a disease in the tropical tank as it is in coldwater aquaria, but it is very much in evidence once death has taken place. Most dead fishes are thrown away but fanciers can learn quite a lot by keeping small specimens in a small glass container and watching the onset of fungus and the speed with which it spreads. Frequently a dead fish will become well covered with fungus and may float for about 14 days. By now little of the fish can be seen but the fungus covering is about twice the original size of the fish. The body sinks and can no longer be distinguished as a fish at all. Unhurt fishes added to the water do not become infected with fungus but rarely live more than four days, their bodies being found mixed up in the fungus mass at the bottom.

It is interesting to add the bodies of dead creatures such as a large moth to this water—an amazing growth of fungus is on the moth in a matter of hours. Seeing is believing and this experiment demonstrates very clearly how quickly the disease can be passed on to sick or injured fish. However, fungus is not always fatal even although statements to the effect have appeared in literature. Some fishes can and do throw off attacks following injury to the tail or scales, in particular cichlids, *Corydoras*, *Panchax* varieties and *Copeina*. *Panchax* can always be saved further trouble by a light salt treatment, to which they react very quickly.



Apparatus required for the "pan method" of culture: a strip of Perspex across the enamel dish separates two feeding rings from the brine on the other side

of Perspex. At the apex of this prism-shaped container is fitted an aerator stone through which a powerful jet of air is introduced. The container holds about a gallon and a half of brine and can handle three spoonfuls of eggs per hatching if necessary. Of course, my needs for shrimps do not merit taxing the full capacity of the hatcher, and as a routine, only about a teaspoonful of eggs is used per hatching.

The drawing off of the brine containing the shrimps is achieved by means of a tube fitted to one side of the container and controlled by a pinch clamp. To collect the shrimps aeration is cut off to allow the shells and unhatched eggs to settle (a few float). The position of the opening of the drawing-off tube was so designed during the construction of the apparatus that it lies approximately half an inch above the layer of sedimented shells and unhatched eggs, and thus only the brine containing hatched shrimps is drawn off, leaving the shells and unhatched eggs behind. The brine is maintained at approximately 80° F. by an immersion heater and an external-fitting thermostat. The whole gadget is suspended by chains and hooks under a section of the staging holding the tanks in my fish house.

With this technique it is not only possible to hatch large quantities of shrimp eggs but to keep the shrimps alive for at least three to four days after hatching (no feeding is required). Hence one is not compelled to use the entire hatching all at once, the shrimps being drawn off as and when wanted. At the final collection of shrimps all the brine is passed through a handkerchief and can be used again for a long time. The egg shells and unhatched eggs remain behind in the hatcher, from where they can be washed out with plain water. To facilitate this the rubber tubing carrying the brine shrimp draining-off tube is pulled down. Carrying out these simple manoeuvres takes very little time and brine shrimps are available "on tap" almost all the time. Of course, for a really continuous supply two such hatchers would be needed but I do not like relying exclusively on any one food, however good. During the cleaning period after cleaning out the hatcher, fry carry on with other foods such as micro worms or very fine powdered yeast food.

Brine Shrimps to Adult Size

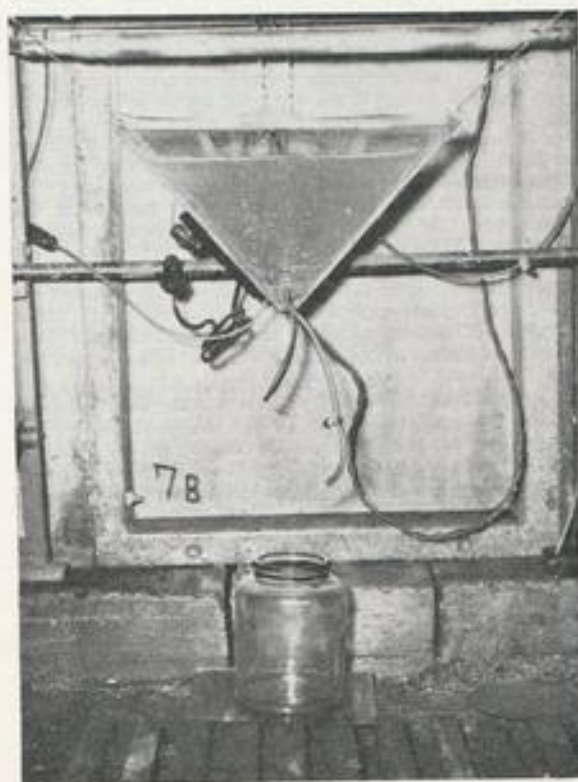
This is an interesting experiment to try, and broadly the principles for rearing adult brine shrimps are the same as those for rearing fish fry. Half-a-dozen to a dozen shrimps can be reared even in a 2 lb. jam jar, but hundreds can be reared in a 10 gallons all-glass tank. These creatures

feed on plankton organisms in their natural habitat, hence one of the best ways to rear them is to allow the brine to turn green by sprinkling some fine dry food on the surface and to stand the container in a strong light. Newly hatched brine shrimps may then be introduced and will grow to adult size without further attention as long as the brine remains green.

Another way is to feed them on very small quantities of baker's yeast. The amount will of course depend upon the size of the tank and the number of shrimps, but no more should be added than will make the brine only very slightly cloudy. Even though freshwater Infusoria cannot live in brine very long, the shrimps can be fed by introducing small quantities of an ordinary Infusoria culture into the brine. As in fry rearing, success depends on feeding adequately without fouling the water and so creating an oxygen deficiency.

I have not tried rearing these shrimps in my new hatcher as at the moment it is too busy producing newly hatched shrimps for fry, but I intend to try this, as it would appear that with forced aeration to take care of the limited space problem and any oxygen lack created by pollution through over-feeding, one could heavily feed the shrimps with yeast or very fine dried food. And thus it may become possible ultimately to rear a large number of adult shrimps in a limited space.

Finally, must be mentioned one great advantage that brine shrimps have over many other types of food, and that is that the aquarist can be confident that no disease-producing organisms or other undesirable creatures can be introduced by the use of this live food.



Apparatus built by the author for the "inverted-cone" method of brine shrimp culture



jars, but these are really a bit too small, and even if one's need for newly hatched shrimp is quite modest it is advisable to use nothing smaller than a half-gallon jar. It is said that better hatchings are obtained in round jars than in jars with flat sides though no reasons have been put forward to explain why this should be so. As already mentioned the number of eggs that can be handled will depend upon the surface area of the brine in the jar. The jar should be filled about one-half to three-quarters full with brine, and a quantity of brine-shrimp eggs sprinkled on the surface. A safe rule is not to put any more eggs than will cover approximately half the surface area of the brine. The jar should now either be stood in a warm place or floated in an aquarium.

Though a modest number of eggs can be hatched out without aeration a much larger quantity can be hatched when strong aeration is employed. Mild aeration is better than none, but for best results sufficient air should be introduced to keep the eggs swirling in the brine all the time. When sufficiently strong aeration is employed a teaspoonful of eggs can be hatched out in a half-gallon jar.

Once the shrimps have hatched, pour out the contents of the jar on to a handkerchief or a net placed over the mouth of another similar jar. The shrimps, egg cases and unhatched eggs will all be left behind on the handkerchief. These can now be transferred directly to the tank containing fry. The small amount of salt thus introduced with the shrimps is of no consequence and will not harm the fry in any way. The egg cases and unhatched eggs introduced with the shrimps are a nuisance but not actually harmful, for both fry and snails ignore them and the shells do not readily decompose and pollute the water. Occasionally, a fry will swallow an unhatched egg and this may be seen lying within it through its transparent body, but the egg is soon passed out unaltered, neither the fry nor the egg being any the worse for the experience.

However, one can separate the shrimps from the eggs after hatching. In the contents of the hatching jar you will see that some of the shells and unhatched eggs sink to the bottom and some remain floating. But none are to be seen in the large middle layer which contains hatched shrimps only. So if instead of pouring out the entire contents of the jar on a handkerchief you carefully siphon off this middle layer with a piece of aerator tubing, none or



On the left a magnified picture of newly hatched brine shrimps is seen. Above the apparatus for hatching eggs by the "jar method" is shown. A stone diffuser block is fitted to the end of the air line; the handkerchief over the jar to the right is used to filter off the shrimps

only a very few shells will be picked up. To facilitate this an electric lamp may be held on one side of the jar. The shrimps will be drawn to the light and will collect in a dense cluster near it, where they can be easily picked up by the end of the siphon. The majority but not all the shrimps can thus be separated from the shells. The method is therefore somewhat wasteful. The brine left behind after the hatching can be used again and again many times, but must be discarded if it goes foul or develops any odour.

Pan Method

In this method a shallow, new unchipped enamel container such as a baking dish or, better still, a flat glass dish which has been painted black on the outside, is used for the purpose of holding the brine. A couple of feeding rings are now floated on the brine and a strip of Perspex or wood is laid across the tray to keep the rings restricted to one section of the pan. Eggs are sprinkled within the rings. When the eggs hatch the shrimps swim out of the ring, under the strip of Perspex, into the clear section of the pan. By holding a light over this portion of the pan the shrimps can be concentrated to one small spot where they can be picked up by means of a large pipette. The glass tray is painted black to prevent stray reflection upsetting this planned migration of the shrimps. The contents of the pipette are emptied on a handkerchief placed over the mouth of a jam jar. The shrimps thus obtained are fed to the fishes, and the brine is returned to the pan. It is not necessary to clean out the pan after each feed. This can be made into a continuous process, fresh eggs being added to the rings as needed and old shells occasionally picked up from the bottom of the pan under the rings by the pipette.

Inverted-cone Method

For those who need really large quantities of shrimps the inverted-cone method is the answer. It is labour saving and far more efficient than either the jar or the pan method. Here aeration is employed to full advantage to churn the eggs about in the brine. After experimenting with various models I have constructed a brine-shrimp hatcher on this principle which has been in operation for some time now and has proved very satisfactory indeed.

It consists of a container made out of three triangular



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only a very few shells will be picked up. To facilitate this an electric lamp may be held on one side of the jar. The shrimps will be drawn to the light and will collect in a dense cluster near it, where they can be easily picked up by the end of the siphon. The majority but not all the shrimps can thus be separated from the shells. The method is therefore somewhat wasteful. The brine left behind after the hatching can be used again and again many times, but must be discarded if it goes foul or develops any odour.

Pan Method

In this method a shallow, new unchipped enamel container such as a baking dish or, better still, a flat glass dish which has been painted black on the outside, is used for the purpose of holding the brine. A couple of feeding rings are now floated on the brine and a strip of Perspex or wood is laid across the tray to keep the rings restricted to one section of the pan. Eggs are sprinkled within the rings. When the eggs hatch the shrimps swim out of the ring, under the strip of Perspex, into the clear section of the pan. By holding a light over this portion of the pan the shrimps can be concentrated to one small spot where they can be picked up by means of a large pipette. The glass tray is painted black to prevent stray reflection upsetting this planned migration of the shrimps. The contents of the pipette are emptied on a handkerchief placed over the mouth of a jam jar. The shrimps thus obtained are fed to the fishes, and the brine is returned to the pan. It is not necessary to clean out the pan after each feed. This can be made into a continuous process, fresh eggs being added to the rings as needed and old shells occasionally picked up from the bottom of the pan under the rings by the pipette.

Inverted-cone Method

For those who need really large quantities of shrimps the inverted-cone method is the answer. It is labour saving and far more efficient than either the jar or the pan method. Here aeration is employed to full advantage to churn the eggs about in the brine. After experimenting with various models I have constructed a brine-shrimp hatcher on this principle which has been in operation for some time now and has proved very satisfactory indeed.

It consists of a container made out of three triangular

Culturing *Artemia* to the Adult Stage

MANY aquarists are familiar with brine shrimp (*Artemia salina*) as a very good food for rearing tropical fishes after the initial green water-Infusoria stage has been passed, but the adult brine shrimp is seldom mentioned. When adult the female shrimps are about 17 mm. in length and the males about 10 mm., and they are far easier to culture than *Daphnia*. They are relished by all cichlids, the larger barbs and, in fact, by any fish that is large enough to take them. A further advantage over *Daphnia* is that a thicker culture of *Artemia* can be maintained in far less space. If any aquarist has a spare aquarium in the fish house and a desire to grow his own live titbits for any special fish for showing or for conditioning before breeding, then *Artemia* adults will well repay culture.

The first requisite is a 24 ins. by 12 ins. by 12 ins. tank. I have reared many cultures in smaller tanks but if one wishes to "cut and come again" then a 24 ins. aquarium is a necessity. A layer of loamy soil to the depth of an inch is spread on the bottom of the tank and sea water is added to this, swirling the soil with the water. The temperature is kept at from 60°-80° F. Up to 80° F. the higher the temperature the quicker the *Artemia* will grow. When the soil has settled out to the bottom, put in enough *Artemia* eggs to cover a penny, and provide moderate aeration. After 48 hours the eggs should have hatched, and the nauplii can be seen swimming in the lightest part of the tank. After this comes the difficult part—feeding.

Artemia can be profitably fed on baker's yeast. Cream a piece as big as your little fingernail into the tank so that the water becomes uniformly cloudy. If this concentration is cleared within 24 hours, then you have a thriving culture on your hands. As the *Artemia* grow, larger quantities can be given, but a little and often is a good beginner's policy. If your feeding is correct the *Artemia* will grow apace, and your fishes will be happier in the winter months for an occasional feed that is different. If the water remains cloudy after 24 hours all sorts of things may happen. The probable result is a smelly mass of grey fungus on the bottom, with the *Artemia* dead or dying, if you continue to give yeast. If no food is given for a day or two, and then only in small amounts, the trouble may clear itself. The golden rule, of course, is to give enough yeast to promote the growth of the shrimps without leaving excess to cause pollution. Only by experience can one tell how much food to give, but a piece as big as a pea is of the right order of size for a 24 in. tank if given every 24 hours.

With aeration and high temperature, evaporation is high and the tank will need frequently topping up with fresh water, not sea water. When topping up the tank an occasional topping up of "green water" from an old wooden rainwater butt or a neglected fish tank provides a welcome change of diet for the *Artemia*. A cover should be provided, preferably of glass.

For those who have no easy access to the sea, then a solution made up of 35 grams of Tidman's Sea Salt to a litre of fresh water, or any one of the many artificial sea-water formulae, will give good results, provided that soil is always used. The soil should be loamy and contain no insecticide spray such as D.D.T., nor should it contain unrotted organic manures. Worm casts from the lawn are ideal. It is probable that growth-promoting substances present in the soil condition the sea water to the benefit of the culture. This is why one should thoroughly stir round the soil initially placed in the tank, in order to liberate such substances.

When they become large, the adult *Artemia* will be seen to be swimming on their backs by means of their swimming legs. The motion is like the ripples of wind passing over a



Photo:

P. Scholes

Female (top) and male adult brine shrimps. Natural length of the female was 12 mm. and she shows swimming legs and egg sac. The male demonstrates the claspers on the head region (to the left)

wheatfield and it is these legs which filter off any particles such as yeast which may be present in the water. They act as a food-catching basket, as well as a means of locomotion.

Reproduction is usually by parthenogenesis—that is, eggs are produced and develop into adults without the aid of sexual reproduction. The females may be seen swimming with the egg sacs showing white on the genital segment. Sometimes the culture will be all female, but usually one or two males are present. These can be seen to be smaller than the females and have large claspers on the head. They are much faster swimmers than the females. If many males are produced suddenly in an old-established culture it is usually a sign that the culture is becoming senescent, or conditions are becoming unfavourable. Usually it is best to start a new culture going before the old one is completely finished. When established the females will produce many nauplii, which in turn grow up to adults, and if the culture is "cropped" continually it should last well through the winter months.

The above methods have proved quite successful with me, but occasional failures occur which are extremely difficult to account for. This, as we know to our cost, is no rare thing in fish keeping and will not deter most addicts.

Finally, when showing a visitor round the fish house it is ten to one that he or she will say on seeing your *Artemia* tank: "Those graceful little fish there! What on earth are they?" Even seasoned aquarists who have used *Artemia* nauplii for years have difficulty in realising that the gracefully flowing big-eyed shrimps are their old acquaintances grown up a little.

P. Scholes

THE AQUARIST

OUR EXPERTS' ANSWERS TO TROPICAL AQUARIUM QUERIES

I have one large community tank, and one small tank. In the community tank I have several live-bearing fishes, but the moment the females drop young the other fishes eat them. I should very much like to breed one or two of these livebearers, and wonder whether it would harm the females to remove them to the small tank to have their young directly I notice the gravid marking in the anal region.

Gerrid mollies do not like to be disturbed just before they are about to deliver a batch of young, but most other livebearer females do not seem to mind too much about being moved into a sort of maternity tank. We think you should transfer your gravid females to a special tank to have their young, for the chances of raising many livebearer fry to maturity in a community tank are very slender.

I have obtained a small quantity of peat to use as a subsoil in my aquarium, but it looks full of dust. Is it safe to use it "dirty" or should it be cleaned in some way before it is introduced into the aquarium?

There is always a certain amount of dust in peat obtained from dealers. This cannot be helped. But if you prefer to use the peat dust-free, place small amounts of it in a fine-gauge wire sieve and shake it to free it of small particles. We usually pour boiling water onto peat before introducing it into our aquaria. Boiling water sterilises the peat, and after it has cooled down it may be pressed flat on the aquarium floor, and coarse sand spread on top to stop the foam stirring it up and fouling the water.

One of my gouramies has gone blind in one eye. Will this blindness prevent it from finding its food, and, if so, would it be kinder to put it out of its misery?

Fishes having only one good eye get along very well in the wild and in the aquarium. Do not worry about it. Blind fishes which have lost the sight of both eyes often seem to find live food by picking up vibrations in the water. Directly a worm falls into the water, or a tiny fish swims close by, the blind fish senses its nearness, and usually succeeds in drawing it into its mouth.

The other night I decided to give my aquarium a good clean out, so I scraped the sides and siphoned lots of muck and water from the bottom. Then I topped up the aquarium with water straight from the tap, mixed with hot water to bring it to the same temperature as the aquarium. In a few moments all the fishes were huddled together on the bottom, as though suffering from bright or cold. They stayed huddled together until I went to bed, but in the morning they were swimming about as usual. Can you tell me what made them behave so strangely?

The introduction of several pints of fresh water from a tap into a small or medium-sized aquarium often results in the fishes reacting in the way you described in your letter. The rapid change in pH value and the sudden change in the mineral and chemical composition of the water probably accounts for it. If you were suddenly whisked from the atmosphere of south-east London and set down just as suddenly high up in the Himalayas you would probably feel and act like your fishes. When topping up an aquarium it is best to use water which has been drawn several days previously. This exposure of water to the atmosphere helps to rid it of chlorine and other chemicals which are used to-day to make our mains water safe to drink.

When will you give me some information about the cichlid *Parachanna kribbensis*? I particularly wish to know what food should be given to it, temperature requirements, and whether it can be placed in a community tank.

For a cichlid, *P. kribbensis* is quite well behaved. It does not take much interest in the plant life, and is fairly peaceful. In other words, it may be placed in a large, planted aquarium housing other similar-sized fishes. But all cichlids are dangerous to other fishes when they decide to raise a family. *P. kribbensis* needs a temperature of about 75° to

Many queries from readers of "The Aquarist" are answered by post each month, all aspects of fish-keeping being covered. Not all queries and answers can be published, and a stamped self-addressed envelope should be sent so that a direct reply can be given.

80° F. The diet should be a meaty one; that is to say, to keep the fish in good health, it should be given earthworms, bloodworms, *Tubifex*, small gentles, finely chopped butcher's offal, etc.

I have a community aquarium containing a number of medium-sized peaceful fishes. A local dealer has a fish called a 'penguin.' Would this attractive fish be suitable for introduction into my aquarium?

The so-called penguin or oblique fish (*Thayeria sanctaemariae*) is well-behaved enough to share a tank with other sociable species. But take care that the aquarium is not left uncovered, for the fish is a very proficient jumper!

I was advised by a fishkeeping friend to furnish my new aquarium with lumps of coal to form a background for the fishes. I took my friend's advice, and then filled the aquarium with water from the hot-water system. A few days after I had introduced the fishes, most of them became ill, and several died before I could transfer them to another tank. What I should like to know is this: is coal poisonous to fishes?

Coal which has been well scrubbed and left to soak in water for a few days is not harmful to fish life. At least we have never experienced any trouble with it. In fact, the water and plants look cleaner for using it, and the fishes appear to swim about in excellent spirits and health. Your trouble might have been caused by filling your aquarium with water obtained from the hot-water pipes. This water is usually run through copper pipes, and unless the tap is left to run for a short while the traces of copper which are usually found in copper-stored hot water will soon poison the fishes in an aquarium. If you wish to fill an aquarium quickly and introduce fishes right away (never a wise practice), it is best to use boiled water allowed to cool down to the proper temperature, or ordinary cold water from the mains, heated to the right temperature by the addition of hot water from a kettle. The correct thing to do, of course, is to fill the aquarium with matured water, or else leave the aquarium filled but untenanted for several days.

After treating my fishes for white-spot disease, several of them became blind. Does white-spot disease cause blindness in fishes?

We have not come across any records of white-spot disease causing blindness in fishes but we must say at once that certain medicaments used in the treatment of *Ichthyophthirius* might cause eye troubles or actual blindness, just as certain chemicals added to the water can cause sterility in fishes.

I am very worried about the condition of my male fighting fish. For several days he stayed hidden in the plant life, but when at last he emerged, I noticed that a small portion of what looked like his intestines was protruding from his underparts. Can you please tell me what is wrong with this fish?

Do not worry too much about your fish. There may not be anything really wrong with it at all. When fighting fish are in breeding condition, they often develop a tiny tube or nipple from the vent. This often becomes more prominent after meal-times. On the other hand, your fish may be suffering from constipation, which would result in short pieces of excreta hanging from the vent. Try feeding the fish on plenty of live food and scraped raw meat in preference to dried food.

COLDWATER FISH-KEEPING QUERIES *answered by A. BOARDER*

I have some coldwater fishes which have been affected with flukes. I have cured them for a time by using the Dettol treatment but soon afterwards the trouble recurs, what have I done wrong?

You must realise that the tank may contain some flukes, and when you return the treated fishes to the tank some of them can re-infest the fishes. Also if you only treat one fish at a time the others may have some flukes which quickly spread again to the treated fish. I am quite sure that fish can be cleared of flukes by using the Dettol treatment, either with a quarter-teaspoonful to the gallon of water and leave the fish in this for 15 minutes, or with a stronger solution and the fish removed much earlier. Whichever you use see that the fish is watched all the time it is in the solution, and if it turns over it must be removed to fresh water, when it will soon recover. It is, of course, of little use treating a fish and then putting it back into the same tank without seeing that this is quite free from pests.

I have recently set up a 15-gallons tank with small goldfish in it and would like to add some golden orfe. The goldfish are two three-inch ones and two very small ones. How many orfe can I add and would they do well without constant aeration?

The amount of water is not the main consideration. The surface area of it is the more important. You can have an inch of fish to each 24 square inches of area; that means 12 inches of fish to a 24 ins. by 12 ins. surface. Any more fishes will mean that aeration is necessary to keep them alive. Even with aeration it must be realised that although the fishes may get sufficient oxygen to keep them alive the fishes cannot thrive and grow in a proper manner without proper space. The golden orfe is essentially a fish which needs plenty of oxygen, and you are not likely to succeed with these for long unless they have plenty of space and a well-oxygenated water. Orfe can grow to large sizes, 18 inches long or more, and so I do not consider that they are a suitable fish for an indoor aquarium; as very small ones they may be all right for a time, but they are healthier in a large out-door pond.

I have an 18 ins. by 12 ins. by 12 ins. tank with one golden orfe and two American catfish; the overall measurement of the fishes is just over nine inches. I have plenty of water plants in the tank but have just installed an aerator. How long should I keep this on each day?

It is difficult to say definitely how long to keep the aerator on each day. So much depends on other things. If the water plants are growing and getting sufficient light they may be able to keep the water safe for your fishes. It would then be better to run the aerator for a time during the hours of darkness when the plants were not providing oxygen. You can only find out by watching the actions of the fish. If the golden orfe is seen mouthing at the surface then put the aerator on at any time of the day. Although aerators have their uses I consider that when it is necessary to use one there are too many fishes in the tank or the conditions are foul. In other words a well-run tank should not need an aerator.

I have a large out-door pond with over 150 fishes. Recently, many of them have shown red veins in their fins. The fins do not split or rot, and the fishes appear to be otherwise in good health. I have had sudden changes of temperature take place in the water; could this be the cause of the trouble and will it harm the fishes?

It is quite possible that the red veins in the fins has been caused by sudden changes of temperature, although you say your pond is fairly large and this should not vary in temperature as would a small pond. You do not say which varieties of fishes you have. I suspect that they are the fancy varieties of goldfish, such as veiltails and Bristol shubunkins. The fishes mentioned have large finnage

which is always prone to attacks of this red-vein trouble. I have noticed that the farthest part of the fin from the body of the fish is the worst affected. There is not a great deal you can do in a large pond; a little salt would probably improve matters but this must not be overdone. A tablespoonful of salt to a gallon of water may be all right when treating a sick fish for a short period, but this strength is far too much for a pond. The same amount of salt to about 10 gallons would probably be all right but you must realise that the red veins on the fins may be the sign of some pest, such as flukes, which could only be seen with the aid of a strong magnifying glass. It would be a good plan to catch one of the worst-affected fishes and examine it closely to see if any pest is present before taking any other steps.

When should I start feeding my goldfish in the pond again?

If you see the fish moving about well and obviously searching for food it is well to give them some. The last thing you should do is to withhold food from them in the early spring when they are able to take it in quantity. I never cease feeding my pond fish in the winter, but give garden worms as often as the fish appear active and able to take the proffered food. Hungry fish in spring are prone to develop fungus and other troubles.



Photo:

Laurence E. Pugh

Enlarged picture of a dragonfly larva, a common pond pest

I have found in my pond some horrible looking creatures, black thin-bodied beetles. Can they do any harm and what are they?

I expect the creatures are either the larvae or pupae of a dragon fly. They can eat small fry but are not likely to harm sizeable fish. The photograph shows a larva of a dragon fly nearly developed. When ready it will climb from the water and the back skin will split. The dragon fly will then emerge and fly away as soon as the wings dry off.

I have a furnished coldwater tank with small fancy goldfish. Is it possible to convert this into a tropical tank or would the fancy goldfish die?

It is quite possible to convert your tank into a tropical tank and still keep the fancy goldfish. There are several tropical fish which can thrive quite well at a temperature of higher than 70° F. and at this range small fancy goldfish will do well.

(Continued at foot of opposite page)

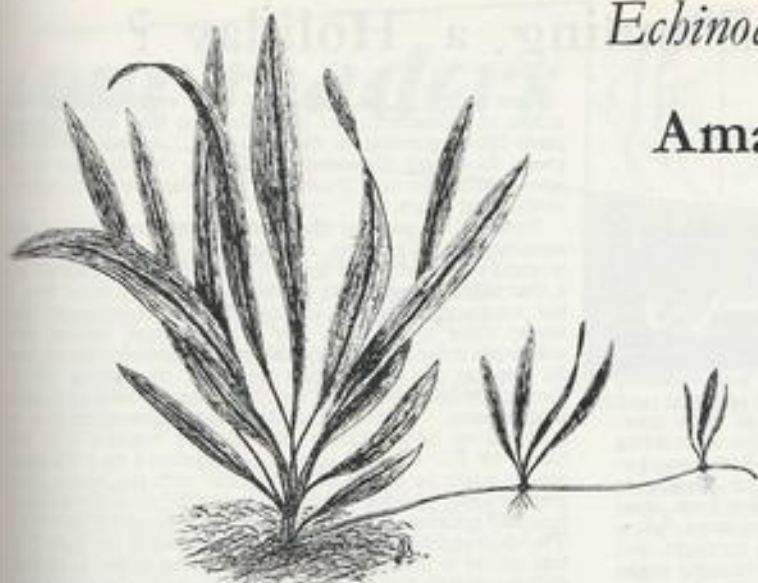
Echinodorus intermedius

Amazon Sword

Plant

by

JAS. STOTT



As a decorative plant for the tropical aquarium it is true to say that the Amazon sword plant is now firmly established among aquarists as a popular favourite. It was first introduced to this country somewhere around 1877, but achieved popularity during the years immediately following the war.

It is not a difficult plant to grow and propagate but objects to cramped conditions and, therefore, being a large plant when in full growth, is more suited to tanks in which ample room is available. As far as height is concerned it seems to be a very accommodating sort of plant for it appears to adjust itself to the depth of water in which it is growing, within certain limits. In this respect a minimum depth of 10 inches is essential if stunted growth is to be avoided. At the other end of the scale, I have, for instance, seen Amazon sword plants growing in a tropical pool having a depth of 30 inches and they have made beautiful specimens.

The leaves are sword-shaped and are light green, of thin texture and supported by a thick, central rib. They require plenty of light to produce maximum leaf growth and that delightful shade of green to be seen with the healthy plant. A strong, vigorous root system requires a good depth of

gravel in which to develop and spread. The plant does not seem to be particularly influenced by water conditions for it will grow in soft or hard water but, personally, I believe the best results are obtained with soft water, and taking this idea a step further I believe it appreciates a lime-free gravel.

By virtue of the fact that angel fish seem frequently to select the broad leaves of *Echinodorus* for spawning when the plant is present, it may be placed in the list of "spawning plants."

Propagation is by runners, which are put out from the crown, and a strong, healthy plant will produce a considerable number of young plants in the course of a year. The young plants should be permitted to root themselves in the compost and become established, or the process speeded up by having their developing root system carefully embedded in the compost, before the runner is severed from the parent plant.

Occasionally buds are produced at the end of long stems. The bud opens on the surface of the water to reveal a somewhat insignificant flower which, however, seldom fruits in the aquarium.

Coldwater Fish-keeping Queries

(Continued from previous page)

would also thrive. Most coldwater plants do not mind this temperature and so would be quite all right. For tropical fishes you can have many kinds including white mountain minnows, guppies, platys (*varietus*), paradise fish and rosy loaches; in fact, most of the tropicals can be kept at about 70° F. as long as they have not been bred and kept for long at much higher temperatures. Let your tank range from 60°-70° F. and you should be able to keep quite a large range of fancy goldfish and tropicals together. You will probably find that the fancy goldfish will grow fairly quickly and so may have to be exchanged for smaller ones after a time.

There is a small fantail which appears healthy enough and feeds well. It spends most of the time resting on the bottom. If it remains about on an uneven keel I would think that it was suffering from a bladder trouble, but it swims fairly normally when it does do so. What is the matter with it?

For all that it appears to swim well at times I am inclined

to think that the fish has some form of bladder trouble; apparently the bladder is insufficiently filled with the gas or air that should be there and the fish has lost some of its buoyancy. Try the usual swim-bladder treatment and it may get all right.

RARE JAPANESE PLANTS FOR NEW AQUARIUM

VANCOUVER.—This city's new public aquarium will house part of one of Japan's national treasures when it opens some time in April. The Japanese Government has promised the Public Aquarium Society here it will send six marimos as a gift. Marimos are a plant growth found only in Lake Akan and are protected as a national treasure. The ball-shaped plants lie on the lake bottom until their oxygen supply is exhausted, then they pop to the surface. As soon as they have replenished their oxygen they sink to the bottom again. It will be the first gift of marimos to an aquarium outside Japan. *Winnipeg Tribune, Canada.*

Are You Planning a Holiday ?

by JACK HEMS

AS soon as family conversation drifts on to the topic of the annual holiday, the enthusiastic and kindly fishkeeper often starts to worry about his fishes. Can a neighbour or friend be trusted to look after them? And, presuming that a non-fishkeeper volunteers to give the fishes their food, will too much food be introduced into the aquarium with disastrous results? And, if the weather became really warm, will the fishes suffer from excessive heat, and die of suffocation?—and so on and so forth.

Yet there is only one sensible answer to all these questions: stop worrying, and get on with the job of deciding whether to stay at Shrimpsville-on-Sea, or Rompover-by-the-Sands. And do not even hint to your friends or neighbours that "the problem of the fish" has been exercising your mind. For most, if not all freshwater fishes, coldwater or tropical, will survive a fast of a fortnight, and not be any the worse for it. In fact, a lean fortnight might well do some over-fed and pampered fishes a lot of good.

But a week or so before going away, the aquarist should make a point of feeding the fishes with as much live food and lean red meat or offal as they will take without fouling the water. And the morning or night before setting forth, empty a little more than the usual quantity of mosquito larvae, *Daphnia*, or brine shrimps into the water. If the fishes are not too savage, where molluscs are concerned, it is a good idea to introduce a few large ramshorn snails into the aquarium. The snails will soon lay jelly-like capsules full of eggs on the plants and the sides of the aquarium, and the baby snails, when they hatch out, are much enjoyed by the fishes.

Most fishes, in the absence of more exciting food, will nibble at greenstuff; so do make sure that soft-foliaged plant life is growing in the aquarium. Among favourite green foods are *Cabomba*, *Vallisneria*, *Nitella* and fine-leaved willow moss. Duckweed is relished by most greenstuff-eating fishes.

Now let us turn to the question of maintaining the aquarium at a suitable temperature. If the tank is a tropical one kept warm by an electric heater regulated by a thermostat, then things are best left as they are; but if the temperature is not controlled by a thermostat, the wisest thing to do is to buy a low-wattage heater, and substitute it for the heater (100 watts or so) already in use. So long as the temperature does not rise above 90° F. during the full heat of the day, the fishes should not come to any harm. It is most unlikely that the temperature of a closed-up house during the summer months will fall below 68° F. In small aquaria not regulated by a thermostat, it might be advisable to dispense with the heater, and rely on paper packing on three sides of the tank, to conserve heat and maintain a temperature range of from 68° to 74° F. The uncovered side should be the one facing the light. If this course is decided on, see that the fishes are gradually acclimatised to the lower temperatures before the holiday begins.

Pet goldfish may need a little more thought and attention. If they are being kept in a large aquarium, shade them from excessive sunlight by fixing tissue paper to the outside of the glass. If the goldfish live in a small container which normally has to have a change of water every now and again, the kindest thing to do is to stand the tank under a coldwater tap adjusted so that one drop of water falls on to the surface about every 30 seconds. A piece of wide-meshed white curtain net stretched tightly over the top of the container will prevent the goldfish from jumping out or rolling over the rim to die in the sink below.

FRIENDS & FOES No. 45

MEGALOPTERA

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

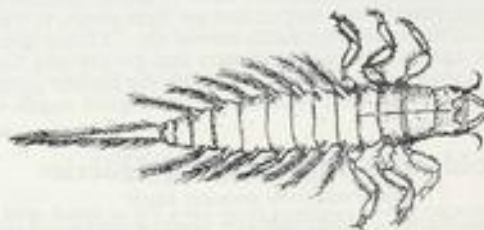
CLASS: Hexapoda, from Greek *hex*-six, and *podos*-foot.

SIALIS lutaria and *S. fuliginosa* are the only two known British representatives of alder flies. Both are clumsy, weak fliers, usually found in quantity during May and June, hovering over or in the vicinity of ponds and slow-moving streams. Fishes frequently rise to snap them up, for they are easily caught, and are of substantial size, three-quarters of an inch.

Batches of up to 2,000 eggs are laid on vegetation near or over water. These hatch in about 14 days, the larvae falling or crawling into the water and making their way down to the mud and silt of the bottom. At first sight the larvae appear to have ten pairs of legs, but closer examination reveals that seven pairs are really jointed, hair-fringed, leg-like gills.

They live for a considerable time under water, and all this period are carnivorous, feasting upon mayfly or Caddis-fly larvae. After two years or so they emerge, to make themselves a cell in the soft earth or vegetable debris adjoining the water. After breaking

Alder Flies



Larva of alder fly (*Sialis*), magnified

out of the cell about three weeks later, the pupae undergo a final moult before becoming imagines.

If caught while pondhunting you may be tempted to introduce them into aquaria. They can consume creatures nearly as big as themselves, and although they may have no taste for fishes or fish fry, caution should be observed—just in case. No doubt freshly killed larvae might be consumed by the bigger fishes, but any left over should be speedily removed, particularly from tropical tanks, where decomposition of unaten animal food is extremely rapid.

C. E. C. Cole

our readers



write

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

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

Cosby Gourami

A FRIEND of mine in England mailed me a copy of your magazine, *The Aquarist*, December, 1955 issue. I have enjoyed reading it very much. On pages 175 and 176 there is an article on the three-spot gourami. The last two paragraphs of this article interested me very much. It was in reference to an article in one of our magazines, *The Aquarium Journal* (1952), where sports had originated from the three-spot gourami, and as far as your writer knew, nothing had been heard of them since.

I am happy to say there is such a gourami. It is called the "Cosby" gourami, named after Mr. Cosby from Texas, who started this strain. A few years back six or eight of the Cosby gouramis were brought into San Diego, California, and given to one of our dealers who was successful in spawning them. Of the first spawn, I purchased two of them. One died but the other I still have in one of my aquariums. Since then, I have had many more and have also spawned them.

Before writing this letter, I checked with this dealer and he told me (to his knowledge) the only Cosby gouramis that are on the market are in the San Diego area. Also he, another man and myself are the only ones who have spawned them out in San Diego. This dealer told me he is short of them right now, with no breeding pairs, and didn't know what he was going to do. I played it smart with my last spawning and saved out many pairs just in case I should lose some. I told him I would help him out as he is a good friend.

They are really beautiful fish, far more than the three-spot. When they are in spawning colour, words cannot describe their beauty. I have a pair right now that should be spawning within a day or so. I am a member and corresponding secretary for the San Diego Tropical Fish Society.

(Mrs.) THELMA GEISLER,
San Diego 16, California.

Electrical Safety First

THE article "Electrical Safety First for the Aquarist," by A. P. Rayner, which appeared in your February issue is grossly inaccurate on several points. It is simply not true that all electrical equipment must be earthed. The Regulations for the Electrical Equipment of Buildings of the Institution of Electrical Engineers clearly exempts installations in earth-free situations from the necessity. I have covered this point in more detail in a recent letter to your columns (*The Aquarist*, November, 1955) in which I also pointed out the fallacy of earthing the water by "dangling" a wire into it.

Further, to connect a 25-watt bulb in an earth lead is not a satisfactory method in any case. Obviously, an earthed frame should remain at earth potential (zero volts) in the event of a fault. If a lamp is connected in the lead, however, there is nothing to prevent the frame attaining full mains voltage. Here there is confusion between an earthed system and an insulated-fault indication system, which latter should only be adopted in earth-free situations. In the vicinity of earthed water pipes, stone floors, etc., a system such as described could become a deadly menace—no less.

On this point the regulations cited above state: "The earthing arrangements of the consumer's installation shall be such that on the occurrence of a fault . . . a current corresponding to three times the rating of the fuse . . . can flow, so that the faulty circuit is made dead."

The insertion of a 25-watt bulb would clearly contravene this.

It is not correct to say that the usual thermostats will operate equally well on A.C. or D.C. supply. Most thermostats on D.C. will handle only a fraction of their normal A.C. load, some being unsuitable for use on D.C. at all.

Finally, in his directions for the selection of accessories of suitable current rating, the author completely omits what is, perhaps, the most important point of all, namely, that the rating of all components and wiring should exceed that of the fuse protecting the circuit. For instance, it would be most unwise to supply a circuit rated at five amps from a socket connected through a 15-amp. fuse, for in the event of a fault the wiring might suffer damage before the fuse blew.

C. W. THOMAS, Faversham, Kent.

Goldfish at the Fair

WHEN visiting the Hull Fair last year I was surprised to see that the goldfish was still held to be the chief prize on many stalls. One did not have to toss a ball into a bowl but to toss a coin on to a plate to win a fish. To my disgust the fish were presented to the winners in polythene bags. Imagine how many reached home safely in such containers after being shoved through dense crowds! Is it not time this kind of thing was brought to an end?

L. R. POUNDER, Hull.

Flexible Heater

FURTHER to the article describing the new flexible heater, we wish to point out that this type of heater is not a completely revolutionary one. This aquarist's business introduced such a heater to the public about five years ago under the trade name of "The Calflex" heater and advertised it fairly extensively in your journal.

G. F. BOYCE, London, S.W.17

Aquarium Notes

AS an ardent reader of *The Aquarist* I would like to tell my fellow hobbyists three of my recent experiences:

1. A warning: although I had switched off the electricity when cleaning my tanks recently, I was slightly shocked, because, as I was told, the switches (on alternating current) were wired the wrong way. So to be on the safe side, remove plugs from their sockets after switching off.

2. The other day I heard water dripping, and after looking for leaks I at last found that the water from an upper aquarium was running through the air-pipes to a lower tank by suction, for the air-pump was doing its work in reverse!

3. Lately, I had more young swordtails than I wanted. Some I placed in a separate aquarium (24 ins. by 12 ins.) and fed them with shrimps and fry foods, and the others I left with their parents and other fishes in a 18 ins. by 12 ins. tank. The separated youngsters are growing very slowly but the ones left with the larger fishes are growing rapidly and have escaped being eaten, although they have not been given special food. It seems almost as if they have grown more quickly to be out of danger.

F. COSSEN, Berkhamsted, Herts.

HERE is a tip for aquarists with leaking tanks. A wad of chewing gum rolled into a thin ribbon and pressed into the leak will stop it at once, and permanently, too. For aquarists with cars—this treatment will also stop leaks on cylinder blocks and radiators, etc. It has never failed me yet!

G. BARCROFT,
Pendlebury, Manchester.

Bookbinding

WE can confidently recommend the bookbinding service offered by The Sir Robert Jones Memorial Workshops, to readers who wish to keep their copies of *The Aquarist* permanently in a form permitting easy reference. The 12 issues making one volume will be bound in full cloth and with lettered spine by the Workshops for 13s. 6d., postage extra. Address orders to The Sir Robert Jones Memorial Workshops, 74, Upper Parliament Street, Liverpool, 8.

Cacti in the Fish House

FAIRLY frequent watering must be given to all cacti and other succulents during the summer months. Although they can go for long periods without any water it is necessary to give a fair amount as long as it is warm, for they cannot grow without it. Re-potting is also essential at yearly intervals. The soil in the small containers can soon become foul or worn out and no more goodness remains therein. When re-potting see that the new pots are quite clean; old pots are more easily scrubbed if they are allowed to stand in water for a few days. A good potting mixture will suit most cacti but it must be made very porous. Where John Innes Potting soil is used it is better to add about a sixth part of coarse sand so that the porosity is increased. Cacti are not very fussy as to soils as long as these do not hold moisture too long. The one thing which will kill most plants is the soggy nature of the soil. Water when given must be able to drain away from the pot, and, not leave the soil in a wet messy state. Pots should not stand direct on the top glass of a tank or shelf as the drainage hole can be blocked. All pots should stand in a container of gravel to ensure good drainage from the pot.

The AQUARIST Crossword

Compiled by J. LAUGHLAND



CLUES ACROSS

- Main use of fish skin (5, 3, 4)
- Wise bird could be low (3)
- Tribe bearing common surname (4)
- Generic name of guppy (8)
- fish, a small shark. Bite worse than bark here (3)
- Take greater part of a fin and you will not be far out (2)
- Motorists' organisation (1, 1)
- Features of thick-lipped gourmies (4)
- What angler does to his reel (5)
- Female offspring of brother or sister (5)
- A dory starts the trouble (3)
- Father of parasites (2)
- Its eggs were once a popular goldfish food (3)
- Toad's head (2)
- Separate from trap (4)
- All agree that these are shocking fishes (8, 4)
- Thanks (2)
- Part of the *Acara* is shocking too (1, 1)
- Device for keeping the tank clear (6)
- Final or perfect state of immaturity (5)
- 4,840 square yards of land nearly all mother-of-pearl (4)
- Genus of yellow water lilies (4)
- Young eel (5)

CLUES DOWN

- Aquarist or all-year-round swimmer? (4, 5, 3)
- Be under obligation; we are under nothing! (3)
- A fish lacking pigment is this (6)
- Call for aid (1, 1, 1)
- Greatest of all fishing grounds (5)
- He wrote *Kidnapped* and *Treasure Island* (1, 1, 1)
- Fourth note in sol fa notation (2)
- Dace in it to point (8)
- Swine (4)
- Poetic form of the one-time "Brightest Jewel in the British Crown" (3)
- See 36 Across (2)
- Not closed (4)
- The French (2)
- Moorish this is a fancy goldfish (4)
- White this is dreaded disease (4)
- Torpid (8)
- Mixed type of pike (2)
- To froth (4)
- Fisherman's haul (5)
- These specimens bring higher prices (5)
- Pad tanks or pipes to resist heat (3)
- The action of a strong current in a narrow channel (5)
- To wash or flow against (3)
- Age (3)
- At this word (Latin abbreviation) (1, 1, 1)

PICK YOUR ANSWER

- Ceratophyllum* (hornwort) is represented by four species, of which is exclusive to North America: (a) *Ceratophyllum demersum*, (b) *Ceratophyllum thalictroides*, (c) *Ceratophyllum muricatum*, (d) *Ceratophyllum submersum*.
- Shakespeare describes duckweed (*Lemna*) as "the green mantle of standing pool" in: (a) Hamlet. (b) King Lear. (c) Macbeth. (d) Pericles.

(Solutions on page 41)

THE Bristol Aquarists' Society met last month and were given a talk by Mr. R. Isaacs of the Surrey Trout Farm and United Fisheries, Ltd. Meetings of the Society are now held on the third Thursday of each month, 7.30 p.m., at the Crown and Dove Hotel, Rupert Street, Bristol.

RESULTS of the inter-club table show between Brixton Aquarists' Society and Lambeth Aquarists' Society resulted in a win for Brixton with 1,196 points; Lambeth had 1,036 points. Brixton won four awards, Lambeth five. The prize for the best fish in the show was won by Mr. G. Rogers.

THE Hampstead Aquatic Society's vice-president, Mr. G. S. Canadale, T.V. personality, gave a talk on "Animals I Have Kept in West Africa," recently. Mr. Canadale made the evening a success by producing a female lion cub, African bush baby, a python and an African king snake. Members of the audience handled the animals and the bush baby was specially popular.

RECENTLY the Leicester Aquarist Society met and were given a talk on "This Hobby of Ours," by Mr. W. L. Mansdell, of Birmingham. Also last month Dr. F. N. Ghadiali of Sheffield showed some films and told of his breeding experiences.

ON future Rochdale and District Aquarist Society will meet only on Mondays. Meetings will be on the first Monday evening of each month.

THE Rochdale and District Aquarist Society last month had a visit from Mr. A. Wattle of Bury, who spoke on general fish-keeping. This month Mr. H. Loder will be the speaker.

IT is announced that the Edinburgh Aquarist Society has now taken over larger clubrooms in the Edinburgh Working Men's Club, Inverness Street, Edinburgh 1. Aquarists interested in membership should contact Mr. J. Wilson, 1, Melgund Terrace, Edinburgh, 7, or attend the clubrooms any Tuesday, at 7.30 p.m.

THE Goldfish Society of Great Britain has elected Messrs. Franklin (senior), James, Wilson and Whitehead as fellows of the society. The system of the pond exhibited at the Water Life Show is available for hire from the society for use at other shows. A recent table show was for the adult singletails. Mr. R. J. Affleck, the presenter spoke on preparation for the breeding season at the last meeting.

PROGRAMME at the Sunderland and Sharncliffe Aquarists' Club's recent meeting included a film strip on pond and aquarium systems. The commentary was given by Mr. J. Hall. Also there was a table show which was very well supported. Mr. A. Brunton started a discussion on the merits of feeding dried food as a main part of the diet of fishes. Last month's meeting included a lecture given by Mr. A. Brunton on aeration and filtration. This month's table show is to be held.

NEXT month, on 7th June, the Croydon Aquarists' Society is to stage a "Jubilee Year Table Show" of members' fishes. Visitors are encouraged at this special meeting, to be held at 7.30 p.m., at Eldon House, 2, Lansdowne Road, Croydon. The Federation of British Aquatic Societies is presenting a Jubilee Year Trophy awarded at the show.

SECRETARY of the F.B.A.S., Mr. R. O. B. Lee, was speaker at the March meeting of the Northampton and District Aquarists' Society. His subject was water plants and the management of aquaria, and he advised his audience to examine roots as much as leaves and stems when purchasing water plants. An "open" aquarium hood with space for vertical tubes of lamps was recommended and the speaker stated that he employed 100 watts for 24 hours daily for lighting a 24 ins. by 12 ins. tank. To kill blue-green algae in a tank he suggested that a Victoria or Edward penny piece

News from AQUARISTS' SOCIETIES

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

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

should be suspended in it. The amount of sand ($\frac{1}{8}$ - $\frac{1}{4}$ in. grain) recommended for a 24 ins. aquarium was 32 lbs. At the conclusion of the lecture a table show was held.

A.S.L.A.S. Report

THE Association of South London Aquarist Societies has recently issued to its member clubs an information file which will enable individual secretaries to more fully understand the organisation and to make better use of the facilities offered. The file contains a brief outline of the origins of A.S.L.A.S.; the rules; details of the functions of the delegates' meetings and of the executive; lists of facilities offered and the lecture subjects available; tank hire charges; the organisation of the annual show; a list of member societies (with appropriate addresses); names of the executive and show committee for the current year. As information in the file becomes out-of-date amendment slips or pages will be issued. The re-introduction of the A.S.L.A.S. Newsletter is another feature which the recent purchase of a duplicator has brought about. The new series will appear at minimum three monthly intervals and will contain articles of aquatic and allied interest together with news of the Association's work. The executive will be interested to hear of any similar Association which produces such a publication, with a view to arranging an exchange.

On 9th April a delegates' meeting was held at Sutton. The final result of the 1955-56 Table Show Competition was announced as a win for Mitcham A.S. over runners-up Streatham A.S., after a close contest (51 points to 49). To further strengthen the Lecturers' Panel (which already covers 21 major subjects) the delegates asked that the executive should consider the formation of discussion groups at which topics such as suitable subjects, methods of presentation, visual aids, etc., would be debated by prospective new speakers. The Association has honoured Mr. A. W. L. Sayle for his work as show secretary in past years by the institution of the Sayle Cup which—on Mr. Sayle's recommendation—will be held for the best pair of mollies exhibited at the annual show. Requests for information concerning the Association should be addressed to the secretary, Mrs. Davies, 16, Milton Road, Wallington, Surrey.

Secretary Changes

CHANGES of secretaries and addresses have been reported from the following societies: **Derwent Aquarist Club** (Mr. H. P. Finch, 6, Sale Street, Derby); **Huntingdon and District Aquarist Society** (Mrs. J. Yeady, 32, Priory Road, Huntingdon); **Lowestoft Aquarist Society** (Mr. G. A. Francis, 34, Sussex Road, Lowestoft); **Portsmouth Aquarists' Club** (Mr. E. G. Bishop, 46, Aylem Road, Copnor, Portsmouth); **Rochdale and District Aquarist Society** (Joint secretary, Mr. R. Hudson, 9, Tomlinson Street, Sudden, Rochdale); **Stoke Newington and District Aquaria** (Mr. E. G. Gatehouse, 115, Bourverie Road, London, N.16); **Tottenham and District Aquatic Society** (Mr. J. K. Hall, 8, College Road, Tottenham, N.17).

Aquarist's Calendar

24th-26th May: **Bedford and District Aquarist Society** open show in Bedford. Details and show schedules are available from show secretary Mr. R. R. Pope, 51, Aylesbury Road, Bedford. Closing date for entries, 2nd May.

26th May: **Eastern Counties Section of the Federation of Guppy Breeders Societies** third guppy show with three open classes. Benching 10 a.m.-1 p.m.; show open to public 2-7 p.m. at Altmore Avenue School, East Ham, London E.6. Show schedules from show secretary Mr. E. Wignall, 481, Roman Road, Bow, London E.3. Closing date for entries, 19th May.

29th-31st May: **Riverside Aquarium Society** show at Hammersmith Town Hall. For further details write to the secretary, Mr. N. W. Webb, 90, Wellesley Road, Chiswick, London, W.4.

14th-16th June: **North Staffs Aquarists' Society** second annual show, open to North Staffs area. Details and show schedules are available from show secretary Mr. L. J. Perks, 6, Radford Road, Cliffe Vale, Stoke-on-Trent. Closing date for entries, 20th May.

28th-30th June: **Southampton and District Aquarists' Society** seventh annual open and competitive show at the Avenue Hall, Southampton. Schedules and entry forms can be obtained from show secretary, Mr. E. C. Galesworthy, Westways, Remsey Road, Nursling, Southampton.

7th July: **Lambeth Aquarist Society** open show, to be held at St. Luke's Church Hall, West Norwood. Closing date for all fish entries 23rd May. Show schedules are obtainable from secretary Mr. A. F. M. Bartlett, 27, Beckwith Road, London, S.E.24.

9th-11th August: **Portsmouth Aquarists' Club** fifth annual open show at the R.A. Drill Hall, Commercial Road, Portsmouth. For further details write to the show secretary, Mr. G. Elverson, 24, Bertie Road, Portsmouth.

Crossword Solution

C	O	A	T	S	F	O	R	F	I	S	H
O	W	L	O	C	L	A	N	O			
L	E	B	I	S	T	E	S	D	O	G	
D	I	N	A	A	L	I	P	S			
W	I	N	D	S	N	I	E	C	E		
A	D	O	P	A	N	A	N	T			
T	O		O	P	A	R	T				
E	L	E	C	T	R	I	C	E	E	L	S
R	A	A	T	A	C						
F	I	L	T	E	R	I	M	A	G	O	
A	A	C	R	E	V	H	U				
N	U	P	H	A	R	E	L	V	E	R	

PICK YOUR ANSWER (Solution)

1 (b). 2 (b).

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