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Editorial

SPONTANEOUS generation, the theory that at any time living matter might appear in an environment free from any forms of life which could have given rise to it, is a theory that has long been discredited. It was once held to be true for such highly organised animals as the eel, which, it was said, could be formed from a horse-hair falling into a pond. The origin of the microscopic bacteria and infusorians was attributed by many to spontaneous generation until the beautifully simple experiments made by Pasteur in the last century proved otherwise, and since that time the idea has been of historical interest only. And yet to listen to some aquarists discussing fish diseases is to gain the impression that spontaneous generation is an everyday event.

Of none of the diseases which are heatedly debated by aquarists is this so true as it is of white-spot disease. We are told over and over that this scourge has "suddenly appeared" in an aquarium, and that nothing has taken place to account for the outbreak. Time and again is the disease spoken of as if it were a visitation brought about by some aquarium gremlin. One almost hears the delighted chuckles of this malignant creature as the demented aquarist describes the spots that came in the night. White spot is caused by a protozoan parasite; this has been known and identified for many years now. Do those who delight in mystifying us over the origins of their white-spot attacks really believe that *Ichthyophthirius* can appear from nowhere?

Because we know there is so much muddled thinking concerning white-spot disease, and because the disease is of such common occurrence that an understanding of it is essential for the aquarist, we are pleased to publish this month the first of two articles in which Dr. F. N. Ghadially reviews current knowledge of the subject fully. We think that, like fungus and algae, white-spot parasites will probably always threaten our aquaria, but that it is not difficult to be safe when sensible precautions are taken.

White-Spot Disease

A complete review of this parasitic condition

by Dr. F. N. GHADIALLY

(Photographs by the author)

Fig. 1. Young free-swimming white-spot parasites (Ichthyophthirius). These occur in the water around an affected fish in large numbers

EVERY year a large number of budding aquarists are lost to the hobby when their beautiful tanks are ruined by "white-spot." Perhaps nothing produces a more acute sense of frustration in well-wishers of this hobby than news of this nature, for really the disease is so easy to tackle once you know how. Part of the blame must be laid on the perpetual plague of letters which appear in aquatic journals describing new "wonder cures," decrying old well-proved methods of treatment, making fantastic claims for some drug and proclaiming all others as useless.

The evidence on which such conclusions are based are usually so flimsy that no scientific or logical thinker would consider them seriously for a moment. While nobody wants to stand in the way of progress or discourage free thought it must be realised that such letters are a real menace as they mislead the novice and cause endless confusion and chaos in a subject which by itself is hard enough to grasp at the best of times. Therefore I feel that a somewhat detailed review of our knowledge on the subject of the disease is now sorely needed.

If you are thinking that I am about to describe a new wonder cure let me disillusion you straight away. I do not know of any, but at the same time let me assure you that once you understand the natural history of white-spot and the way in which various drugs can be used to attack this parasite, and if you are prepared to apply this knowledge intelligently, you need never suffer serious loss of fishes from this disease. Furthermore, if you are a careful, methodical type of individual, and have the requisite knowledge and facilities to place new arrivals in strict quarantine, your collection of fish need never get white-spot. No rule-of-thumb propounded by some pseudo-expert, no patent drug supplied in a fancy bottle with a multi-coloured label at a prohibitive price, will forever banish this plague from your tanks. The only true weapon to fight this menace is knowledge; I am afraid there are no easy short cuts.

In the interests of the novice I have tried to write this article in as simple a manner as possible, but the subject itself is a complicated and difficult one, so let me warn you this may not prove easy reading. Do not lay this article aside now just because your fish are healthy at the moment; if and when the disease does break out it will be too late to start learning then. Let us now consider the many aspects of this problem in some detail in an orderly fashion.

White-Spot; Definition. White-spot is a disease produced by the parasitic infestation of the skin of fish, characterised by the appearance of small slightly elevated white spots on the skin. (Note that the term infestation is used when denoting the presence of an animal parasite while the term infection is restricted to disease caused by bacteria.)

Aetiology. By aetiology we mean the study, or theory of the causation of any disease: the sum of knowledge regarding causes. More than one cause (correctly termed aetiological factors) may operate to produce a disease. To give an example, in human beings the disease called tuberculosis or "T.B." is caused by the germ *Mycobacterium tuberculosis*, but as a rule it succeeds in producing illness or disease mainly in run-down, poorly-fed individuals living in crowded conditions. Thus we see that there are numerous aetiological factors responsible for the production of tuberculosis in an individual. The primary aetiological factor is the germ itself. This is the main or important factor, without which tuberculosis could not occur, and the secondary aetiological factors are malnutrition, overcrowding, etc., without which the germ would have poor chance of producing serious illness. Let us now examine the aetiological factors involved in the production of white-spot.

Primary Factor. The disease is produced by a protozoan parasite called *Ichthyophthirius multifiliis*. (Protozoa is the lowest division of the animal kingdom including the unicellular organisms).

Secondary Factors. Mainly chilling (sudden or prolonged drop in temperature or both), such as experienced by fishes during transit or owing to failure of the heating apparatus in an aquarium. Perhaps malnutrition, old age, overcrowding, etc., are other factors of some importance.

The main point that I would like to stress here is that

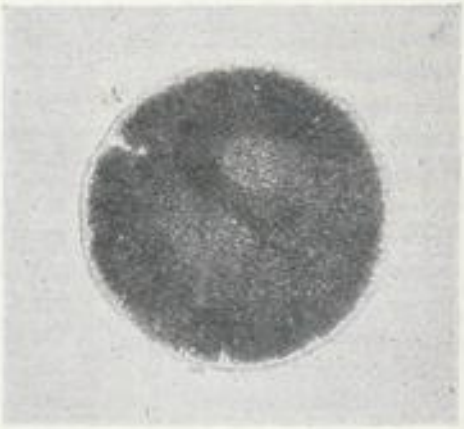


Fig. 2. A large mature parasite scraped from a white spot on a fish. It is filled with opaque food granules and the horse-shoe-shaped nucleus is faintly visible (pale area). Both photographs on this page were obtained under a phase-contrast microscope

if the parasite is absent no amount of chilling, malnutrition or anything else will produce white-spot disease; of this we are absolutely certain. No *Ichthyophthirius multifiliis*, no white-spot. On the other hand, it is quite possible that even when a few parasites are present in the water, if the fishes are in fine condition and are not chilled, they may not develop the disease. That chilling is not absolutely necessary to produce the disease is illustrated by the fact that fishes can get the disease when parasites are introduced to a tank in which an adequate, fairly constant temperature is maintained.

Thus the primary factor is all important, the secondary factors, as their very name implies, are only of secondary importance. Many aquarists firmly believe that white-spot is caused by a chill, but I hope you will now appreciate that this is at best only partly true. Such statements cause much misunderstanding and they detract attention from the main cause of the disease—the parasite *Ichthyophthirius multifiliis*; hence they are best avoided.

If you still believe that white-spot disease can be produced in the absence of the parasite by chilling alone, I suggest that the next time a fish suffers from the disease

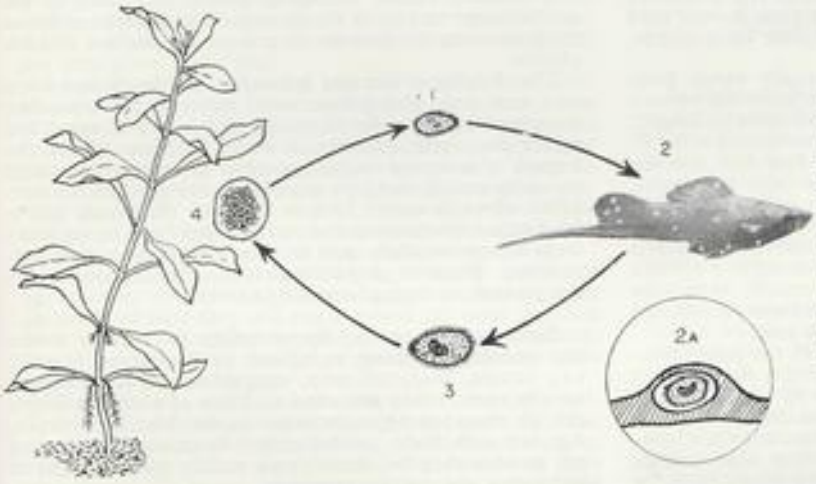


Fig. 3. Diagrammatic representation of the life cycle of white spot. The young free-swimming stage (1) infests the fish (2) and produces white spots. A section through a white spot and the skin of the fish (2A) reveals the parasite in a fluid-filled cavity. When this bursts the adult Ichthyophthirius emerges (3) and settles on a water plant as a cyst (4). Within this, rapid division of the cell produces 500-2,200 young parasites which are then liberated into the water and can infest new fishes to start the cycle all over again

you should examine under the microscope the contents of some of the spots by gently scraping them off the fish and placing the material so obtained in a drop of water between a slide and cover slip. You will then find organisms similar to that illustrated in Figs. 2 and 3 (2A) and this should convince you beyond a shadow of doubt that the parasite *is* present.

Numerous reports of outbreaks of disease in set-up tanks where neither material capable of spreading the disease nor new fishes have been recently introduced, but where the fishes have been chilled, have been made. If these reports are correct the explanation may lie either in a hitherto-undiscovered resting phase of the parasite, or in the yet unproved power of one of the known stages of development of the parasite to be unduly prolonged by factors we are not aware of, and not on the often-made ridiculous suggestion that the disease can be caused by a chill in the absence of the parasite.

Species-resistance. Various species of fishes vary in their susceptibility to white-spot though probably none are completely immune. Individual variation between members of a given species also no doubt exists. Thus when an outbreak of white-spot occurs in a tank not all fishes develop the disease. In the outbreaks that I have studied in my tanks and those of fellow aquarists I have observed that catfish (*Corydoras paleatus* and *C. aeneus*) are invariably not affected. I have often wondered whether these fishes, with their hard bony plates, are really completely immune from attack by these parasites. It is generally agreed that cichlids are somewhat more resistant to attack than say characins, barbs and livebearers. This is no doubt true, but even the large cichlids are by no means completely immune from attack.

Life Cycle of the Parasite. If the contents of a white spot are examined under the microscope one can see the adult form of the parasite. This is a unicellular round or oval organism (0.2-1 mm. in diameter) with a dark crescentic nucleus. Its surface is covered by fine cilia (hair-like projections used for locomotion). The parasite lies in the superficial layers of the skin of the fish. The tissues of the fish react against the parasite by pouring out a small quantity of fluid which then surrounds the parasite. In this cavity filled with fluid the parasite lives, and feeds on the tissue juices of the fish. The white spot thus produced gradually increases in size because (1) as the parasite feeds it grows larger; (2) more and more fluid is poured out by the tissues of the fish; (3) there is accumulation of waste products produced by the parasite.

This increasing tension within the white spot first causes a thinning of the superficial layer of skin covering the top of the white spot, and finally its rupture. This sets free what may now be called the adult free-swimming form of the parasite; see Fig. 3 (3). This plump creature, loaded with food reserves, as it emerges from a fish cannot infest other fishes; it must first develop in a series of stages in the water before it can infest other fishes. It swims away from the ruptured white spot and soon attaches itself to a plant or rock or any other such static object in the aquarium. Here it secretes around itself a cyst and proceeds to divide within it a number of times until approximately 500 to 2,200 young parasites are produced. The cyst ultimately ruptures and this large number of young free-swimming parasites are liberated into the water. These are pear-shaped individuals covered with cilia (Fig. 1), and are much smaller than the plump adult form which emerges when the white spot on the fish ruptures.

The young free-swimming parasite then swims about in the water till it meets with a fish, when with its pointed end, it burrows into the skin and produces a white spot (each spot usually contains one or two parasites). There,

by feeding on the tissue juices of the fish it grows and is transformed into the adult form of the parasite, thus completing the life cycle.

The time taken to complete the cycle depends upon the temperature of the aquarium. The life cycle of the parasite is considerably faster at 80° F. than at 65° F. At any given temperature only approximate times can be stated, as considerable variations are quite commonly encountered. Nevertheless, this is an important subject that will repay study.

Incubation Period. The incubation period of a disease is the time taken from the moment of entry of the parasite into the host animal to the time of appearance of the first characteristic signs or symptoms of the disease. Thus it is well known that we do not go down with typhoid or pneumonia as soon as we come in contact with a person suffering from the disease, but that some time elapses between this event—when obviously the germs enter our body—and the actual occurrence of the disease; that period is called the incubation period. During the incubation period although the animal is infested and is about to suffer from the disease it appears quite normal. The importance of that is quite obvious. Even if a fish looks as fit as a fiddle it is not safe to introduce it into your community tank without quarantining it first, for it may be incubating white-spot.

The incubation period at 80° F. usually varies from approximately two to four days, though there are reasons to believe that this may sometimes be much more prolonged. Thus, if a newly purchased fish that has been kept at 80° F. does not show white-spot at the end of four days one can be reasonably certain that the fish is free from white-spot. The time taken from the moment a spot is first sighted to the moment it ruptures varies roughly from three to six days at 80° F. A raw area technically called an ulcer is left behind when the spot ruptures (very small and difficult to see). In otherwise healthy fish this rapidly heals over but in heavily infested fish or in otherwise debilitated individuals fungus may form over the raw area.

It is said that at a temperature of 68° F. the young free-swimming form of the parasite must find a host after it emerges from the cyst in approximately 55 to 60 hours or perish. (At 80° F. this time would be considerably shorter). This is what one would expect, for this creature is a complete parasite and has no means of feeding when free in water. It must find a fish to feed on the tissue juices or perish. When it is liberated from the cyst it carries a small store of nutrient material in its body to provide the necessary energy for life and locomotion for a few hours till it finds a host; if it fails in this it must starve to death. It is like a car running short of petrol with no pump in sight, it can go so far and no further.

How long it takes the adult free-swimming parasite to form a cyst and for the cyst to rupture and liberate the young free-swimming forms cannot be accurately stated, but there is evidence to suggest that all this takes much less than a week, probably as little as four to five days. For if a tank in which an attack of white-spot has occurred is allowed to stand after all fishes have been removed at 82° to 85° F. for a week, it is then safe to introduce healthy fishes without treating the tank in any way. That is to say, that within eight days all the cysts have hatched out and the young free-swimming forms produced have perished.

Mode of Spread of Infection. The most common way in which this disease starts in a healthy tank is by the introduction of a new fish suffering from the disease or one incubating the disease. To the best of our knowledge snails, *Daphnia* and *Tubifex* do not themselves suffer from the disease nor do they form intermediate hosts for some stage of development of the parasite. Hence, these as such cannot be held responsible for spreading the disease. However, it must be realised that as these objects are sold in the wet state or immersed in water, there is the risk that the water itself may be contaminated by the parasite and thus can produce an outbreak of white-spot when introduced into a healthy tank; e.g. a dealer or aquarist may use the same net to catch some fish from a tank where an outbreak of white-spot has occurred or is about to occur, and then use it to net out some *Daphnia*; or he may dip his hand in the tank to pull out a plant and then handle *Tubifex* with the still-wet hand. Such contaminated material when later introduced into a healthy tank can then produce an outbreak of white-spot.

Daphnia and *Tubifex* collected from the wild by the aquarist himself can be considered reasonably safe as far as white-spot is concerned, for these live foods are usually collected in water too polluted to support fish life. And if no fishes are present then obviously no white-spot parasites will be present, as this organism cannot live without its host for any appreciable length of time. Further, it is said that in this country this parasite is not or only very rarely found in the wild. However, on the continent and in the U.S.A. *Ichthyophthirius multifiliis* is endemic in the free waters. Plants, rockwork, gravel, etc., may in yet another manner help in the spread of the infestation for as we have seen, the parasite encysts on the surface of such objects.

The dipping of wet jars belonging to friends into one's own tank when giving them some plants or fish is another dangerous practice, for if the jar had held a diseased fish earlier the small quantity of water so often left at the bottom of jars may contain parasites or cysts which could be easily transferred into your tank and produce an outbreak of white-spot. Lest in case you think that this is far-fetched, let me state that two past outbreaks in my tanks were almost certainly due to failure to observe this precaution. However, any article which is dry cannot transfer the parasite, as drying invariably kills it.

Signs and Symptoms. By symptoms one strictly means the evidence of disease as noticed by the patient himself, i.e., nausea, headache, pain, etc., while the term sign is usually restricted to objective evidence of a disease which can be observed by some other person like a physician, e.g., skin rash, fever, paralysis, etc. Since our fishes cannot tell us what they feel we can only strictly speak of signs of white-spot and not the symptoms.

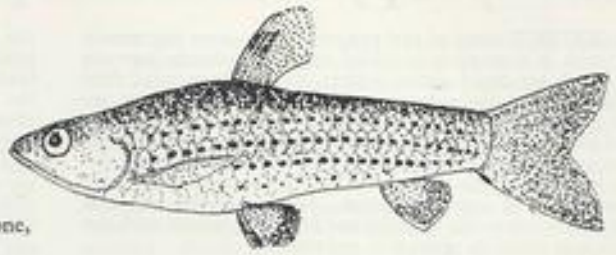
The main sign on which the diagnosis of white-spot is commonly based is the appearance of one or more slightly elevated white spots approximately 1-2 mm. in diameter on the skin of the fish. There is no characteristic distribution of these lesions; they may be seen on the fishes' fins or on the body or on both. The diagnosis can be confirmed by examining the contents of such spots under the microscope and finding the adult form of *Ichthyophthirius multifiliis*. But even before the appearance of these characteristic lesions the observant aquarist will notice that all is not well in the tank, for he may see fish standing still in corners with folded fins (some species will "shimmy") or making mad swoops against rockwork or gravel as if they were trying to "scratch" themselves.

The burrowing action of the parasites as they make their way into the skin of the fish probably causes some irritation and hence the fishes behave in this manner. But one cannot diagnose white-spot by these appearances alone, as they can be caused by numerous other conditions. For instance, fishes will behave in a similar manner when they are placed in polluted water.

(Preventive and curative treatment of white-spot disease will form the subject of another article by Dr. Ghadially next month.)

Red-spotted *Copeina*

(Copeina guttata)



Red-spotted Copeina

ORDER:—Ostariophysi, from Greek *ostarion*—a little bone, and Greek *physa*—a bladder.
FAIMLY:—Characidae, from Greek *charax*—a sea fish.
SPEICES:—*Copeina guttata*, after American scientist, Mr. E. D. Cope, and Latin *guttata*—spotted or speckled. (Sometimes *Pyrrhulina guttata*).

MANY people will be surprised to hear that this four-inch, streamlined fish is a characin. It seems too solid somehow, so unlike the semi-translucent, dainty and fragile-looking species we are accustomed to seeing. None the less, as far as I am concerned at least, it is a beautiful creature well worth more attention than it has been given in the past.

I remember well obtaining some of the first specimens re-imported after the last war, and how delighted I was when they bred. The youngsters were passed back to the dealer from whom I obtained the parents, to our mutual pleasure. All were sold, but after two or three years no more came on to the market, and I have not seen any since. The picture in Wm. T. Innes' *Exotic Aquarium Fishes* conveys a good impression of their coloration—the best I have seen—but does not do them full justice. Well fed with ample live foods, they take on a highly burnished appearance; the blue and red tints appear to glow. Brought up on dried food they will reach almost the same size, but have a dull sheen like dampness on polished furniture. For those who have not Innes' book to refer to, more explanation is necessary.

The eye, large and full, has a red patch over the pupil. The back is reddish brown, changing to a Cambridge blue on the sides, and fading to creamy white as it nears the ventral surface. Fins are yellowish, with broad red margins, except the dorsal, which has no red in it, only a faint dark marking in the position shown on the drawing above.

The male, when in first-class condition, develops a red spot on nearly all scales, a truly striking pattern. There is no adipose fin between dorsal and caudal. The female is identical in outline and general colour scheme, but seldom if ever develops spots.

Pike-like Behaviour

They are great poseurs, and will remain in one position like a pike for minutes at a time. This makes them first-rate exhibition fishes, particularly as colours do not fade unless the water in the show tank is too cool. The temperature most liked is 72° F. but tolerance is good and *C. guttata* will live in a fluctuation of 30°, from 60° to 90° F.

Best breeding temperature is 75° F. Placed together in a large aquarium (I used a 24 ins. by 12 ins. by 12 ins., but larger is preferable) and fed liberally with live foods—gnat larvae and pupae, Mayfly larvae and nymphs, etc., the fishes soon come into condition and begin to fan depressions in the compost. Plants are not necessary in the breeding tank, nor is special water; alkaline tap water several days old is good enough.

Before satisfied the pair will fan quite a number of depressions, moving from one to the other without cessation. At last however, the female slips into one depression, followed by the male, and lays a large number of eggs. When the female is spent the male drives her away and starts fanning the eggs with his pectoral fins with cichlid-like solicitude for their welfare. It is wisest to remove the female at this stage of the proceedings. It is unlikely that the male will damage her if she is left, but she worries him by her curiosity about his charges, and it is silly to run unnecessary risks.

Early Stages

In about 48 hours the fry rupture their eggshells and lie in the depression in a seething mass. The male, at least in my experience, still shows no desire to feast off his young, and stays near them. At first they do not venture more than an inch or two away from the depression, but in a day or two they are stronger and bolder, moving all round the aquarium. An Infusoria culture is fed to them several times a day for the first week, after which new-hatched brine shrimp, *Cyclops* nauplii, tiny *Daphnia*, etc., can be added.

The male was still inoffensive at this time in my aquarium, but he ate too much of the fry's food, and I was afraid he might mistake his offspring for some of his breakfast, so I moved him to another tank, where he rejoined his spouse.

In two months the fry had grown to an inch in length, but this would have been impossible if they had been left in the original spawning tank. I transferred them, when big enough to net, to a six-feet aquarium in which I had previously bred shubunkins, and where they had room to stretch their fins and get ample exercise.

Aquarium Science

IT is well-known that algae in a dried form can be blown about in air currents and that in this way they may invade fresh bodies of water, including the aquarist's aquarium. Can single cells of algae carried in the air be one cause of "hay-fever" and similar "respiratory allergies"?

A group of scientists at the Imperial College of Science and Technology, London, have suggested in a letter to *Nature* (31st December, 1955) that in some parts of the country at least, algal cells occur in the air at certain times of the year in numbers large enough to make this a possibility. They have found a blue-green alga (*Gloeocapsa*) in air samples collected at Thorney Island, Hampshire, in a three-weeks period at the end of June and beginning of July, and the number of cells averaged about 800 in each cubic metre of air throughout this time.

The same alga was traced in inland air samples, for it is known to grow on moist surfaces both at the coast and inland, but its cells were present in lower numbers in these samples. The scientists suggest that dispersal by air is an important means by which this alga can spread.

Microscopy for the Aquarist—16 *by* C. E. C. COLE

I EXPECT some of you put my article down last month with a somewhat wrinkled brow, wondering how on earth we could obtain a large, evenly illuminated field without using the substage mirror at all. Moreover, we can make our background any shade of any colour we wish, and place the microscope lamp so far away from our stage that even using 100 watt lamps (making the lamphouse too hot to touch in less than a minute) we obtain cold light for observation of our specimens. Before we try out this method however, let us make one final experiment with the mirror in position, plane side uppermost.

Comb-like tail of the larva of Chaoborus ("phantom larva") seen with a ⅛in. objective and ×5 eyepiece, with sub-stage lighting

Beneath the slide, on the stage, place a piece of ground glass. Examination of the field now shows a large, evenly illuminated area, but there is a granulated appearance of the background, because the glass is in focus at the same time as the object. Having decided, as no doubt you will, that this is unsatisfactory, remove the substage mirror altogether, placing it carefully to one side in a safe position —one from which it is unlikely to find its way to the floor. Lower the lamphouse to within two to three inches of the table top, and place a piece of plain white paper or card on the table top beneath the microscope.

Switch the lamp on and look through the microscope. The object on the stage appears to float above a beautifully even, yellowish-white background. The card or paper now serves as the light source, and its texture cannot be made out because it is not in focus with the object.

Artificial Daylight

A nearer approximation to daylight can be obtained if we slip the blue filter supplied with the lamp in the filter holder. Now we come as near as we are likely to, to having that bright cloud from the northern sky right under our microscope stage, and we can get it at any time of day or night, seated not at a freezing window, but in comfort by a warming fire. Moreover, we can keep it where it is for just as long as we like, independent of the vagaries of climate.

For observing slides, or when using live creatures in the troughs referred to and illustrated in article 13 of this series, the microscope is tilted to the most comfortable angle for viewing. If we were previously using the microscope in the vertical position this will necessitate adjustment of the position of card and lamp. The greater the angle of inclination of the body tube, the further from the base is the card or paper removed, and the greater the distance of the lamp from the microscope.

Head of Chaoborus larva. ⅛ inch objective and ×8 eyepiece, with sub-stage lighting

Eventually a point is reached however, where the lamp and card are so far distant that it becomes necessary to get up every time an adjustment is necessary. This is inconvenient, but fortunately there is an alternative which obviates such a necessity. Replace the substage mirror, cut a piece of card or paper to fit it and very lightly gum this in position over the plane surface. The smaller the amount of adhesive used the less trouble cleaning the mirror afterwards. A couple of tiny dabs at the edges should be sufficient to make the paper hold. Raise the lamphouse to the top of its pillar, and incline it steeply so that the light strikes the covered mirror surface. By adjustment of the distance between lamp and microscope it is now possible to lower the microscope almost to the horizontal.

To use the same lighting technique when the tube really is horizontal, the lamp must be placed to the side of the microscope (to the left or right, whichever is most convenient). The nearer the stage, the greater the intensity of the light, but always the background is beautifully even and viewing comfortable, free from glare or dazzle.

Coloured Backgrounds

At the beginning of this article I referred to coloured backgrounds, and by now I expect most of you have guessed how to obtain them. That's right! Simply substitute card or paper of whatever shade you desire for the white card or paper used in our experiments. It is better to use a "matt" or unshiny surface than a glossy one, which tends to introduce an excess of light.

Middle leg of a common variety of water beetle (Acilius) drawn under a 2 in. objective and ×5 eyepiece

The difficulties we have surmounted in obtaining an evenly illuminated field are not likely to arise again when we use our higher powers, for the same technique can be adopted. As we progress we shall meet other problems, however. We are by no means microscopists, yet! Next month we overcome fresh obstacles concerning illumination for special purposes.

Having obtained an idea of the general shape of some of our macroscopic aquatic creatures, remove the 4 in. objective, and begin to examine them in more detail. You will be fascinated by the complex structure of, say the legs of a water beetle, the head and "comb" of a "phantom" or "glass" larva, and countless thousands of other things. I hope to include a drawing or two of these with each article for the benefit of those of you who have not seen them before, or are unable to draw them for yourselves.

Electrical Safety First for the Aquarist

by A. P. RAYNER

THE very nature of our hobby calls for a sound knowledge of electricity. A few moments reflection will show that we use electricity for many purposes, e.g., heating, lighting, aerators and so on. Without such knowledge the use of electricity always entails an element of risk. However, provided care is taken at all times, and by paying attention to a few basic principles, the elements of danger are reduced if not completely eliminated.

Readers who are conversant with electrical matters should always offer their advice, and preferably their practical aid, to those aquarists who are not quite so experienced in dealing with electrical wiring and apparatus. But a word of warning—never give aid or advice if you are a little hazy about things yourself. It is hoped that the following will help those readers, who regard even fuse-mending as a task best passed to someone else, to wire up their heaters, etc., with the maximum amount of safety and confidence.

Except for those who do not use the electricity from the local mains supply most electrical gear associated with aquariums will be connected to the local mains. The mains supply is still available in one of two forms. One is called Direct Current (D.C.) and the other Alternating Current (A.C.). The differences between them are of little importance to us, except where motors or transformers may be required. The usual electrical heaters, filament lamps and thermostats will operate equally well on A.C. or D.C. supply. Thus, generally speaking, for lighting and heating there is nothing to worry about. However, if you should propose to use motors or transformers a check must be made upon the kind of supply, for transformers will not operate on D.C. Furthermore a motor designed for A.C. will not work on D.C. or vice versa. Thus before buying or using a motor make sure that it is intended for your form of mains supply. If you are on D.C. mains I would suggest the use of universal motors, since the need to replace them, if the mains is changed over to A.C., will be avoided.

A most important point to remember with all electrical equipment is that it must be correctly earthed. If a tank is not properly earthed, there is always a possibility of an electric shock, which can be most unpleasant at the best of times and possibly very dangerous. A good earth can be attained in several different ways, the best being the use of three-pin connections. This is because three-pin connections, if properly connected, incorporate an earth.

Because it is often the practice to connect heaters, lamps, etc., into a house lighting circuit, or some other two-pin connections, there is rarely, if ever, an earth associated with many aquariums. A tank can be satisfactorily earthed by connecting a normal mains lamp, of about 25 watts, between the tank frame and earth, so that the earth wire connects with both water and frame. If there is any leakage of current, the leaking current will be conducted to earth via the bulb. In the event of a serious leakage the bulb will light up thereby giving a visual indication of the leakage.

If you should desire to directly earth the actual water of your tank, the obvious way and the easiest, is to dangle one end of a length of wire into the water and to connect the other end of the wire to the tank frame, which latter is in turn earthed. But in this case you must bear in mind that some metals, e.g., copper, will render the water toxic to fishes. A piece of lead wire will do the job, and at the same time will not harm the fish by poisoning the water.

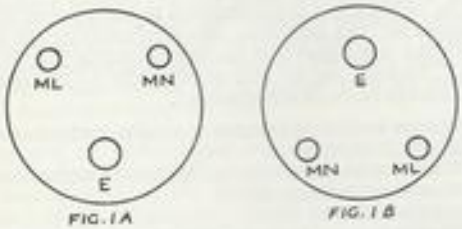


FIG. 1A

FIG. 1B

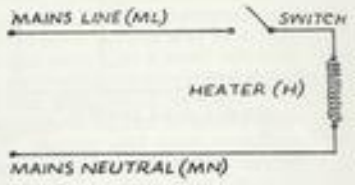


FIG. 2.

Figures 1a and 1b show a typical three-pin socket positioned in its two commonly used positions. One socket (usually of a larger diameter than the others) is for the earth connection, whilst the remaining two are associated with the current. One is called "mains line" or "mains live," and the other "mains neutral." So far as we are concerned only the mains line carries the current. For safety reasons all switches must be connected into the mains line, that is the current-carrying wire. Hence we must identify the mains line in order to determine which wire is actually carrying the current.

The necessity for putting all switches into the live mains is illustrated in figures 2 and 3. Figure 2 represents a conventional heater (H) and a thermostatic switch (TS) connected to the source of current supply (for the sake of clarity only the earth wire has been omitted).

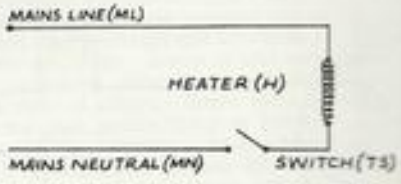


FIG. 3.

Figure 3 shows the switch (TS) and the heater (H) connected in a slightly different manner.

Let us look carefully at figure 2. The connections are as follows:—source via the mains live lead to the switch (TS), the heater (H) and the mains neutral back to the source. However, in figure 3, the connections are source via mains line heater (H), switch (TS), and mains neutral back to the source. You may well be wondering what is the difference, for the switch cuts out the heater in each case. That is quite correct, but only one circuit is *safe* and that is the circuit shown in figure 2.

Analysing figure 2 we see that the switch (TS), when open, breaks the current supply to the heater since the switch is in the mains live line. Hence no current can reach

the heater. Whereas in figure 3 the switch, when open, merely breaks the return wire to the source, viz. the mains neutral. Thus the current will be able to flow as far as the heater, and even though the latter is not working, it is still possible to receive a shock from the heater, which can be receiving up to the full mains current.

It will now be clear why all switches must be connected into the "live" line, i.e., to ensure that when the switch is open the switched apparatus is also *safe*. In the case of lighting circuits the safest method of switching is to use a double pole switch in the circuit. Figure 4 shows the operation of a double pole switch in a circuit of the kind commonly used with aquariums.

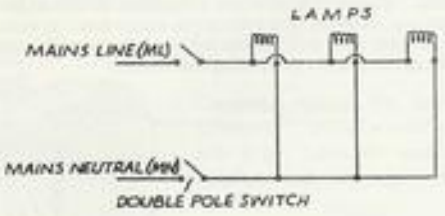


Fig. 4. Use of the double pole switch

In figure 4 the double pole switch breaks both the mains line and mains neutral wires, hence when the switch is "off" there is no chance of the bulb sockets being live, as might be the case if an arrangement similar to that of figure 3 is used. This need for correctly switched lights in tanks is important, since the atmosphere in which they operate is very humid, and if a bulb is changed, a shock is possible if the socket is still "live" because of an incorrectly wired switch.

Where three-pin or two-pin sockets with integral switches are used the switch must always be connected into the "live" line. Hence, provided the sockets are properly installed the equipment will always be earthed. It is quite a safe assumption that wherever electrical fittings have been installed by competent electricians, all the wires will be properly connected. If, however, you are not sure about this, the local Electrical Authority or an electrician will check up for you. If in doubt, do not take unnecessary chances but always seek sound advice.

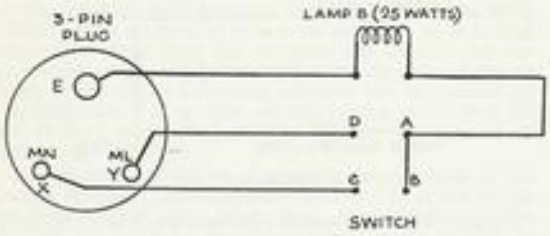


Fig. 5. Circuit for identifying neutral (MN) and live lines (ML) of the mains

The simple device shown in figure 5 will prove handy for sorting out the ML and MN wires in a three-pin installation. The earth pin of the plug is connected to one side of the lamp B, the other side of the lamp being connected to the pole A of the switch. The remaining pins X and Y of the plug are respectively connected to the poles C and D. Poles A and B are connected together. When the switch is in the position shown, a circuit is completed from earth via the lamp, pole A and pole C, back to pin X. When the switch is changed over, a circuit is completed from earth via the lamp, the pole B (which is common to A) and pole D to the pin Y. Hence, it will be seen that when the plug is plugged into the three-pin socket, and the switch is positioned to cause the bulb to light up, the "live mains" is immediately determined.

Before connecting together the various components, e.g., heaters, thermostats, plugs, of a circuit, always make a point of drawing a small diagram of the circuit. The operation of the circuit must be clearly understood from the diagram. If this is done, the chances of making a mistake in wiring will be practically eliminated, especially if each wiring step is traced on the diagram. It will also be found that a neater and tidier wiring system will be obtained.

Before connecting the various parts of a circuit make sure that all the components and the wire can withstand the current flow into the circuit. It is definitely dangerous to use components designed to withstand a fairly low current, say 2 amps., when the current in the circuit is going to be fairly high, say 3 or 4 amps.

The following table is intended to provide a quick and easy means of obtaining the current for a few common heaters, wattages and voltages.

Load in watts	Current in amps				
	100 Volts	200 Volts	220 Volts	230 Volts	240 Volts
25	0.25	0.125	0.114	0.109	0.104
50	0.50	0.25	0.227	0.207	0.208
75	0.75	0.375	0.341	0.326	0.312
100	1.00	0.5	0.455	0.435	0.416
150	1.50	0.75	0.682	0.652	0.625
200	2.00	1.00	0.910	0.870	0.833
250	2.50	1.25	1.14	1.09	1.041
300	3.00	1.50	1.36	1.30	1.25

To show how to use the table let us assume that a 100 watt heater is to be used on 230 volts supply. Referring to the table we see that the current is 0.435 amps. This is given by the intersection of the 230 volts column and the 100 watts row. From the table we note that, for most aquarists' purposes (excluding the range 200 to 300 watts at 100 volts) two ampere fittings will be quite suitable. If, however, a number of tanks are run off the same power point, don't forget that the total heater wattage can soon add up to a few hundred watts. Hence, first of all check up on the amps and use components which will readily withstand the highest current value likely to be used. For example, 1,000 watts at 230 volts means a current of 4.32 amps. and this value requires at least 5 ampere wire and fittings.

The connection of all wires to the plugs, etc., must always be clean and neat. In addition make sure that there are no loose wires or bare wires left unprotected by insulating tape or the like. Always ensure that joints are firm. Even in temporary set-ups always insulate connections and bare wires. The few minutes spent upon safety precautions will avoid unexpected shocks.

Lastly, never effect any alterations or adjustments to your equipment without switching off—preferably at the mains. Actually the safest plan is to remove the mains plug from its socket. To sum up, for safe working the following points should always be carefully observed.

(1) Always switch off prior to making any adjustments.
(2) Earth all equipment.
(3) Use components which will withstand higher currents than those being used.
(4) Insulate all bare wires.
(5) Always connect switches in the mains "live" line.

AQUARIST'S Notebook——

by

RAYMOND YATES

I ALWAYS think it a bad policy to buy a number of varying types of fishes from a dealer and to bring them all back in the same carrying can. The chances of passing on disease is much increased, and it is probably a wiser plan to buy only fish of one variety at any one time. We all make mistakes, and some time ago I purchased quite a mixed bag of tropicals and carried them away in a single gallon-sized Thermos jar. These were duly emptied into a bucket, and the fishes were netted and placed in a 25 gallon tank along with its existing inhabitants.

Long immunity from disaster makes one careless, but I was not left long in doubt that this time I was to pay for my sins. The following day most of the fishes were very listless indeed, lacked any interest in food and generally showed themselves to be in a very bad way. Many of them had closed-up tails and fins, mostly sealed up by a white scum, others had bands of white scum round the body or head and others had large red patches or blobs on their sides. Without exception all the fishes showed signs of intense itching, although white spot was not in evidence. I realised that for once I had really landed the jack pot of piscine ills and knew that I was likely to lose every fish; some were already beyond hope of recovery.

I would have liked to have tried salt as a treatment but this would have ruined the plants, and there were some fishes which may have been unable to withstand this remedy. Furthermore, the whole tank needed treatment, so I decided it was all or none. I did not know just what various organisms were causing the trouble so I had to risk a policy of trial and error, and if necessary, mix up several chemical "cures." First of all I put in the tank a large bag of peat, bearing in mind the fact that a low pH is inimical to many aquarium troubles. I followed this up immediately by adding acriflavine in the proportion of five teaspoonfuls of 5 per cent. solution to the 25 gallons. The following day no obvious improvement was seen so I dosed the tank with five capsules of Phenoxetol as an anti-fungus agent.

One naturally hopes for immediate results but forgets that these are not always possible. Meanwhile the weaker fishes were dying off at the rate of about five a day, so on the third day I decided to try T.C.P. I added five teaspoonfuls of undiluted T.C.P. to the 25 gallon tank fearing the worst, but no ill effects were seen. Hydrogen peroxide would have been useful but would have badly affected the plants, hence it was not used. However, fishes still died off so I decided to try permanganate, mainly because the fishes seemed to be so troubled with itch. I used a heavy concentration but no immediate improvement was observed. Finally, as a last resort I dipped the worst cases in Dettol (two teaspoonfuls in half a bucket of tank water) for 15 seconds.

All seemed about flat out after this drastic attention but all recovered and not one fish so treated died. From start to finish these combined-operation treatments took about eight days, during which time 30 of the 60 odd fishes died. Suddenly, I noticed that the fishes were beginning to look happier and that the signs of the disease were less apparent. Within a week all trace of trouble had vanished; I emptied much of the medicine water and refilled with fresh, ran a filter and found myself left with just over 30 survivors when I had feared complete loss.

I have no idea which of the remedies used proved most helpful or if the combination was the answer needed, but at one time none of the fishes looked as if they had a chance. The final analysis of the losses was interesting as they consisted of all the guppys (12), all the harlequins (five), both angels, all the pencil fish (five) and about half the platys, (six) or 30 fishes in all. The survivors I have split up into two sections, those badly affected and those who were less troubled. The fishes which were in a very bad way, but which survived and regained perfect health, were flying foxes, keyhole cichlids, *Barbus tetrazona*, *B. partipentazona*, nigger barbs and leeri gouramies.

The fishes which did not reach the "free-list" stage were zebras, *Corydoras*, glowlights, swordtails, *Copeina arnoldi*, *B. filamentosum* and *Rasbora leptosoma* and *R. einthoveni*. The single adult male fighter was in a hopeless state so I removed him and gave him a small salt tank to himself for five days; he recovered completely in the salt, as expected. Aeration was run throughout 24 hours a day. The effect on the plants of these mixed remedies was unusual as the *Cabomba* really thrived and grew rapidly. On the other hand the water fern died off just as quickly. *Aponogeton* species were retarded as also were *Cryptocoryne*, although it is hard to judge the latter.

When an epizootic strikes and you are faced with almost certain disaster I think nothing is lost by trying out several remedies at once provided that you keep within the toxic limits for each and run constant aeration. Raising the temperature may assist but is risky with crowded tanks like this one or with fish suffering from troubles which force them to the surface.

* * *

Most aquarists are what is known as "handymen," and with this in mind, one enterprising hobbyist in Derbyshire has made it possible for anyone to make their own heaters. This has been done by offering for sale a heater kit complete with very detailed instructions indeed, so that anyone with average intelligence will have no difficulty in assembling a heater from the parts provided. These consist of a Pyrex-glass tube, fireclay former, element (unstretched), rubber bung, length of cable, internal connecting wire, beads and label. In addition a smear of rubber solution is necessary. All the parts are of first-class material and well made. The directions are very thorough and lay stress on all important points of the assembly. Stress is laid on the importance of having everything damp-free, with details of how to ensure this state of affairs. Spare parts are obtainable if and when required, prices being as follows: Pyrex tube, 1s.; former, 2s. 3d.; element, 11d.; rubber bung (drilled), 5d.; length of cable, 11d. These kits allow the hobbyist to obtain a heater at approximately half the cost of almost any other heater available, a great saving for those aquarists with several tanks to heat. The inventor is Mr. J. McWilliam of 192, Alfreton Road, Little Eaton, Derbyshire, from whom full details can be obtained. There is a lot of very ordinary equipment available nowadays to the aquarist at quite low prices. These heaters do not come in this category; they are really excellent.

* * *

Not very long ago I tried out a deliberate overcrowding experiment. The fishes concerned were all large, and included blue acaras, dempseys, keyholes, giant danios, a very large angel, a big *Aplocheilus lineatus* and some festive cichlids as well as *Corydoras*, *Pristella* and *Barbus filamentosum*. The tank was four feet long, and was given constant aeration day and night. It was not long before trouble was

evident, because in spite of the aeration most of the fishes appeared to be breathing at a quicker rate and some kept near the surface. The first to give up the contest were the festive cichlids, after which about six blue acaras died. Subsequently, one of the giant danios died and soon after a *E. linearus*. The period taken covered about a fortnight.

During the whole time the Dempseys never showed any sign of discomfort although they were large specimens and the *Barbus filamentosum* were also unaffected. The keyholes looked constantly as if they were at their last gasp but came through, and the angel, although affected, survived. The *Corydoras* went about life as if everything was normal. A balance having been reached no further losses occurred. It was interesting to note that the fishes which died never made any effort to eat, but the survivors were just as keen on their food every day. I did not notice any bullying of the fishes which were obviously weakening, apart from the *Pristella*, which may have been attacked. The fishes which died were all found in brilliant colour, probably better than they had had in life. Many fishes seem to put on their best colours at the approach of death, cichlids in particular.

Later I removed the keyholes, which had been very quiet, inoffensive fish, to a tank where the other fishes were only about a third of their size or even less. Although they never became bullies they certainly left the other fishes in no doubt which were the largest and strongest specimens in the tank. Fishes are like that, and in reverse it is a good thing sometimes to put a bully in a tank with fishes much larger than himself. It is surprising how they reform—at least for the time being.

* * *

I am sometimes asked what are the best books on such a section of the hobby. This is hard to answer because it depends somewhat on the hobbyist concerned, his age, experience, pocket and education. What suits one will not suit another. Generally, books are now available on the hobby for beginners, for advanced fanciers and lastly for experts. No one book can contain everything. Then again, some aquarists want everything in print, others numerous diagrams and still others are only satisfied with numerous photographs. Few books contain all three. Books in the hobby can be divided into sections, e.g., aquarium management for the beginner, for the more advanced, fishes to keep, catalogue of fishes and plants, breeding data, water and pond life, microscopy, show requirements, etc. Don't grumble when you find that everything isn't in one book, that book just hasn't been written yet!

I would like to recommend two books for the serious hobbyist. The first is on microscopy and gives the reader the A to Z of using the microscope for pond-life study. It is called *Freshwater Microscopy*, by W. J. Garnett, and is published by Constable & Co., Ltd. at 30s. There are 300 pages, an index, a glossary of technical terms, some 51 drawings and over 220 photographs. There are chapters on collecting specimens, microscope equipment, introductions to animal and plant life in fresh water, making mounts, notes on scientific names, useful formulae, etc. This is not, of course, a book for the complete beginner, although such a person would find it fascinating and would pick up many useful hints.

The second book is on pond life and is called *Freshwater Life of the British Isles*, by John Clegg, published by F. Warne at 21s. This has 351 pages, an index, a large bibliography, over 160 black-and-white photographs, 29 colour photos or pictures and 95 drawings, as well as numerous tables. For beginner or expert this book contains everything the aquarist could ever want to know about life in fresh water, animal or vegetable. There are many details of pests met with in the aquarium and a thorough explanation of the meaning of pH and what it entails. It is not a book to lend out—you'll never get it back.

* * *

Some time ago I mentioned the excellent issues of the Spanish colonies in the form of fishes on stamps. Some new issues are now out which are a delight from both the stamp collector's and the aquarist's viewpoints. The new issue consists of 12 stamps, all large and oblong in shape, these being 5, 10, 15 and 60 centimos for each of the colonies, Spanish Guinea, Sahara Espanol and I.F.N.I. The stamps depict the hammerhead shark, another variety of shark, flying fish, a lobster, a turtle and a type of sea fish. The cost of the 12 stamps mint is only 1s. 6d., so that any hobbyist can buy a set for his son (or himself) at little cost. Sets like this are useful as prizes for table shows (juniors) or raffle consolations. If they stimulate interest they serve their purpose. The Spanish authorities are to be congratulated on once again putting fishes on stamps. Someone in Madrid must be something of an aquarist himself with all this interest.

* * *

Cichlids are fish which rarely contract disease but trouble can come from the fighting and love-play so common in this family. Some cichlids tend to panic if a light is switched on suddenly or if their owner leans over their tank and looks at them through the surface. Festive cichlids have one danger spot, their heads, and damage to this often results in an inflamed area which slowly spreads; fungus steps in and the fish dies. This tendency with festivum should be remembered—they are long-lived fish if you can prevent them from banging their foreheads. Where this has happened the forehead seems to be slowly eaten away, the fish hiding in a dark corner and ignoring food. As cure seems problematical prevention must be the aim.

* * *

As a general rule there is not much of interest to aquarists (who are not anglers) in the various magazines devoted to fishing, probably because most of these devote their pages to the art of catching fish and very rarely touch on other aspects of fish lore. However, some time ago I noticed one or two items which were out of the ordinary. It appears anglers can now buy polarising spectacles to enable them to see through the water without eye strain. In unbreakable frames these were 18s. 6d. each. Another interesting item was an offer to send a taxidermy course through the post on how to stuff and set up fish specimens with full instructions, for 5s. 6d. Anglers landing specimen fish were advised to get the local butcher to put them in cold storage or to preserve them by using formalin in the proportion of one tablespoonful to one pint of water. Yet another novelty obtainable is a "weed cutter" for streams, lakes, ponds, etc. These run from £5 5s. to £28.

* * *

I heard recently of a new form of dry food for fry used with great success. This is the powdered form of the well-known product "Sanatogen." It appears that this is very popular indeed and produces vigorous growth and obvious health.

* * *

An excellent French language magazine for hobbyists is *Notre Aquarium*, published monthly in Liége, Belgium. It runs to 24 pages with a bare minimum of advertisement matter. A summary of recent contents includes "Looking after an Aquarium," Plants, Details of Franco-Swiss conference, *Rasbora trilineata*, Dutch 25th birthday, Marine fish, Beginners' page, "Should temperature be constant?" Our readers write, etc. Many of the excellent photographs are by Timmerman. In common with most Continental magazines for the aquarist each issue costs the equivalent of about two shillings.

A Visit to Raymond

An interview by

PHILIP

DEE

Photograph by

LAURENCE E. PERKINS

Raymond with his daughter and aquarium

IT was with enthusiastic pleasure that I learnt that Raymond, the celebrated hair-stylist, kept tropical fishes. On learning this, I at once 'phoned him at his Albemarle Street parlour to request an interview. "Come up right away, and let's have a talk," was Raymond's answer, so up to the West End I went to conduct the first part of a very pleasant interview.

While I was talking to Raymond his lovely wife Jennifer arrived, and after short introductions I made arrangements to visit them at their home in Maidenhead. This entailed a car ride to Fifield, near Maidenhead. A long white-posted drive brought me into the courtyard of Raymond's lovely L-shaped, half-timbered, Tudor-styled country residence. I was admitted into a very large period-styled lounge. The timbered ceiling, the very large open fireplace, and the furnishings, breathed an atmosphere that was very refreshing. Raymond and his daughters Cherry, Amber and Scarlet were having fun with a tape recorder and it was interesting to watch the method Raymond was using to break down the shyness of one of his daughters. We went through the dining room, where although the antiquity was maintained it was modern in its furnishings, and so on to the breakfast room. This had been completely transformed in a contemporary style, and set along one wall on a recessed ledge was Raymond's aquarium. It is one of the popular plastic bow-fronted type and this was the first time I had seen one of these aquariums installed. I was greatly impressed with its simplicity, smartness and the way it fitted contemporary furnishings. The colour scheme of the aquarium was, I thought well planned, the whole unit being pale pastel blue with the bow-front panel edged with a black band top and bottom, and a plain black flush-fitting top cover.

It was quite well furnished with twisted *Vallisneria*, *Hygrophila*, *Cabomba*, *Cryptocoryne cordata* and a well-proportioned spatterdock. The rockwork was artistically tiered strata fashion with York stone. The collection of fishes consisted of platys, mollies, beacons, tiger barbs, rosy barbs, zebra and angel fishes and a pair of red Siamese fighters.

The aquarium was a constant centre of attraction for the kiddies as well as for Raymond, and it was enlightening for me to discover that this personality finds that apart from its decorative value, an aquarium is an asset in assisting him to relax. I wonder how many of Raymond's hair creations have been born in those moments of relaxation? For even when relaxing Raymond is mentally still at work; in fact, I go as far as to say he never stops. He works hard, and plays hard, but work has priority. There seems no doubt that the rhythm and movement within an aquarium can assist, and probably has assisted, this genius in his art.

I asked Raymond how long he had been interested in fish. "Oh, for quite a while," he remarked. "In fact I always use an aquatic background wherever possible in my hair-style presentation shows." Then I recalled how he had adapted the mermaid costume (which was used by Glynis Johns in her film "Miranda"). "And there is, of course," he continued, "one of my latest hair creations which is known as the 'Miranda line'."

A twin-toned automobile horn of a powder-blue Cadillac broke the silence to announce the arrival of Diana Dors and Dennis Hamilton, her husband, who were paying a social call. "What a beautiful aquarium!" said Diana Dors. "You know, I have always wanted to keep tropical fishes and I must really get down to doing something about it. Perhaps you would come to my home and advise me just where I could instal one?" (Who could deny Diana Dors a visit anyway?)

After photographs and some discussion of biological theory of the aquarium we retired to the lounge, from where Laurence Perkins, our photographer, and I, said our goodbyes. During the ride home I could not help thinking how different Raymond is from the original mental picture I had formed, and how much of a family man he really is. I gather Raymond must get quite a kick from what I think must be his personal theme: "It's nice to be nice."

Marine Life at the

A description of the famous Marine Studios of Marineland, Florida, U.S.A.

by H. J. VOSPER

Photographs by courtesy of the United States Information Service

In this aerial view of Marine Studios the two main tanks with their surrounding observation decks are seen before the Atlantic Ocean background

OFFICIALLY opened in 1938—when 30,000 scientists, photographers, technicians and other visitors were present—Marine Studios is a unique establishment. As the name implies, it is primarily a place where research and photography may be carried out, yet so attractively has it been planned and built that it is also a centre of interest to the merely curious and the holiday-maker.

Efforts to photograph animals under natural conditions had not been successful until corrals of various sizes had been built, in order that some measure of control could be exercised by preventing the subjects from disappearing into the depths of the forest. It was realised that this technique might be advantageously extended to underwater life, and it was decided that giant tanks should be built on the seashore so that a constant supply of fresh seawater would be available. Thus Marine Studios came into being 18 miles south of St. Augustine, Florida.

The establishment consists of two main tanks, one round and the other rectangular, supplemented by several smaller tanks. The "circular oceanarium" is 75 feet across and 12 feet deep, and contains some 400,000 gallons of water with a continuous circulation from the nearby ocean of 3,000 gallons per minute. The water is drawn up from infiltration galleries under the adjacent beach, being filtered and aerated in the process. This is a temperate tank with temperature fluctuations according to the seasonal changes in the neighbouring waters. In here are to be found dolphins, turtles, groupers, rays and very many smaller species.

It should be remembered that the Floridan peninsular extends to the tropic zone, and in order to exhibit specimens from that area the second main tank—the rectangular or tropic oceanarium—together with the small corridor tanks (of from 15 to 50 gallons capacity) are kept at a minimum winter temperature of 68° F. The tropic tank is 100 feet long, 40 feet wide, 18 feet deep in the central basin and holds 450,000 gallons, circulated at 2,000 gallons per minute and heated by oil-fuelled boilers. One end of the tank has a five-tons rock ledge, and the other has a seven-tons coral reef, while in the basin lies a barnacle-covered wreck—placed there to give authenticity to motion-picture films, as a centre of interest for onlookers and as a form of sanctuary for smaller fishes. In this tank are sharks, moray eels, tarpon, barracuda, etc.

Lying between the two main tanks is a receiving trough

A giant manta ray weighing about 1,500 pounds and measuring 12 feet across the "wings" is lowered into the receiving tank at Marine Studios after its capture from the open sea

where newcomers are examined and may be given a period of isolation. Specimens come from the coastal regions, the Bahamas, Florida Keys, etc., and the Studios maintain a fleet of very highly equipped fishing vessels which range far and wide to obtain new stock. Some boats have 15 feet open tank-like wells with four-inch portholes along the sides which allow for a continuous circulation of fresh seawater. Some barges have larger apertures in order that larger specimens may be accommodated without their leaving their native element. The Studios also possess specially designed tank-trucks in which fishes are brought from the Florida Keys.

Rare specimens are sometimes obtained from individual fishermen and cash awards are granted for those provided in good condition. Some 10,000 fishes of 2,000 species are normally on view, the most beautiful probably being the many species of tropical coral-reef fishes.

Of particular note is the fact that this is the only institution in the world where dolphins have been successfully born and reared in captivity. Of the colony of 12 present in the summer last year, seven were born in the tank—the oldest being eight-and-a-half years old. Marine Studios have been the means of obtaining a great insight into the life processes and habits of these creatures, and owing to

"Oceanarium"

the very remarkable intelligence they display and the ease in which they may be trained, a special "Porpoise Stadium" has now been built where they perform in a 100 by 30 feet pool. The Stadium has seating for 1,000 visitors.

The large tanks are made of welded-steel plates covered on the inside with gunnite, and open to the sun to obtain natural illumination for observation from inside the enclosed corridors. The corridors themselves are lit by a soft-blue light. Let into the tank-corridor walls are 300 portholes, each of a double construction consisting of two ¾ in. plates of special glass with an air space between. Pipes to and from the infiltration units, and elsewhere, are of cement-lined cast iron. No refrigeration is used in any circuit. Three electrical pumps pass 7,000,000 gallons of water through the oceanarium daily, and there is a complete secondary system standing by in case of breakdown.

Observation under Community Conditions

It should be realised that specimens are not living segregated lives but rather in a more natural or community tank condition. This is very advantageous for research and photography. Apart from the resident teams of scientists, several Universities provide part-time assistance, while—although still- and small cine-cameras are welcome at all times—35 mm. film facilities are reserved for the major film companies.

Visitors may walk round at surface level on the outdoor observation deck and then descend to the portholes in the two lower corridors. They watch the inhabitants not only in their normal behaviour but also at feeding times, when a diver enters the tanks and hands out such foods as crushed squid and mullet. Live shrimps are also used. Various specimens constantly disappear through being eaten. An example is the shark swallowed whole by a giant black grouper. Cabbage and lettuce are provided for the vegetarians, anchored whole to the bottom to provide "pickings." Feeding takes place several times each day and despite the presence of sharks, rays, groupers, barracuda, etc., there have been no serious incidents in the history of the estab-

(*Continued at foot of next page*)

A visitor watches the fishes through a porthole, of which there are 200 arranged around the sides of the large tanks

One of the collecting barges from Marine Studios. Here a porpoise is being transferred from the skiff that captured it to the barge's open well

Feeding time—squid and mullet from the basket are the items about to be received by the anticipatory porpoise

Starting a Tropical Aquarium—3

A series of articles by "AQUARIUS" for the guidance of beginners commencing to keep a tropical aquarium

IF you have followed the previous articles in this series you will now have the tank in good running order. The plants should be commencing to grow and the water should be clear and at the correct temperature. If this is the case you can add some fishes. This is where you must display plenty of caution. Do not try to stock the tank to its capacity. Remember that fishes must have room in which to grow, if not to breed. Also, do not start up with the idea that as long as you put in plenty of fishes of both sexes you have only to wait a few weeks to have hundreds of youngsters which you can sell and make a small fortune. This is the wrong outlook and will only lead to disappointment. Very few aquarists are able to breed many fishes in one tank. To be able to get a steady supply of youngsters of most kinds it is necessary to have a large number of tanks, in which to hatch the fry or raise the young of livebearers.

We must now consider what kinds or species of fishes we are going to keep. I shall assume that the main object in setting up the tank is to obtain an attractive addition to the living room or hall. Do not worry about any breeding possibilities at the moment. This can come later on when you have gained some experience with keeping the tropicals in good health. There are two main groups of tropicals we can consider: the egglayers and the livebearers. Some of each kind can mix quite well in the community tank, and there is no need to restrict your choice of fishes to either type. It is a fact that some fishes mix better than others, and only experience will teach you which they are, although fishes of the same species can vary considerably as to whether they are likely to become bullies or not. With a few exceptions most of the more commonly kept tropicals will mix as long as they are not overcrowded or underfed. It is when there are too many fishes in the tank and food is scarce that the conditions encourage a large fish to bully the smaller ones.

I know that you will have certain preferences for kinds of fishes which you like, and so I shall only make a few suggestions and hope that as you gain experience you can try some of the less common ones. The common ones are cheap mostly because they are easy to keep and breed. The dearer ones are either new discoveries of which little is known of their requirements, or they are difficult to keep and breed.

So make a start with cheap fishes and you are not so likely to be disappointed. Also only buy a few, it will be so much better for the fishes and for your pocket. It is possible to stock your tank (24 ins. by 12 ins. by 12 ins.) with fishes none of which cost more than half a crown. In this group can be found such fishes as:—Guppys, platys, swordtails, zebras, rosy barbs, nigger barbs, blue gouramies, beacons and white clouds. As a suggestion for a beginner's collection I advise the following: four zebra fish, two rosy barbs, two pairs of guppys, one pair of red swordtails, one pair of black platys, two white cloud mountain minnows, a catfish and a male fighter.

This list will be ample for any beginner, and if the pocket does not allow so many fishes, there is no need to worry. Do not buy adult fishes, but get youngsters. These will soon grow under good conditions and at least you will know that you may be able to keep these fishes for some considerable time. Some tropicals are old at three years, and so may not have long to live when you buy them. Also you will find that the fishes will mix much better if they are young ones and can grow up together. There are many more kinds of fishes which you can keep together and later on in this series they will be described.

A very good beginner's fish is the paradise, *Macropodus opercularis*, which is what is termed a labyrinth fish. This type of fish can live in water so polluted and devoid of oxygen that ordinary fish would soon succumb if kept therein. They have the power to break surface and take in a gulp of air, and the frequency of their visits to the top for air depends on the amount of oxygen in the water. These paradise fish are ideal for a start as they are not fussy about food or clarity of the water, and can exist at low temperatures which would kill many other tropicals. All labyrinth fishes are bubble-nest builders, and I have know these fish to breed in a community tank which was not overcrowded.

A beginner may not know what to look for when buying fishes, and so if he knows an experienced aquarist who can accompany him to the dealer's it will be much better for him. When the fishes are brought home see that the temperature of the water in the tank is about the same as that in the carrying can. I expect that it will be a little warmer, and this will not matter very much. It is better to place fish into slightly warmer water than into colder water. The fishes may be placed in jars floating in the tank until the temperature of jar and tank water are about the same. Once the fishes are emptied into the tank do not start feeding them immediately. It is much better to wait until they have settled down before starting to feed. Feeding will be dealt with in the next article, but there are a few pointers which will save some heartburns I might add concerning the different species of fishes.

Of those species mentioned the following are livebearers: guppys, platys and swordtails. The others are egglayers. The livebearing fishes can have youngsters at any time provided that you have both sexes present, and it is possible for the platys and swordtails to cross. Where youngsters are born in the community tank you will find that many will be eaten, but even so plenty more may be reared if there is sufficient cover by water plants to enable the fry to hide from the older fishes. As for the egglayers, it is improbable that many will breed in your tank. As a rule most of the eggs laid will soon be eaten and it is only by taking special precautions that young will be reared in the tank. Many of the methods employed for breeding egglayers will be dealt with but first learn to keep your tank in sparkling condition and the fishes in the pink of good health. In the next article the weekly servicing of the tank will be described together with the all-important topic of feeding.

Marine Life at the "Oceanarium"

(*Continued from the preceding page*)

lishment. Internal maintenance and inspection is also carried out by divers.

The overall picture of Marine Studios has nothing of the carnival aspect. Guides and announcers provide scientifically accurate information, and all are prepared to answer intelligently any questions that may be asked. Built in a graceful and modern architectural style, set in a palm grove at the edge of a sand and rock beach, with a restaurant, with fishing, bathing, boating, etc., close to hand, it is no wonder that traffic on State Road A1A brings over 1,000 visitors each day.

Fighting Fish in a World of Amazons

by Dr. MYRON GORDON

WHAT goes on when adult female fighters live in a world without males? James and Zora Braddock of the University of Nebraska wanted an answer to that question, so they set up several aquarium worlds, populated them with female fighting fish and studied them. They found that when 20 or more female *Betta* were crowded together in an aquarium, they managed to get along without fighting. Many fish fanciers have known this to be true, for they practice this method of housing surplus females, although occasionally an extremely aggressive female has to be removed to keep the peace.

The Braddocks discovered the explanation for the almost total absence of fighting among many adult females when they are living in close proximity. It turns out that it is not because they are incapable of fighting, but because the conditions for a pair to stage a combat are lacking under crowded conditions. When many fish are present and wandering about at random, some of them interrupt the procedural steps that lead up to the fight between two fish that have separated themselves off from the group and that have begun to "size-up" one another.

It takes two to stage a fight. Some animals, including man, may provoke another into fighting, but fighting fish do not behave in this way. In the *Betta* established social hierarchy an aggressive female may threaten and bite another member of a group without fear of retaliation. But if two strange well-matched females are placed in a common aquarium the chances are that they will fight like males.

Whether the females will fight or not depends upon the attitudes of both fish—not just upon the more aggressive member of the group. The top female must be challenged by another before she will be induced to fight, and not necessarily when only two females occupy the same tank. The challenge is associated with changes in colour pattern and in movements. The challenger will replace its ordinary striped pattern with a display of its brightest colours. Its movements are directed towards its target member, with its fins wide spread almost to the point of tremor. The female that is challenged responds similarly. They fight like males, first jockeying for position, then charging, biting and locking jaws. While the fight is on the embattled pair are only mindful of each other, except when one or the other is forced to take time out at the surface for a fresh supply of air.

Like the males, a female will not attack its opponent while it refreshes itself at the surface. The fight usually ends with a definite surrender by one of the pair, and comes at a time when the better of the two is poised in a threatening attitude. The loser retreats while the winner continues her aggressive display for a short period after the actual fighting is over. Once the loser retires, the winner does not pursue and attack its beaten foe again. The champion maintains her dominance merely by visual threats alone. This is sufficient to induce the whipped member to retire from the scene.

What is the significance of fighting among females? The Braddocks say that it is not necessary for the establishment of dominance in the social rank in a community because the social hierarchy among many females living in close quarters is established without fighting. In nature the bright colour that fighting females display may be disadvantageous in that it may attract predators against themselves. And the total visual concentration of a pair of fighting females upon each other may lower their awareness of danger from predaceous birds. Fighting among male *Betta* is understandable in that they defend their nest and thus set desirable territorial limits between nests.

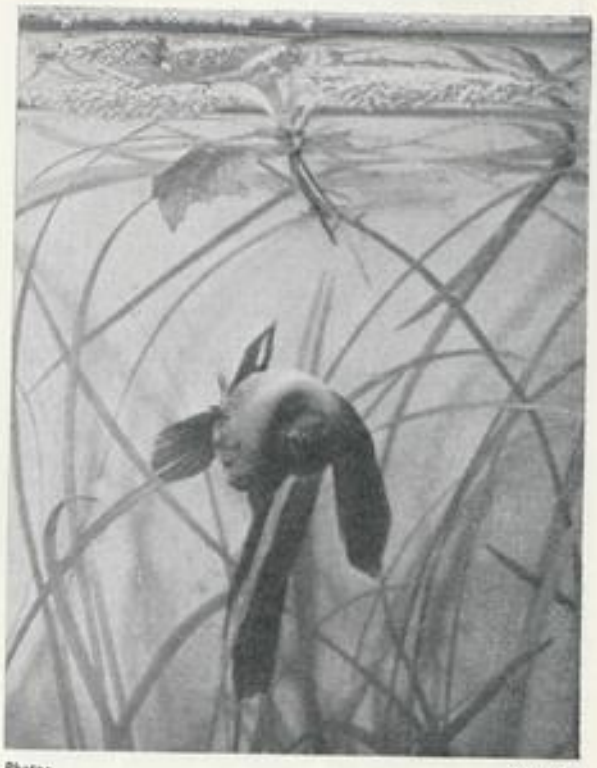


Photo: John Pola

Male and female fighting fish locked in the nuptial embrace beneath the bubble nest

The Braddocks think that perhaps a female in breeding condition remains near a nest to help to protect the developing embryos. Should a strange female approach during and after the eggs are extruded, the breeding female released from the male's embrace is free to drive off other females—the male being occupied with the task of placing the scattering fertilised eggs in the nest. This would ensure that a strange female would not eat some of the eggs. But often the very female that is breeding sometimes eats the eggs she helped to bring into the world. The Braddocks admit that they have no satisfactory answer to this question as yet.

It may be that fighting among female *Betta* is neither inevitable nor universal even under optimum conditions.

Fighting may be restricted to those individual females that have inherited the tendency towards combativeness. This may be expressed through a hormonal imbalance; they would be over-stimulated and may take on some of the attributes of maleness. Some pugnacious females have actually caused males to retire—at least temporarily. The

(Continued at foot of next page)

In the Water Garden in FEBRUARY

by ASTILBES

IT is probable that severe frosts will occur during this month, and so little is likely to be done to the pond. All the water plants will be resting, and no attempt must be made to try to split any for propagation purposes. There is plenty of time for this later on. The main task will be to see that the ice is kept from forming too solidly over all the water and to keep a watch on the colour and odour of the water. At any time when the pond loses its clarity it is essential to change a good deal of the water or the inhabitants may suffer.

After a severe freeze-up make sure that no leaks have been caused, as the water may drain away under the ice and the leak may not be apparent until most of the water has gone. Should this happen the fishes must be caught up and placed in safety whilst temporary repairs are made to the pond. It is possible to repair small cracks with putty, which must be forced into the crack. As this will keep rather pliable it is likely to give as the pond alters slightly with a thaw. There are several types of compost which are very suitable for this purpose, but whilst the pond sides are wet it is necessary to use plenty of force to push whatever is used well into the crack.

Towards the end of the month there are likely to be signs of life in the pond. This is more probable in the south of the country, but few Februarys pass without some signs that spring is not far away. The first to come to the pond are likely to be the frogs. A few may have spent the winter in the mulm at the bottom and others may arrive for breeding purposes. Few ponds of any size are likely to be free from at least some kind of amphibian and one can expect frogs, toads and smooth and great newts. All these breed in the pond and leave it soon after. It is strange how some ponds attract certain species and yet others never visit them. For very many years my own ponds have many frogs which breed in them but I have yet to have my first visit from a toad. Toads appear to favour certain districts. I know a pond in a very crowded residential district of London which has had a few toads breed there every year, but no frogs ever came there until some frog tadpoles were introduced one year; since then some frogs have appeared each year.

Pond Visitors

Frogs can be a blessing but not so the toads. The frog tadpoles make good food for the fishes, but toad tadpoles will be rejected. The frogs lay their eggs in a mass of jelly which floats to the surface shortly before hatching time, but the toads lay their eggs in a double string, like a necklace of beads, and these strings are usually laid among the underwater plants and are less obvious and more difficult to collect. Many pond-keepers are in doubt as to whether they should encourage frogs in their ponds. I certainly like to have them in mine as I consider that the tadpoles are a great change in food for the fishes and those which are not eaten will make splendid scavengers.

There is one point to watch for however, with frogs in the pond, and that is that occasionally a male frog will clasp a fish as it does a female frog when pairing. In many years I have only had this happen once and when the frog was removed the fish was quite all right. It may have killed the fish if I had not noticed it in time. I think that it is possible that only a very sluggish fish is likely to be attacked. The presence of newts can be dangerous where fish breeding is concerned. Newts can eat under water and will attack most living things there. They are rather ravenous feeders, and so can deprive the fish of a fair amount of food during the time they are in the pond. Added to this is the fact that young newts can eat young fish fry, so I do not consider that it is a good plan to introduce newts deliberately to your pond.

If you have a spare hour or two it is a good plan to look through a water-plant list from one of the dealers to get your order for plants ready in good time. They will not be sent out before about April, according to the weather, but it is well to make sure that you book the ones you require in order that they are not all sold. Some of the better types of water lily are not always obtainable later in the season. There is a large list of water lilies to choose from and usually the depth of water required is stated in the catalogue. There is one point which I must make here concerning the planting of water lilies, and that is although the size of flower may be stated it is not necessary that the plant you purchase will produce flowers of such a size. It is a fact that small types will give larger flowers if the plant is given extra good conditions; that is, plenty of space and a good nourishing compost. If medium-sized flowering kinds are used and they are planted in shallow water with poor soil they are not likely to produce flowers anything near the size of better-planted specimens of the same species.

I consider that it is a good plan to make up your mind which colours you prefer in the water lilies and then to tell the dealer what you require together with particulars of the type of pond and depth of water. It is always possible to raise the pots of shallow-growing types when planted in a deep pool, but it is not possible to deal adequately with a type which requires deep water in a shallow pond. Provided that your pond has plenty of room there are many other subjects which can be grown, although I consider that the water lily is supreme among water plants. Some of the more usual kinds for the pond and pond-side are: *Caltha palustris*, the marsh marigold, and *Iris pseudacorus*, the yellow flag, both for the pond-side; *Butomus umbellatus*, the flowering rush and *Pontederia cordata*, the pickerel weed, for a shallow part of the pond. Several of the *Sagittaria* are suitable either for the shallow part of the pond or in a wet situation at the side. Many suitable subjects for the pond-side can be raised from seed and these will be dealt with later on.

Fighting Fish in a World of Amazons

(Continued from the preceding page)

Braddocks suggest that although fighting among females certainly occurs in aquarium-reared *Betta*, their wild counterparts may not fight in their natural habitat. They insist, however, that they have not yet found an aquarium sufficiently large in which the females would not fight. But, of course, they observed the same kind of females—not wild ones.

An unquestionably important point of theirs is that the student of animal behaviour is interested or should be in what the fish is capable of doing. It is a fish's capacity to act in various ways that is of vital importance rather than what it is reported to do or not to do in nature. If we know the range of possible behaviour of the members of a species we may attribute to the species the proper significance in terms of its evolutionary past and possibilities for future development.

In a restricted world populated only by females, or only by males for that matter, strange behaviour appears. Since aberrant sexual behaviour almost inevitably shows up in groups representing one sex, perhaps it would be better to refer to such behaviour as typical rather than strange or aberrant.

Fish Culture in BULGARIA

by V. IVANOV

THAT autumn morning, dense fog crept down the wooded slopes of the Balkan range and covered the river bed. The sun was hardly visible through its milky film until the fog slowly crawled down-stream and the wide expanse of the sky shone bright over the valley. The leaves of the alder trees glistened like gold.

In the pool under the cliff, a few trout were lazily floating across the sandy bottom. Around them swam other fish, pushing them, spreading their fins and tilting them over, then suddenly changing the direction of their swim and stopping as if petrified. They were dancing their nuptial dance.

Then an electric motor rumbled on the shady bank. A technician's hand turned on the switch and a 300 volt current flowed down the wires. Suddenly the dancing fish stiffened. They came up to the surface with wide-spread fins and half-open gill covers. The scarlet spots on their bodies glittered beautifully. The man looked at them fascinated. But he quickly set to work and took the dizzy fish out of the pool, before the dangerous current could kill them. In a few minutes he had placed them in special containers with flowing water. Slowly they woke up, as a lorry whisked them away to the fishing station.

There the pisciculturist, with rubber-gloved hands,

Trout collected from the natural river are conveyed to the fisheries for breeding purposes

Electricity-generating motor in use by the Kostina river for the capture of trout alive after electric "stunning"

smoothly pressed the female fish until the large amber spawn poured into a bowl. Then he took a duck feather and spread the eggs evenly with a milky fluid extracted from the males. Thus fertilised, the first batch of roe was placed in the incubator. It was to stay there over 100 days, until a swarm of swiftly moving little fishes appeared, under the ceaseless care of the pisciculturist. There were no water lice there, and none of the diseases that destroy eggs spawned into the mud of the river.

Carp Sorting

It was quiet in the Dubene fishing station. A cold breeze rustled through the leafless trees and the bare stalks of the water reeds swayed sadly. The withered grass blades were covered with frost. A group of men in fur coats was watching the water flow through the channels from the large fish ponds. They saw to it that the ponds were emptied slowly and evenly. As the water level fell, hundreds of big, golden carp left the dry sedge-covered bottom. There was hardly room for all of them in the channels. The teams stood waiting for the orders of the pisciculturist. The net was cast, and the scaleless carp glistened on the lift. In the autumn they had weighed only 40 grammes, whereas now the average weight was a kilogramme.

What a good reward to the pisciculturist and to all men who had helped him for months! There were 12 tons of large carp before them. They sorted them out and placed them in the temporary storage pools, where there was abundant flowing water. In a few days the unpleasant odour of the fish, acquired in the ponds, was washed away and they were ready to be shipped to the market.

It is only the parent fishes and the small offspring of

superior breeds that are left in the fish pond in winter. The young ones are transferred to the fish ponds of the co-operative farms and to the lakes as soon as spring comes.

Bulgarian Fisheries

At the Fishery Department of the Ministry of Supplies reports were being received from fishing stations throughout the country on their preparatory work of extracting, fertilising and casting the spawn in the incubators. They had also begun catching fish for consumption, sorting out the best breeds for reproduction and preparing them for winter. The southern regions sent more than satisfactory reports; the results were beyond expectations. The fishing station near Plovdiv claimed the record achievement of 450 kg. of fish per acre of water. Pisciculturists of the Union of Hunters and Anglers studied the results together with the experts of the Ministry of Supplies.

Twelve barbel stations (eight State-owned and four sponsored by the Union of Hunters and Anglers) applied for five million fertilised fish eggs from local mountain trout. Another four fishing stations were to provide some four million one-year pedigree carp for new fish ponds. They were also ordered to supply the fish ponds of 600 co-operative farms. The big State dams, the ponds of the Black Sea shore and along the Danube river, as well as the lakes in the Rila mountains were also to be stocked with fish.

Fishing is a profitable aspect of Bulgarian State and co-operative farms and it is growing in importance. Pisciculture plays an important part in supplying the country with fish, ensuring a varied food supply for the population and providing a pleasant pastime for numerous amateur anglers.

This building at the Chaira Fish Hatchery is known as the incubator, where fry are hatched

OUR EXPERTS' ANSWERS TO TROPICAL AQUARIUM QUERIES

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.

I have just bought a 36 ins. by 15 ins. by 15 ins. aquarium. Please will you tell me how many heaters I will need to keep the water warm? I intend to use a thermostat.

If your aquarium is going to be placed in a heated room, a 100 watt heater controlled by a thermostat should prove sufficiently powerful to keep the water at around 72° F. even during the coldest weather. But if, on the other hand, the aquarium is going to be placed in an unheated room facing north or east, then you will need two 60 watt heaters to keep the water warm during the coldest days of winter. When you connect up the heaters, see that they lie in a horizontal position close to the bottom of the water. Such a position makes for a better distribution of heat.

I live very close to the seaside, and wonder whether shrimps, crabs and other shellfish may be used as live food for my tropicals when my usual supply of *Daphnia*, *Tubifex* and the like is cut off by extremely cold weather?

Any raw or cooked shellfish may be used to feed aquarium fishes, but make sure that you cut such sea food into tiny pieces, for some tropical fishes experience great difficulty in swallowing crab-flesh, etc., unless it is rendered into tiny fragments.

I have been given a pair of *Aplocheilus blockii*. The fish are not very old, and I am wondering how large they will grow and whether it will be all right to keep them in a large community aquarium with other medium-sized fishes?

A. blockii attain a maximum size of about two inches. They are rather shy little fish, and like to stay close to the top of the water, especially if there is a good toplight, and a thick growth of floating vegetation. The species is not quarrelsome, but do not expect livebearer fry to remain safe from its jaws. Like the pike, *A. blockii* will remain quiet among the plant life until a tiny fish swims into view, then, quick as a flash, it will dash out of its hiding place and gulp it down in a moment.

My community aquarium contains swordtails, guppys, mollies and flame fish. I have been advised not to introduce tiger barbs into this tank for fear that they will harm the other fishes. I like the look of tiger barbs, and feel very tempted to buy a pair or two. Do you think they are unreliable in a community aquarium?

There is no question that tiger barbs can cause trouble in a community aquarium. With increasing size and age, they often become persistent fin-nippers and bullies. It is not uncommon for slow-moving fishes to have their eyes bitten out or their gills damaged. If you have set your mind on having a pair or two in your tank we do advise you to keep an eye on their behaviour, and if you find one or more of them annoying the other members of the community, the best thing you can do is to transfer the offender or offenders to another aquarium.

I am a newcomer to the tropical fishkeeping hobby, and wonder whether you can help me to solve a mystery. I have a community tank populated by guppys, swordtails, black widows, barbs, neon tetras and a mollie. During the last few weeks, I have found several of my fish lying dead on the bottom, usually with an eye missing or damaged fins. A friend told me that the mollie is the culprit. I have watched this fish but never seen it attack any of its companions. What is your opinion, please?

It is most unlikely that the mollie is the cause of the trouble. As a rule, mollies are very docile fish and spend most of their time nibbling away at mossy growths on the glass sides of the aquarium or the tender shoots of the plants. We have never come across a bullying or dangerous mollie. More likely, it is one of the barbs (one or two species have a tendency to bully: see answer above). Black widow fish in their smaller sizes are delightful aquarium occupants, but when they reach full size, their dispositions take a turn for the worse, and they become a positive menace to smaller species.

A week or two ago I acquired a catfish which the dealer assured me was *Corydoras melanistius*. I am rather puzzled however, because this fish is quite active and swims about quite a lot in open water, and up and down the front panel of glass. I have always understood that catfish are shy, retiring creatures, and do not go on the prowl until after dark. Do you think the dealer made a mistake when he told me the fish is a catfish? I must say it looks like a catfish. It has "whiskers" on the mouth, a dark patch on the dorsal fin and a dark marking running over the eyes from the domed head.

From your description, we would say that your fish is *Corydoras melanistius*. This species is more active than many other catfish, and spends a lot of time in front of the tank and in full light, searching for food. *C. melanistius* is a delightful fish, long-lived, peaceful, and most attractive in appearance.

Please can you tell me the breeding habits of bloodfins?

These fish become very excited when they are about to spawn, and the male will chase the female all over the tank, even jumping out of the water during the frenzied chase. The eggs are not adhesive, and are extruded as the female dashes through the water. Plenty of plant life should be used to fill the corners and middle of the aquarium, and a layer of rounded pebbles on the bottom helps the eggs to remain safe from the parent fish. But after spawning it is best to transfer the fish to another aquarium before they have time to seek out and devour the ova. The eggs take about 30 hours to hatch out; that is, if the water is maintained at about 75° F.

I am puzzled by the behaviour of my pair of fighting fish. The male keeps building a bubble nest, and the female swims under it; the couple embrace, but there are no eggs. Can you tell me what is wrong?

Either the female is not quite ready for egglaying, or the male is not ardent enough in his embrace to "squeeze" out the eggs. But these preliminary embraces often take place between young fish. The best thing you can do is to separate them for a fortnight or so, then place them together again. While they are separated, make sure that they get plenty of raw red meat, chopped earthworms, and live food such as *Tubifex* and other pond or stream life. If the fish can see each other through a sheet of clear glass it often helps to stimulate the reproductive urge.

I had a pair of mollies in my aquarium; a male and a female. The female died, so I bought another one to take her place. The male was very interested in the new fish, but you can imagine my surprise when I noticed that the female had started to develop a pointed anal fin. Within a short while she had completely changed her sex. Please can you explain this amazing change from one sex to the other?

It is not an uncommon occurrence for female livebearers to change their sex. But we have never heard of a male fish changing into a female. A female fish which has changed into male is usually larger than a normal male, and is quite capable of fertilising another female and producing normal young.

I intend to place a specially constructed aquarium on top of the mantelpiece in my lounge. I am now rather worried because a friend has suggested that the water will become too warm for the fish during the winter months when the fire is alight. Please may I have your opinion on this matter?

We do not think you have anything to worry about. So long as your electric heater is controlled by a thermostat we do not think there is any danger of the water becoming overheated. After all, the heat rising up to the mantelpiece would have to be very great to raise the temperature to, say 85° F. and a good thermostat would switch the current off before the temperature got anywhere near that figure; that is, if you set the thermostat to break contact when the temperature of the water reached the mid-seventies.

One of my white cloud mountain minnows has a small raised pimple or spot on its back just in front of the dorsal fin. Please will you tell me what to do about this growth?

We have noticed that these fish often develop tiny growths or tumours on the body, particularly on the throat and mouth. Although they look unsightly, these tumours appear neither to shorten the life of the fish nor to inconvenience them in any way. You can try dabbing the spot with acriflavine or iodine, but take care that these do not run into the mouth or gills, or damage to delicate membranes may result and even immediate death.

FRIENDS & FOES No. 43

Caddis Flies

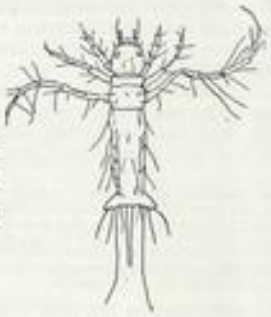
TRICHOPTERA (*Continued*)

THE larvae of Trichoptera differ considerably in their food and habits generally. Many species are herbivorous, some carnivorous, and still others omnivorous. Some construct portable homes, while others spin underwater cobwebs and seldom leave their vicinity.

One of the most remarkable things about *Caddis* is the fact that the home-builders have very marked preference for certain materials for construction, but each species has a different material and a different "typical" design.

To quote just a few examples—the Phryganidae utilise roots, reeds, or leaves, cutting rectangular pieces and cementing them together with a sticky secretion, in the form of a tunnel or slightly tapering cylinder. The Leptocerids use heavy material like grains of sand. The genus *Triaenodes* (a new-hatched larva of which is sketched above) swim freely about in tiny conical tubes of bright-green leaves or reeds. Others utilise stones, mollusc shells—not always empty—and twigs.

Size of the larvae varies from a quarter-of-an-inch (fully grown) to almost an inch-and-a-half. The house-builders have fat, grub-like bodies, which they at all times (unless poked from behind) keep safely indoors. The exposed parts are well chitinised.



Drawing made of a Caddis larva immediately after it had hatched and left the egg-case. Its life size was 1/25th in.

Some fishes such as trout, make no bones about swallowing case and grub complete, crushing the larva and ejecting the unwanted pieces of case.

For large goldfishes, or tropical species, it is sometimes possible to bring home numbers of *Caddis* grubs of certain slow-moving species, which are easily found among marginal vegetation in natural ponds. Do not, however, introduce eggs or larvae of the carnivorous species, which may do a little damage to fry.

C. E. C. Cole

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

I have a pond 6 feet by 3 feet by 8 inches, in which I have six goldfish. If I go away for about four weeks in February, will the fish be all right if left without food?

The fish will be all right for the period you are away without artificial feeding, provided, of course, that the fish have survived the winter. Your pond is far too shallow to be a safe place for the fish during a severe spell. As long as the water keeps cold the goldfish will be very quiet and will require very little food. They can, however, eat even when the pond is frozen over, but it takes a long time for the food to be digested. You say you have been feeding them almost every day; this is quite unnecessary, especially if you have been giving them dried foods.

I have made a garden pond and now wish to know whether to put snails in or not? Some people say yes, others say no, and I would like your opinion.

My opinion is that snails are unnecessary in the pond. You can have them, of course, if you wish, but let us see what good they do and what harm they can do, and try to work out a balance one way or the other. Snails will breed in the pond and so give a little food for the fishes when the snails are tiny. They are not of great value as a food as by the time they get any size the shells have become so hard that ordinary fishes cannot cope with them. They can eat some of the decaying vegetation and so act as scavengers; however, they can also eat many useful water plants and so this advantage is cancelled out. They can help to pollute the water with their droppings and should some die the water soon smells very badly and so they can do more harm than good. If you are considering breeding from the fishes in the pond it is possible that the snails will eat many of the fish eggs, although once the fry have hatched out no further trouble is likely from the snails. So there you have it, and you can take your choice.

Could I cultivate Infusoria in a cool cellar in screw-top jars to keep the smell from causing annoyance?

You are not likely to breed many Infusoria in a cool cellar. The dark will suit but the Infusoria breed very slowly in cool conditions. They thrive best in a temperature of about 70° F. You could keep the tops on the jars, but do not screw them tightly to exclude air. As for the smell, if sufficient decaying vegetable matter is placed in the water it is almost sure to smell, but if some water is removed each day and replaced with fresh it will not be bad. The finest live food which can be bred quite easily in your cellar are white worms. If these are kept in boxes of peat, and fed on brown bread only, they will thrive greatly and give no offensive smell.

I am moving into a new house which has a water-softener supply, do you advise using this supply for water for fish tanks or would I be better using the ordinary supply?

My advice is to use the ordinary supply of water and not that which has gone through the softener.

Am I overcrowding my tank with fish? It measures 16 ins. by 9 ins. by 9 ins., and I have in it one three-inch goldfish, one two-and-a-half inches, one two-inches and one about an inch long.

You are overcrowding the tank and one or more of the fishes will soon be in trouble. The tank will only hold six inches of fish at the most, and no more than five would be a safer allowance. I advise a tank 24 ins. by 12 ins. by 12 ins. for your fish, when they will not only be healthier and less trouble but will have a chance to grow.

Last year I completed a garden pond and stocked it with plants and fishes. When the fishes were first installed they were always ready to take food which was given them. During the last month or so they appear to have gone off their food. Is this anything to worry over?

It is quite natural for the goldfish to lose their appetites during the winter. Most fishes do the same once it gets very cold. It is a fact, however, that the weather does not keep so cold all the time, and during a warmer spell it is possible for you to give the fishes some food. I have seen it advised that no matter what the weather is like never to feed goldfish of any types during the winter. I do not agree with this. The fishes should know best what is good for them. They will not overeat and as long as they take food readily I do not see what harm it can do them. On the 27th December, 1955, the temperature was 58° F. and my fantails were quite active at and near the surface of the water in the open pond. I offered them some garden worms and they were accepted quite quickly. I never feed with dried foods once the end of October arrives, but I do not cease all feeding. I go by the weather, and as long as the fish are fairly active I am sure that they benefit from a little food if it is live food. I even had my green tench out of the weeds eating worms at the end of December during the mild spell. I am certain that if goldfish get some nourishment during these times during the winter they are more likely to come through in good condition than if they had been deprived of all foods during that time.

I often see the following recommended for feeding fishes: what is the difference between them, what types are the best for feeding and which are the easiest to breed: micro worms, Grindal worms, white worms and *Tubifex*?

Micro worms are tiny worms bred in a solution of oatmeal; they are suitable for very young fishes, either tropical or coldwater. Grindal worms are similar to the former but are rather larger and so form the next-sized food to micro. White worms are much larger and suitable for all fishes over half-an-inch in length overall. *Tubifex* worms are suitable for the same-sized fishes. White worms are the most easily bred of all live foods in my opinion, and *Tubifex* the hardest to keep of those mentioned. Do not try to breed *Tubifex*; they may be bought at pet stores or collected from the mud at the water's edge.

I have a galvanised tank in my greenhouse and would like to know if I can use it for keeping goldfish. It is 25 ins. by 20 ins. by 7 ins., and can be shaded from strong sunlight.

The tank can be used for keeping goldfish and would be especially useful to use as a hatching tank or for rearing fry. If the tank has been in use for storing water for some time it may be quite safe for fishes, but if fairly new the galvanising can be dangerous to some, especially if soft water is used. I have had some such tanks in use for fishes for many years, but these were floated over with a cement wash before being used. You will have to shade quite a lot as otherwise the water will soon turn very green through the growth of algae in the water.

Are ants' eggs suitable for fish food? I have read the book *Coldwater Fishkeeping* and they are not mentioned in it.

The ants' eggs of commerce are not eggs at all but are the dried pupae of the ant. As such they have little food value, the tough skin is usually spat out by most goldfish. This skin can cause pollution in the water and so the use of this food is not recommended. On the other hand if you can obtain some fresh pupae from ants' nests, you will find them a good food for your fishes.

Is it beneficial to use spring water or pond water for filling fish tanks?

It all depends on the purity of the water. As a rule spring water is fairly pure but it can be impregnated with certain minerals to such an extent as to be dangerous to

fishes. Pond water can also vary considerably. I use tap water only and find no trouble from it. For filling a tank use water which has run through a heating system if possible as by this time much of the chlorine will have been eliminated.

I have a large emergency tank, 40 feet by 5 feet by 7 feet. Last year I put in some goldfish. They have bred and now I would like to catch them all and transfer them to another tank. This is easier said than done, and I have heard that they can be given a mild electric shock which stuns them. They then float to the top and can be caught. Can you advise me as to the easiest method of doing this?

In the first place I am not an electrician and cannot give the correct method for doing what you suggest. Secondly, I should hesitate to recommend this method to you even if I knew how to do it. I cannot but think that many of the fishes would be harmed by this method. I suspect that many would be killed even if you could find a means to do this. It would not be easy to know just how much to give to be harmless to the small fishes as well as to the bigger ones. My advice is that you empty the tank and catch the fish with nets when the water is low enough. The whole tank could also be netted. Some dealers have nets with which they net ponds for coarse fish, and it would be a far simpler task to net a tank of a uniform shape and depth than to net the average natural pond; why not contact a dealer who might be able to help?

I have noticed during the past twelve months that our goldfish have developed a small white patch about as large as a postage stamp on their backs. The golden orfe have larger patches. Is this fungus and what can be done about it?

This trouble does not sound quite like fungus. I have found that fungus usually appears about April, and if it has not done so by the end of May it does not appear. Also, if a fish gets an attack it will either clear up fairly soon or develop so rapidly that the fish dies. It is always difficult to say definitely what is the trouble without being able to see the fish. Catch one or two of the affected ones and examine them closely. It may be that they have been attacked by fish lice. These can make a small wound which would develop fungus, and this sore spot would be the only place likely to be affected. The fungus usually attacks a place where the mucous covering has been destroyed. It is strange that it is only on the backs of the fishes that the white is seen. This may indicate that the fishes have been attacked by a bird, such as a kingfisher or a heron, although if a heron was responsible it is certain that it would eat many of the fish and not just damage them. If nothing can be seen when a fish is examined it may do no harm to add a little salt to the water, about a teaspoonful to each gallon. If lice are seen on the fish they can be removed by placing the fish in a solution of Dettol (a teaspoonful to a gallon of water); leave the fish in for 15 minutes, or remove sooner if the fish turns over.

I have made a series of ponds in my garden connected to each other by waterfalls. I am thinking of painting all the concrete with a bitumastic compound. Will this harm the plants or fish?

There are several makes of bitumastic compounds on the market and I think that they would all be safe to use with plants and fishes. There is sometimes a slight film left on the top of the water after use but if this is flooded off and the water left for a few days before being changed all should be well. Many drinking-water tanks are painted inside with bitumastic paint and are safe. Where you may find trouble is if you paint the surface before it is quite dry. The compound is water-proof and so it will not adhere to anything damp. Once it dries on a good dry surface it will usually remain for a long time in good condition. If, on the other hand, it is applied to a damp surface it will in time peel off and so lose its value. It should not be necessary to paint over the concrete at all to make it water-proof. I have made tanks one-half and one-inch thick, and even thinner ones than this, with one part of ordinary cement and three parts of clean sand, and they hold water for months without the outside becoming even damp. If this is possible surely you can make a pond waterproof without the use of any subsequent painting.

I notice that you were a judge at the recent British Aquarist's Festival at Manchester. In this capacity I hope you can help me to obtain some good quality comet goldfish. For two years a friend and I have been trying to obtain a good strain, without success. Where can I get some?

My journey to Manchester to judge the coldwater section did not place me in a position to help you to obtain some good comets! I found on arrival that I had only two pairs of coldwater fishes to judge: a pair of undeveloped orandas and a pair of sun-fish (*Mesogonistius chaetodon*). Apparently very few aquarists go in for coldwater fishes in that area. I do occasionally see a fair comet at a show but they are very scarce. A few years ago I asked all those aquarists interested in comets to write to me, and I have sent you a list of those people who did so. Most comets appear to take so long to change from their original bronze to the required red or lemon colour that few aquarists are trying to establish a strain to-day.

GROWTH IN AQUARIUM

I am sending you a brown, fern-shaped growth which for several years has fouled the leaves of my tropical aquarium plants and which, more rarely, occurs on the aquarium glass. Can you please identify this?

The organism is a Bryozoan moss-animalcule; the species is probably *Plumatella polymorpha*. Although when growing along the edges or over the surface of submerged leaves they tend to make the latter unsightly, I have no evidence that they damage

Plumatella enlarged. Statoblasts are shown greatly magnified from above (left) and from the side (right)

them. Their food consists of microscopic particles brought to them by the currents they create by rapid movement of minute cilia surrounding the many tentacles round the mouth. At the slightest touch the body of each Bryozoan is withdrawn into its protective gelatinous tube, so that normally it is unseen by the casual observer. When expanded it is one of the more beautiful of small aquatic organisms. The tiny elliptical "pips" within the tubes are statoblasts—the equivalent of ephippia in *Daphnia*. Released from the colony, they float upwards and float upon the surface of the water, from which they may be distributed to other localities. Light seems essential for their development.

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

Aquaria and Decor

IT was indeed gratifying to hear from so many readers on the methods they have used to present their aquaria, following my article on "Aquaria and Decor." The letters I received were too numerous to answer individually so I take this opportunity of thanking all of you who wrote to me personally. It was nice to hear from you.

In answer to letters published in *The Aquarist*—to Mr. H. V. Vosper, who apparently revels in sloshing about with a scraper, siphon and pail—come, now, Mr. Vosper, do you really think our womenfolk would stand for all this sloshing about? Have you not heard of air rejectors? And to Mr. Laurence Sandfield I would say, if we are going to split hairs, aquaria as a whole, are as you term it, a frippery. Personally, I love to see the many varied presentations of aquaria surrounds; do you not think it would be a little boring if the general trend was much of a muchness? Anyway, thanks for the comments—it all adds to the spice of life, doesn't it?

PHILIP DEE, London, S.W.4.

WITH reference to your recent interesting correspondence on aquaria and decor your readers may be interested in a simple way of disguising an angle-iron frame. This is to use curtains on a spring curtain wire, hung around the spaces between the tanks. The curtains around my unit of three tanks are of green velvet.

C. N. FORD, Exeter, Devon.

F.B.A.S. Standards

MAY I make it known through your columns that there are no supplies of the handbook *Show Standards for Cultivated Fishes* now available? This work is completely out of print and will not be re-issued. Its place is being taken by loose-leaf sets of *Guides and Standards*. Present issues include a set of Barb Guides, a set of Characin Guides with list of plants, and a set of Goldfish Standards.

R. O. B .LIST, *Secretary*,
Federation of British Aquatic Societies.

Light and Algae

YOUR April issue of last year contained a letter from Mr. G. H. Daniel on light and algae. I am also interested in this problem since, until recently, I have always been plagued by blue-green algae. I think that your correspondent may be correct in his theory that 16 hours light each day for three or four days will clear a tank of algae provided that it contains few or no fishes.

He points out that in poor light plants give off more carbon dioxide than they consume and that this carbon dioxide encourages algae. He also points out that increase of light will prevent production of carbon dioxide by the plants, but it will increase the production of the gas by the fishes since they will be active longer. Thus the final result will be an increase of carbon dioxide in a tank containing an average number of fishes. I recently left a bag of scalded peat in each of my aquaria for about 36 hours. The blue-green algae have disappeared.

D. NOBLE, London, S.W.19.

Goldfish Breeding

JUST over a year ago I made a report on coldwater fish breeding with shubunkins, and I had reared one odd veiltail fish out of a brood of about 330. Last year I have reared 400 fish, out of which there has appeared another veiltail. I also have a shubunkin with two tails which are perfectly formed and not joined together in any part; it also has two anal fins. Is this unusual?

Last year I had no swim-bladder trouble. I have used no bought foods and the fish are larger than the previous year. Foods I have used are sifted *Daphnia*, chopped white worms, grated garden worms and crushed oatmeal. A point of interest for readers: white worms thrive better on tinned cat food than any other food I know. The worms eat it all and no mildew remains and hence no foul soil. I have a 100 gallons tub which keeps me supplied with *Daphnia* for the young fishes; it is filled with water to a depth of three feet six inches and I added to this a bucket of horse manure.

I will give any genuine aquarist who lives near me a pair of young shubunkins to start him off in the hobby.

F. D. J. HOCKEY,
26, Kirk Dale Avenue,
Spondon, Nr. Derby.

An Appeal

I WOULD like to appeal to you and your readers on behalf of the patients of four wards at Robroyston Hospital, Glasgow, where the Northern Aquarium Society has set up and maintained tropical and coldwater aquaria. On a recent visit to the tanks I found that a number of patients were very keen on the hobby and asked if I could get them books, magazines or pamphlets (no matter how old) on keeping fishes. The hospital is for tuberculosis patients, some of whom spend two years in a ward. I will be pleased to forward any books, etc., that readers can spare, and I know that all the thanks necessary is the

AQUARIST & PONDKEEPER

In common with other periodicals, production of the *Aquarist and Pondkeeper* this month has been seriously interrupted by the imposition of "work to rule" and overtime limitations by the London Typographical Society. We therefore ask readers to accept our apologies for the omission of certain items and for any inconvenience caused by late delivery of the Magazine.

knowledge of the appreciation and pleasure that will be derived from them by the patients.

G. H. MEEK, *Treasurer*,
Northern Aquarium Society,
c/o 50, Petershill Road,
Springburn, Glasgow, N.1.

Brine Shrimp Culture

SOMEWHERE I heard that "somebody" had experimented with brine shrimps to try and grow them to full size for feeding to adult fishes and that they had some measure of success by feeding the shrimps on yeast. I have tried this, adding a pea-sized piece of baker's yeast and a half-teaspoonful of carbonate of soda to one pint of fresh sea water, and after exactly two weeks I was feeding my fishes with fresh brine shrimps up to three-eighths of an inch long. Now I have a culture of the shrimps going all the time and I find that after about a week they start to breed, so that shrimps of all sizes are available. I use fresh sea water and add the yeast when the shrimps are a day old, and again one week afterwards.

N. ASQUITH, Morecambe, Lancs.

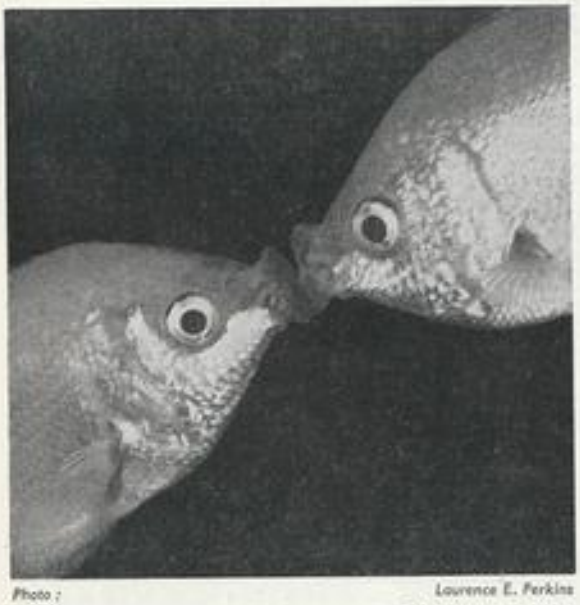
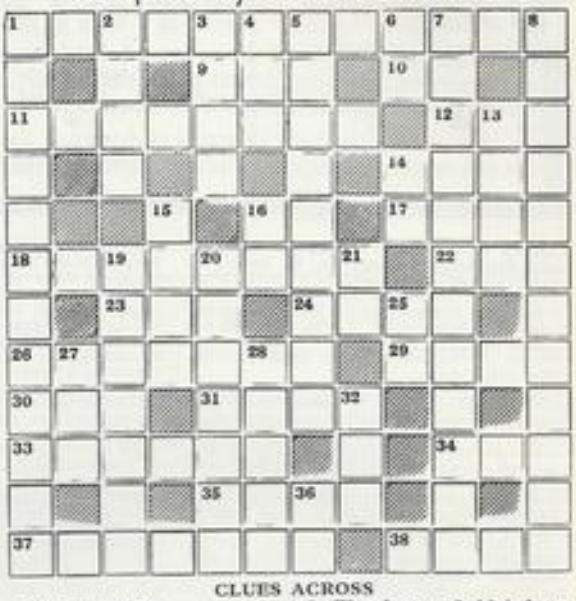


Photo : *Laurence E. Perkins*

Our cover picture this month shows a pair of kissing gouramies (Helostoma temmincki) indulging in the behaviour which earns them their common name. This species is capable of growing to at least 10 ins. in length under natural conditions. In the aquarium kissing gouramies mature at a smaller size and will breed in the typical gourami fashion after building a surface nest of bubbles

The AQUARIST Crossword

Compiled by J. LAUGHLAND



CLUES ACROSS

1 Gill worm (12)
9 Gone, but remains when I'm gone from imago (3)
10 No more than an exclamative sound (2)
11 Mulm to aquarists (8)
12 Prefix encountered by aquarists. Means "on" (3)
14 With necessary gen he would pertain to his racial group (4)
16 The answer be a gift (2)
17 Brief period of time or fish louse, perhaps (4)
18 Tropical fish or bloody arrowhead? (4, 4)
22 In short, water measure; perhaps young woman (3)
23 Before *leeri* lost head and tail (3)
24 Therefore you find it in better goldfish (4)
26 Popular fish, especially on toast (7)
29 Could be root of water plant or tank light (4)
30 Many a one is given at Xmas, but *The Aquarist* is always full of them (3)
31 Cleopatra's river (4)
33 "Returning" medicine from returning item in Eastern Counties (6)
34 Characins lose chains in part of their circle (3)
35 Alosa (4)
37 Leach and little saint all mixed up in the angler's bag (7)
38 Caudal, anal, ventral, pectoral, etc. (4)

CLUES DOWN

1 Stickleback (12)
2 *Scardinius erythrophthalmus* (4)
3 Moist (4)
4 Era (3)
5 Adult leprocephali (6, 3)
6 This means you! (2)
7 Another name for pearl or mosaic gourami (5, 7)
8 Gasterosteidae, fiercest of our fishes, perhaps (12)
13 Type, but of type, not of fish (4)
14 And (abbrev.) (2)
15 Stained, coloured (4)
16 Degree of 18 across (1, 1)
19 Snake or musical instrument (7)
20 Like salt water (7)
21 British in a way (abbrev.) (2)
25 Britain in a way (abbrev.) (1, 1)
27 Target (3)
28 Cranny perhaps in a broken chine (5)
32 Tail, perhaps (3)
36 We end with Mr. Capone; that is nearly all (2)

PICK YOUR ANSWER

1. "Every . . . . must hang by his own gill." The missing word is: (a) carp; (b) herring; (c) mackerel; (d) roach.
2. *Chiropsops goodei* is popularly known as: (a) blue chin; (b) blue chromide; (c) blue fin; (d) blue perch.
3. *Barbus duoscheri* is native to: (a) Ceylon; (b) East Africa; (c) India; (d) Malay Peninsula.
4. *Luciocephalus pulcher* (the pretty pike head) reaches a length of about: (a) 4 ins.; (b) 6 ins.; (c) 8 ins.; (d) 10 ins.
5. The flowers of *Utricularia vulgaris* (common bladderwort) are: (a) blue; (b) red; (c) white; (d) yellow.
6. The optimum temperature for *Cryptocoryne* species is: (a) 74°; (b) 77°; (c) 80°; (d) 83°.

G.F.H.

(Solutions overpage)

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.

AT the annual dinner of **Burnley Aquarist and Zoological Society** Mr. H. Loder, the society's chairman, referred in a speech to the successes of the society last year in inter-club competitive shows and at the British Aquarists' Festival at Manchester. A vote of thanks was passed to show secretary Mr. J. Hodgetts and to Mr. F. Taylor who had assisted at the Manchester event.

* * *

CHAIRMAN of the **Coventry Pool and Aquarium Society** for the past four years, Mr. C. A. Essam retired from office at the annual general meeting of the society last month, and was elected vice-president. Secretary's and treasurer's reports showed that the society had maintained progress during 1955, with 22 new members being enrolled and a sound financial balance existing.

* * *

RECENT meetings of the **Guildford and District Aquarist Club** have included talks on the economical running of aquaria and fish-houses and on water and fish breeding, by Mr. J. E. Edwards. The lecturer said that he had experimented with low-voltage lighting for aquaria, and that he now used 12 volt car lamp bulbs (yellow coloured) operated from a mains transformer. This yellow lighting was said to be effective in preventing blue-green algae. On the topic of water softening, Mr. Edwards recommended a low-priced water softener that can be fixed to the household tap and which is sold by photographic suppliers. The device will lower hardness by about six degrees and one charge will treat up to 1,000 gallons of water before renewal is needed. Mr. Edwards said that he had bred and reared several fishes (such as the spotted danio) in this softened water whereas previous breeding attempts had not been successful.

* * *

NEW address of the **Tottenham and District Aquatic Society** is Warmington House, High Road, Tottenham, London, N.17. This headquarters is close to the main entrance to the football ground.

A Challenge!

Croydon Aquarists' Society this year celebrates its Silver Jubilee. Is there any other aquarists' society in Great Britain which also can claim 25 years (or more) of continuous independent existence? In his report at the 24th annual general meeting the chairman, Mr. Boyes, stated: ". . . The society was originally a section of the Croydon Natural History and Scientific Society formed in 1870, that is, 85 years ago. In 1931 it broke away from the parent body, came into being as the Croydon Aquarists' Society and met at Eldon House from then until 1947. Even during the war there were meetings by a few enthusiasts to maintain continuity. By 1948, owing to greatly increased membership, meetings were transferred to Thornton Heath Library. Then steeply increased rental coupled with the decline in post-war membership which affected most similar clubs forced a move to Pembroke Hall, followed by a short period at the Civil Defence Headquarters. Now, however, we are back where we were originally formed in Eldon House, Lansdowne Road, to start our Jubilee Year, which is surely a very happy omen. At the close of last year we were in rather a sorry state after the retirement of our much-loved president, Mrs. M. Wood-Roberts, but after revising the rules and procedure to meet present conditions, our membership has made most satisfactory progress during the past year . . ." Mr. Boyes thanked the officers, committee and all members for their enthusiastic support, and concluded by expressing his assurance that with a continuance of the present good fellowship, the society can hope to see many more years of happy and interesting existence, maybe even its Golden Jubilee.

To commence the Jubilee Year celebrations, an ambitious and highly successful social was held, when nearly 100 members, friends and visitors had a splendid evening. Letters of congratulation had been received from the first honorary secretary, now retired to Hove, other original founder members, aquarium journals, F.B.A.S., A.S.L.A.S., G.S.G.B. and other societies. Forthcoming meetings at Croydon will include a film show, a talk on aquarium equipment and its maintenance, and a visit (19th March) to the local Water Authority for a special film and lecture on the Borough water supplies with particular reference to aquarists' interests. Visitors are invited. Honorary secretary Mr. H. T. Farrance, 12, Burgoyne Road, South Norwood, London, S.E.25, will be glad to hear from any other aquarist societies claiming longer existence than Croydon Aquarists' Society, and suggests that if there are any, perhaps an interchange of visits may be arranged.

Olympia Exhibition

THE Cage Birds and Aquaria exhibition was held on 12th-14th January, and the Aquaria Section comprised mainly furnished aquaria classes. There was only one class for individual fishes, and that was for coldwater fishes, both foreign and British. It was a pity that separate classes were not made for these, as it is hard for British fishes to compete with foreign ones since the latter are usually more highly coloured. There was a good entry of furnished aquaria in the Club Tropical class, but the standard did not appear to be as high as on some previous occasions. The first two in the Club Coldwater class were very good; the second appeared more pleasing to the eye but lost points on the quality of the plants. The individual set-up tanks were of a good standard especially in the ladies' class. The winning tank in this class had a beautiful base, well set out with grey and white large pebble-like stones with compost composed of very small grey and pink flat oval stones. There was not the slightest suggestion of any sharp edges or roughness which could have harmed a fish. The second prizewinner in this class was also very good at the base, but perhaps the attempt at building strata was not a happy one considering the type of stones used. The bases of these two tanks were object lessons to many of the club members who still fail to make any attempt to match the compost with the rocks. One coldwater furnished tank contained a large runt, which was suitably penalised by the judges. A large fish like a herring is quite unsuitable for a 24 ins.-long tank. The whole picture is spoiled and in any case points must be lost for permanency apart from choice and quality of the fish. The Goldfish Society of Great Britain displayed an artificial pond which looked rather hard, but the display of common goldfish, shubunkins, moors and veiltails was very attractive and was shown in fine roomy tanks.

A. BOARDER.

RESULTS

Class A1.—*Inter-Club Tropical Furnished Aquaria:* 1, Portsmouth A.S.; 2, Stoke Newington A.S.; 3 and 4, Hendon A.S.; 5, West Middlesex A.S.; 6, Stoke Newington A.S.; 7, Feltham A.S.

Class A2.—*Inter-Club Coldwater Furnished Aquaria:* 1, Stoke Newington A.S. (*Water Life* trophy awarded for best inter-club furnished aquarium); 2, Hendon A.S.; 3, Willesden A.C.; 4, West Middlesex A.S.; 5, Hendon A.S.; 6, North London A.S.; 7, Portsmouth A.S.

Class A3.—*Individual Tropical Furnished Aquaria:* 1, Mr. P. O'Connell; 2, Mrs. B. Robertshaw; 3, Mr. T. Atkinson; 4, Mr. H. Groves; 5, Mr. G. Richardson; 6, Mr. F. H. Watts; 7, Mr. E. Quick.

Class A4.—*Individual Coldwater Furnished Aquaria:* 1, Mr. R. C. Harvey; 2, Mr. V. Sones; 3, Mrs. K. Dietsch.

Class A5.—*Ladies' Tropical or Coldwater Furnished Aquaria:* 1, Mrs. G. Skipper; 2, Mrs. M. Bell; 3 and 4, Mrs. F. A. Barry; 5, Mrs. D. L. Walker-Bagg.

Class A6.—*Inter-Schools Tropical or Coldwater Furnished Aquaria:* 1 and 2, New Bradwell County Junior School; 3, Mentem Junior Mixed School; 4, Bromyard Secondary School; 5, Emanuel School; 6, Bromyard Secondary School; 7, George Gascoigne School.

Class A7.—*British or Foreign Coldwater Fishes, excluding Goldfish:* 1, Mr. D. E. Goodbody; 2, Mr. T. Sherwood; 3, Mr. F. W. Keen; 4, Mr. D. E. Goodbody; 5, Mr. T. Sherwood; 6, Mr. D. E. Goodbody; 7, Mr. R. Mayersbeth.

Secretary Changes

CHANGES of secretaries and addresses have been reported from the following societies:

Bethnal Green Aquatic Society (Mr. A. J. Linford, 4, Monkbretton House, Turin Street, Bethnal Green, London, E.2); **Bridlington and District Aquarist Society** (Mrs. J. Catley, 35, Cardigan Road, Bridlington, E. Yorks.); **Bristol Aquarists' Society** (Mrs. N. O. Grimston, 10, Queens Road, Knowle, Bristol, 4); **Burton-upon-Trent and District Aquarists' Society** (Mr. D. W. G. Pretwell, 17a, Rangemore Street, Burton-upon-Trent, Staffs.); **Dewsbury and District Aquarist Society** (Dr. G. Cust, College House, 1, College Street, Birstall, nr. Leeds); **Dukeries Aquarist Society** (Mr. A. M. Deakin, 14, Canal Road, Worksop, Notts.); **Southall Aquarist Society** (Mrs. Evans, 19, Tenning Road, Southall, Middlesex).

Crossword Solution

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

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

The AQUARIST AND PONDKEEPER

Founded in 1924 as "The Amateur Aquarist"

THE BUTTS, HALF ACRE, BRENTFORD, MIDDLESEX

VOL. XX No. 12 1956

TOKEN ISSUE

Normal publication of the March issue was prevented by the trade dispute in London printing houses. These pages form a token issue to conclude Volume XX, and are issued as a supplement to the April issue of *The Aquarist and Pondkeeper*.

White-Spot Disease

A review of methods of treatment, continuing the article in the February issue

by Dr. F. N. GHADIALLY

TREATMENT of white-spot disease can be considered under two headings: (*a*) preventive; (*b*) curative.

(a) Preventive

As any wet object can introduce white-spot infestation into a tank all such objects need some form of pre-treatment before introduction into a healthy tank known to be free from the disease.

Quarantining fishes. The common form of pre-treatment employed for fishes is quarantine. By this we mean the complete segregation of an individual suspected of carrying a disease from the healthy population to which it is to be introduced for a duration longer than the known incubation period of the disease, so as to find out definitely whether the individual is free from the disease or not. Successful quarantine of new fishes sounds easy, too easy, but as a matter of fact it is a prolonged procedure requiring a thorough knowledge of the subject, and also, a spare tank if possible. Unfortunately, the beginner usually lacks both, and hence not infrequently loses his fishes. The closer you can approach the ideal the less likelihood of your fishes getting white spot. Here are some of the ideals of quarantine.

(1). Any and every fish obtained from outside, either from a dealer or from your closest friend, is suspect and must be quarantined. There must be *no exception whatsoever* to this rule. For though nobody wants knowingly to pass the disease on, it may happen that an odd spot or two may have passed undetected in your friends' or dealers' tank, or that his fishes are incubating the disease without his, of course, knowing this. If you now ignore this advice and get into trouble, blame yourself and not your friends.

(2). However fit a specimen may appear it may still be incubating white spot. Do not be led astray by this, quarantine it.

(3). Keep a small spare tank fitted with a heater, thermostat and thermometer, ready all the time to quarantine any new arrivals. Such a tank should have just a very thin layer of gravel at the bottom and preferably should not be planted so as to facilitate treatment if it proves necessary. Maintain the temperature at 80° F.

(4). Place the quarantine tank as far away as possible from the main tank or tanks housing your collection, preferably in another room. In a fish house the tank is best placed on the lowest shelf of the staging, so that any accidental drippings from the tank fall to the ground and not on to another tank, Infusoria culture or any other gadget or paraphernalia in the fish house.

(5). It is best to have a different set of aquarium accessories such as algae scrapers, siphon, net, feeding ring, etc., for this tank. These should not be carried to and fro from the quarantine tank to the main aquarium, for though such articles can be rendered safe by thorough drying one day you may slip up and contaminate the main tank.

(6). Follow a strict feeding and inspection routine. Feed fish in the healthy tanks first, quarantine tank last. After you have touched your quarantine tank resist all temptation to start playing with the main tank or tanks. Algae scraping, siphoning, plant trimming, transferring fishes from one tank to another, all these sort of things should be done before and never, never after attending to the needs of the quarantine tank. If you have forgotten one of these operations it can surely keep for another day.

(7). Inspect the new arrival daily with a strong light, and if it shows signs of white spot treat it at once.

(8). If after eight days at 80° F. the fish does not show signs of white spot it may be transferred to the main tank. The eight-day period mentioned is a somewhat arbitrarily chosen period which has proved reasonably safe in the experience of many aquarists. As already mentioned the usual incubation period of the disease is approximately three to four days, hence on theoretical grounds a quarantine period of approximately similar magnitude should prove adequate. Though this would work in many cases one finds that every now and again even when the temperature is maintained at 80° F. a quarantine period of even six to seven days proves inadequate, and on very, very rare occasions an even longer period may prove inadequate. Hence, to be on the reasonably safe side an arbitrary quarantine period of approximately eight days, i.e., twice the average incubation period, has gained popular acceptance.

Only once in approximately seven years of fish-keeping now have I found a case where even a 15-days' quarantine period proved inadequate. It might be of interest to relate this case in some detail. On visiting my local dealer I saw him just unloading a consignment of fishes that had arrived that day. I noticed a dozen *Barbus filamentosus* swimming about with some other fishes in one of his tanks and I decided to buy six of these fish. I took them home and placed them in my quarantine tank, which had been cleaned out about a week ago and filled with tap water. Temperature was maintained at 80° F.

Next day I called on the dealer again to acquire some diffuser stones which I had forgotten to purchase the previous day. He then informed me that four of the six

B. filamentosus left in his possession were showing a fair number of white spots. I inspected the fish myself and confirmed the diagnosis. None of the other fishes in the tank was showing signs of the disease. I went home and inspected my fish thoroughly; they showed no sign of the disease but I was confident that in a day or two they would be down with white spot. However, when I could see no sign of the disease even a week after purchasing the fish I once more went to see the dealer to find out how his fish were getting on. I found that the disease had been brought under control and the four *B. filamentosus* were now free from white spot.

I pondered on the problem and decided not to be in a hurry to release my *B. filamentosus* from quarantine, but to chill them in order to bring the attack on, if possible. So I poured cold water into the tank and cut the current off for approximately four hours. The temperature was down to approximately 60° F. during that time, but still no white spots appeared. I repeated the performance two days later, and when after all this at the end of a fortnight no white spot could be seen even when each fish was individually examined under a magnifying glass in separate, small flat-sided jars, I decided that I could not keep these fish in quarantine for ever and released them in one of my large conditioning tanks.

The next day five of the six *B. filamentosus* were showing unmistakable evidence of white spot. Needless to say, none of the other fishes in the tank was showing any sign of the disease. All the fishes in the tank were treated with methylene blue, and a cure was ultimately effected. Can we then explain this phenomenon? One can rule out the possibility of free-swimming stages of the parasites lasting for such a long period in the water. As both the dealer's fish and mine suffered ultimately it is very likely that they were all infested at the same place at approximately the same time.

The most likely explanation then would be that the fish were already infested, that the parasites were already in the skin of the fish but for some unknown reason the actual appearance of the disease was delayed; i.e., there was a prolongation of the incubation period. If we try to explain the phenomenon by the delayed hatching of a cyst in my tank then we would have to presume that the dealer's fish were infested from another brood of parasites from another cyst, and not only that but even though all 12 had been together at the time all mine had escaped entirely from the attack, while only some of the ones kept back by the dealer were infested. This seems very unlikely indeed; at least on statistical grounds.

Whatever may be the technical explanation of the phenomenon one thing is certain: that once in a blue moon you will find that even a fortnight's quarantining of a new arrival may prove inadequate. In spite of this experience I quarantine new arrivals for eight days only, as after this time the risk involved is very small indeed.

Could the incubation period be prolonged for months or indefinitely and thus explain the mysterious outbreaks of disease reported by some in isolated tanks where no fishes or other suspicious objects have been recently introduced? There is no way of answering this question, we just do not know. At least, I have never had an outbreak of disease in my tanks where one would have to evoke such a hypothesis to explain it. Though there may be some genuine cases, in most instances such reports fall down hopelessly on closer scrutiny.

Let us now consider how the man with one tank can quarantine new arrivals. Let us say straight away that floating open jars containing new arrivals in a well-furnished aquarium is only very slightly better than putting them into the tank straight away. It would need great skill and luck repeatedly to produce satisfactory results under such unfavourable conditions, for water can so easily be splashed from the jar, either by the aquarist or the new fishes, into the main tank. If you are forced by lack of suitable facilities to use a jar for quarantining a new arrival, use one with a tightly fitting lid in the following manner.

Half fill the jar with water. Place the fish in the container and screw the lid tightly on, wipe the outside with a towel and let it stand in a dry warm place till the outside is thoroughly dry, and then float the jar into the main tank. Every day before feeding the fish remove the jar from the tank, and after feeding put the lid on again and wipe and dry as described above before refloating the jar in the main tank. The wiping and drying is to ensure that any parasites accidentally deposited on the outside of the jar will be killed and not introduced into the main tank. Incidentally, the novice need have no worry about suffocating the fish by placing it in a tightly closed container; there will be enough oxygen to last for a very long time indeed.

Pre-treatment of plants and snails. Newly acquired plants, snails, etc., are best isolated for a week at 80° F. without any fishes being present in the container. Any cysts, if present, will hatch out and the free-swimming parasites will perish by that time. Chemicals strong enough to disinfect plants efficiently are likely to damage them and hence are not recommended. It is no use just leaving them lying in a basin of water for a week; it is most important to be certain that the temperature is at or above 80° F. all the time. Nets used in infested tanks can be rendered safe once more by allowing them to dry out thoroughly. This can be accomplished quite quickly in front of a fire.

(b) Curative Treatment

Numerous first-class methods of treatment are available to the aquarist to-day. Let us clearly state from the start that if the disease is diagnosed early and efficient treatment started at once, one can guarantee to eradicate the disease from an infested tank in eight to 10 days without loss of any or at the most one or two aged or debilitated fishes. Any further loss or prolongation of the complaint is usually due to inefficient handling of the situation, due in turn either to lack of knowledge or facilities or both. The prognosis (forecast of the course and outcome of a disease) with early treatment is therefore excellent, and to-day white spot is no more a menace to the experienced and knowledgeable aquarist; it only constitutes a minor nuisance which involves a bit of extra work and may hold up other pleasant activities such as breeding.

On the other hand, if the disease is not diagnosed early it will spread rapidly, as in the confines of our little tanks the free-swimming forms of the parasite have not far to go before they will find a fish to infest. Hence, even if one or two cycles are completed in the tank the fishes will be literally peppered with hundreds of spots. Even then efficient treatment will save some, but the bulk of them will most probably perish from the intense toxaemia produced. Thus one cannot stress too much the importance of early diagnosis. But this, of course, comes only with knowledge and experience.

At the first sign of the disease, as soon as one or two definite spots are sighted on any fish, treatment of each and every fish in the tank and not just the obviously infested ones should be started at once. To do this one must have a planned line of attack, and the drugs ready and waiting. To the beginner I would particularly strongly urge not to wait until the blow falls, but right now to see to it that he is prepared and has an efficient plan of action ready to be put into operation at a moment's notice. True, with efficient quarantine on theoretical grounds such a calamity need never occur, but we are all human and sooner or later bound to slip up, so the next line of defence should be ready.

It is so easy to fall into the common error of believing that a method of breeding some particular fish or treating this or that disease as practised by oneself is better and more fool-proof than any other known. Perhaps no other subject has suffered more from this type of attitude than the treatment of white spot. The simple fact, however, is that we have now in our possession a number of first-class drugs, any one of them certain to eradicate the disease from the tank if their use is backed by knowledge and experience.

Choice of Treatment

There is no such thing as the best drug for the job, each has its merits and its limitations and unless these are thoroughly appreciated failure can easily result. A drug which ideally meets one set of aquatic conditions may be hopelessly inadequate in another, hence I cannot just simply tell you to use this particular drug in this particular manner and all will be well. The only logical approach to the problem is to study once more the principles involved so that any given drug will be used in an intelligent manner.

Briefly, the main principle behind the treatment of white spot is to introduce some suitable chemical compound in the water in a dose which will kill the free-swimming forms of the parasite without adversely affecting the fishes and any plants present. Let us remember that no attempt is made to treat the spots on the fishes themselves, as the parasite is neatly tucked away under the skin of the fish out of harm's way. We just have to wait till during the natural life cycle of the parasite the spots rupture, and hope to kill the parasite as it emerges from the fish. The parasite within the cysts attached to plants, rockwork, etc., are also somewhat protected by the wall of the cyst and hence they may or may not be killed outright by the drug, but once again we are in no hurry. We can wait for the cyst to rupture and kill the parasites as they emerge from the cyst before they can find a fish to infest.

An important point emerges from such a conception. *Not only must a lethal concentration of the drug be produced in the water, but this adequate concentration must be maintained during the entire period of treatment*, so that the drug is always present waiting to kill any free-swimming forms as and when they appear, for obviously not all the spots on the fish will rupture at the same time. No form of therapy which fails to meet this requirement can hope to produce 100 per cent. successful results, for if at some vital time during treatment the concentration of the drug falls below the critical lethal level for the parasite there is a danger that some parasites may break through the drug barrier and finally succeed in re-infesting the fish.

Though a large variety of drugs are no doubt effective against white spot, they do not offer any great advantage over the four drugs commonly employed, so let us for the sake of brevity restrict our attention to these drugs, quinine, acriflavine, mercurochrome and methylene blue, and see how far they fulfil these requirements, and note their powers and their limitations.

Quinine Treatment—A Paradox

Dozens of letters have appeared in aquatic journals on the effectiveness of quinine as a cure for white spot. Some report excellent results while others have found it useless. The drug has for a long time now been known to medical science as a protoplasmic poison. Though unicellular forms are particularly susceptible to its toxic action higher forms are by no means exempt. It is mainly a matter of dosage. This may be illustrated by the effect of quinine on a patient suffering from malaria. Suitable therapeutic doses of the drug can destroy the protozoan parasites which cause malaria without killing the individual, but toxic effects from the drug such as giddiness, ringing noises in the ear and a depression of heart function are by no means rare. Needless to say, large doses can kill the patient. The lethal action of quinine on unicellular forms such as spermatozoa has led to its use in the preparation of contraceptive pastes and pessaries. Thus it would appear that quinine is, broadly speaking, toxic to many forms of life, certain unicellular forms succumbing at lower doses than more highly evolved creatures such as fishes and man.

The importance of the optimum dosage is thus quite obvious, too much will kill the fish (and plants), too little may leave the white spot parasites unaffected. W. Jung, who first described the quinine treatment of white spot, used it in a concentration of 1 in 100,000. Later, however, Buschkiel proved that this is too low, and does not kill all the free-swimming parasites and leaves cysts unaffected.

A strength of 3 in 100,000 was, however, found to be effective against both free-swimming and cystic stages of the parasite. However, in a strength of 3 to 4 in 100,000 quinine salts will kill several varieties of plants (*Vallisneria spiralis* var. *torta* most susceptible, *Cryptocoryne* least) while at 5 to 6 in 100,000 many fishes will succumb from the toxic effects of the drug. Hence, you will see that if we are going to use this drug there is not a good margin of safety. To use the correct technical term, the drug has a low therapeutic index. Suppose in spite of this we decide to use the drug say at the 3 in 100,000 level, and we are prepared to lose a few plants; are there any other obstacles to overcome? Yes, for as you will remember, we need not only to produce this requisite concentration in the tank but also maintain it over the entire period of treatment. For if we can do this till all the spots on our fishes have ruptured, a cure would be at least a theoretical certainty.

However, factors are at play in the aquarium which makes the maintenance of an even, uniform concentration of the drug over a prolonged period of time well nigh impossible. Quinine is an unstable organic compound (alkaloid) which is fairly rapidly destroyed when in solution; light and heat hasten this deterioration. Besides this it attaches itself to dead organic matter and is also adsorbed on to rockwork, gravel, etc., and is thus further lost from solution. As these conditions vary so much from one aquarium to another it becomes almost impossible to state the correct amount of drug that should be added per gallon of water in a given furnished aquarium to produce the final required concentration. No wonder then that the dose recommended for the treatment of white spot by various authors varies from one-half grain to four grains per gallon. Roughly speaking, the tank with less plants and organic debris, etc., should need less drug. Also now we can realise why some aquarists get fine results with quinine while others fail hopelessly.

Let us face it, the treatment of infested fish in a furnished tank is a hit-or-miss method which will work many times but not always. Where is the point in accurately weighing out the drug, calculating the volume of water (some go so far as to calculate volume of sand and rockwork and allow for this) when we know that a large unknown quantity of the drug will be removed rapidly from the water, making a sheer mockery of all our calculations? Further, quinine is a colourless compound and gives no visual indication of the amount left behind in solution. The only reason why the treatment works at all in a furnished tank is because an excess of the drug is added so that even after some has been removed by the various means described sufficient remains in the water to kill the parasite. Truly, a hit-or-miss type of therapy if ever there was one and far from the 100 per cent. ideal we are looking for.

Treatment with Acriflavine

Acriflavine or neutral acriflavine is a mixture of two complex organic dyes, diaminomethylacridinium chloride and diaminoacridine. It can be purchased either in tabloid form or preferably as a 1 in 1,000 solution; each millilitre (ml.) will then contain one milligram (mg.) of the drug.

It is readily soluble in pure water but even fairly low concentrations of salt (sodium chloride) will throw the drug out of solution (salting out). Hence, it should not be used in a tank where salt has been previously added. Acriflavine is also readily adsorbed on to the aquarium gravel, sediment, etc., which, again just as in the case of quinine, makes the maintenance of a uniform, known concentration of the drug over a prolonged period difficult. However, it colours the water yellow and hence gives a rough visual indication of the amount present in the water.

This is a great help, for as the drug disappears the aquarist can add more to bring back the colour intensity to the original level, and thus by repeated doses help to maintain roughly the required concentration during the course of the treatment. The dose commonly recommended is 2 mg. per gallon (though some have used a dose as high as 8 mg. per gallon) of water when used in a bare tank with clean water. In a planted tank add double the dose to begin with. Some of it will be quickly removed, and then add approximately 1 or 2 mg. per gallon every alternate day to maintain the concentration. All the time attention should be paid to the intensity of the colour, and the dose varied accordingly. Needless to say, only those with some experience with this drug can hope to get consistently satisfactory results. However, one thing that can be said in its favour is that it is kind to fishes and plants. Some plants and gravel are slightly stained, but when the water is changed after treatment this soon disappears and normal growth is rapidly resumed. This, in my opinion, is not a drug for the beginner to play with as it is likely to prove unreliable.

Treatment with Mercurochrome

Mercurochrome is no doubt a highly efficient drug, guaranteed to kill the parasites when a dose of four drops of a 2 per cent. solution per gallon is used in an average furnished aquarium. Some claim that even half this dose is adequate. I have only used it at the higher concentration and found that plants and gravel are badly stained, though in most cases the damage was not permanent. However, fishes do not appear happy in it; they swim about with closed fins listlessly through the water looking very sorry for themselves indeed. Losses of fishes both during, and weeks or even months after, treatment tend to occur. The toxic action of this poisonous drug on fish that are already diseased and debilitated no doubt accounts for some of these deaths.

The delayed deaths so often reported are probably due to the production of the well-known mercurial nephritis (kidney damage). It has also been reported that fishes may be completely sterilised or their fertility seriously impaired after this form of treatment. Recently, these statements have been "pooh-poohed" by some writers. However, it seems to me futile to refute that damage to health or life of the fish can and does at least sometimes occur. Years of medical experience and research have shown without a shadow of doubt how toxic mercury compounds can be to all forms of life, even in so-called small doses, for this is a cumulative poison. No doubt not all or even many fishes are killed or sterilised, but there are lesser degrees of injury than this not so easily seen or detected that one must think of when using a drug containing so notorious a substance as mercury. All this need not be of any interest to the beginner or the man with one tank, but it is of prime importance to serious aquarists conditioning species that are difficult to breed.

Mercurochrome is not stable in solution above 70° F. and at 80° to 85 °F. (the temperature at which it should be used for the treatment of white spot) it is going to be even less stable. The breakdown products are likely to be more toxic than the drug itself. Do not store a solution of this drug in a warm place such as a fish house. The differing accounts of toxicity of this drug are perhaps at least partly due to the use of old solutions which are likely to be much more toxic. Once added to the aquarium it is almost impossible to rid the tank of all traces of mercury compounds, as these are very poorly soluble. There is therefore a real risk of a culminative action when repeated doses are employed to treat numerous outbreaks of the disease over a period of time in the same furnished tank.

As mercurochrome, like the other drugs previously mentioned, also attaches itself to various objects and sediment in the aquarium and is hence lost from solution, in a dirty or heavily planted tank it may be necessary by about the second or third day to add another very small dose to restore the colour of the water to its original intensity.

In spite of all that has been said above this is the best and most fool-proof drug one can think of when one is forced to treat fishes in a furnished aquarium, but if facilities are available for treating fishes in a bare tank there is no justification whatsoever in using so toxic a drug when other harmless equally efficient drugs are available.

(Concluded in the April issue)

Our Readers' Write

Three-spot Gourami

IN his article on the three-spot gourami (*The Aquarist*, December 1955) "Pisces" asked what had happened to the sports that resulted from a spawning of that fish over here. We often refer to them as Cosbie gouramies, for a man by that name in New Orleans or thereabouts had perfected the strain to such a degree as to breed true. To relieve the mind of "Pisces," allow me to advise that only last month in a local dealer's shop I came upon several Cosbie gouramies—unsold and in many ways unwanted. Why? The reason is quite simple—they were novel for a time, but like so many others their appeal has gone.

Personally, I care for gouramies a great deal and have had in my collection during past years several pairs of Cosbies, have spawned them and then turned them out to pasture or traded them off for something else. Were they colourful? I hasten to assure you that they were. The males, when in full fettle, would appear as if almost totally black, with a few lines (marbling effect) running from the top of the body down. Yes, it is too bad that some of these did not occur over your way for they were, and still are in my estimation, truly as rare as black angel fish, and these were out years ago!

I do hope that "Pisces" can still get through one or more of the New York houses, several pairs of Cosbies, unless they are in short supply owing to a very small national demand. The article was well written, and brought to mind the fact that when a chap tries hard enough he can come up with a new "old tropical fish," but its appeal may never last as long as that of mollies or angels!

DON. R. ABEL, *Publicity Chairman*,
The International Federation of Aquarium Societies,
Cincinatti, Ohio, U.S.A.

Try Tea

CONCERNING a notice in *The Aquarist* about the use of peat for water conditioning—have you tried adding a cup of tea at intervals? Please do and you will be astonished at the result. Tea is handy, inexpensive, not poisonous and gives the same result as peat. I am the secretary of the newly formed Aquarist Association, Alexandria, and will be pleased to do any service from Egypt for any reader of *The Aquarist*.

NAGEEB LOUCA,
Alexandria, Egypt.

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NEW headquarters of the **Riverside Aquarium Society** (see secretary change in column 3) are at Westcott Lodge, Lower Mall, Hammersmith, London, W.6, where meetings are held on the first and third Mondays of each month. New members will be welcomed at meetings.

* * *

WINNER of the Richardson Cup for the best bred fish of the year was **Southern Amateur Aquarists,** member Mr. J. H. Wilson. In the society's breeding competition three members tied for first place—Messrs. F. Braby, W. Clyde and R. Coldman. Mr. F. Braby won the viviparous section award.

* * *

FIFTEEN new members were enrolled at a recent meeting of the newly formed **Horbury and District Aquarists' Society,** when a show of livebearers was staged. The society is planning to donate an aquarium to a local hospital.

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CHARACIN fishes were discussed by Mr. H. Russell-Holland when he visited **Dunstable and District Aquarists' Society.** He emphasised that although difficult to breed, these fishes may be spawned successfully if extra attention is given to cleanliness of breeding tanks, spawning plants and the water used. The speaker outlined his own methods and answered many questions.

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MEETINGS of the **Hastings and St. Leonards Aquarist Society** are now held on the first Wednesday of each month. In December last members received a lantern lecture on the Sussex marine flora and fauna given by Mr. L. R. Brightwell. Secretary of the society is Mrs. G. Breathen, 1, St. Peter's Road, St. Leonards, Sussex.

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AT the annual general meeting of the **Leicester Aquarist Society** last month Mrs. W. Gascoyne was elected secretary for her sixth consecutive year of office. Other officers were also re-elected.

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FILMS "Feathered Fishes" and "Coral Wonderland" loaned by Australia House, London, were shown at last month's meeting of **Belle Vue (Manchester) Aquarium Society.** Early this month the secretary Mr. G. T. Bes is giving a lantern lecture called "Poisson Exotique."

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CHANGE of name by the omission of the words "and District" is reported by the **Maidstone Aquarists' Society.** At the annual general meeting held last month the treasurer reported a balance of seven pounds. Owing to extreme weather conditions only ten members were able to attend.

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THE recently formed **Stockport and East Cheshire Aquarium Society** (see secretary change in column 3) is making progress. A trip to Chester Zoo last year was enjoyed by 40 members and a similar outing to Blackpool Tower Aquarium is arranged for early spring. Mr. Waterman of Macclesfield gave a lecture on pond life last December, with films and the aid of hundreds of specimens.

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DETAILS of the planned activities of the **Lambeth Aquarist Society** for the next six months will be sent to those interested on application to secretary Mr. D. W. G. Page, 18, Clive Road, London, S.E.21.

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NORTHOLT **Aquarists' Society** held its first home inter-club table show last December, when Uxbridge society members visited the club. Nearly 40 barbs were staged in three classes, for nigger, rosy and a.o.v. barbs. Messrs. Bunn and West scored 90 points for Uxbridge with first, second and third awards, but Northolt gained 110 points with the exhibits of Mr. D. S. Ross. Mr. J. Carnell was visiting Judge and the evening's speaker.

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MEMBERS of the **Aylesbury and Aqua-life Association** enjoyed a social evening and film show last December at their headquarters at Hampden Buildings, Temple Square, Aylesbury.

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.

Calcutta Aquarists

FORMED just over fourteen months ago, the **Aquarist Society of Calcutta** (secretary Mr. H. Massie-Taylor, 48, Theatre Road, Calcutta 16) reports that it is now established firmly and possesses its own shop at which members can obtain stock at reduced prices. Publication of a monthly bulletin for members is being planned. The secretary has written to say that readers of *The Aquarist* interested in Indian tropical fishes are welcome to write to the society to receive what details members have available concerning fishes they have caught in their natural habitat.

"World Aquarist"

FIRST issue of *The World Aquarist*, a journal published by the World Federation of Aquarists, was received last month. Having 16 pages, it contains an article in English on the coelacanth fishes, a report of Belgium's "Wonderland Exhibition," an article by Dr. H. C. D. de Wit on *Potamogeton javanicus*, reports from member societies (some in German) and summary reviews of articles on fishes published in various world journals. A photographic feature called "Trade Imports Announcements" introduces two new fish species—*Trichogaster microlepis* and *Botia hymenophysa*. The journal sets out the aims and administration of the World Federation, giving details of membership for aquarists' unions or federations as well as private aquarists in all countries. Annual subscription to the journal for non-members is 7s. 6d., and address of its publishers is c/o Mr. W. Veldhuizen, 37, Stieltjeslaan, Hilversum, Netherlands. The editors are Messrs. A. Fraser-Brunner (Great Britain), H. Meinken (Germany) and Dr. H. C. D. de Wit (Netherlands).

Devon Aquaria

BUSY preparations are being made in the Torbay area of Devon to open two new public aquaria, one in Torquay and the other in Paignton, by this coming Easter. At Torquay, curator Mr. H. Sinclair, recently curator of Southsea Aquarium, has formed a company with Mr. H. Dixon of Paignton Zoo and the new aquarium at Beacon Quay will occupy property leased from Torquay Corporation. The Torbay Marine Exhibition and Aquarium is opening at Paignton harbour's south quay and is the idea of Mr. L. A. Jackman and partner Mr. D. E. Halfhide. Most of the equipment to be used in this aquarium will be made by the partners; a unique feature will be a display of models of sea life and made by them and items to interest yachting enthusiasts and those seeking knowledge of trawlers and life-boats, all, of course, in addition to aquarium exhibits of fauna and flora from local shores.

Slides for Hire

COLOURED slides made from photographs by the **Swindon Aquarist Society** and a Swindon photographer are to be made available for hire by other aquarists' societies needing material for lectures. Secretary of the society is Mr. K. E. W. Hislop, 99, Faringdon Road, Swindon, Wilts.

New Society

Manchester Aquatics Club *Secretary:* Mr. L. R. Wattleworth, 417, Greenwood Road, Woodhouse Park, Wythenshawe, Manchester. *Meetings:* Every Monday evening. Details from secretary.

Secretary Changes

CHANGES of secretaries and addresses have been reported from the following societies:

Coventry Pool and Aquarium Society (Mr. L. Fullarton, Newland Cottage, 1, Broadway, Barkdon, Coventry); **Kingston and District Aquarists' Society** (Mr. L. R. Hodges, 96, Norbiton Hall, Kingston-on-Thames, Surrey); **Riverside Aquarium Society** (Mr. N. W. Webb, 90, Wellesley Road, Chiswick, London, W.4); **Sheffield and District Aquarists' Society** (Mr. J. F. Burgess, 62, Bole Hill Road, Walkley, Sheffield 6); **Southport Aquarist Society** (Mr. F. Walshe, 93, King Street, Southport, Lancs.); **Stockport and East Cheshire Aquarium Society** (Mr. D. Whitehorn, 39, Worrall Street, Stockport, Cheshire); **Sunderland and District Aquarists' Club** (Mr. C. Theakstone, 52, Strand Street, Monkwearmouth, Sunderland).

Aquarist's Calendar

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

15th February—"Marine Aquarium Keeping" by L. R. Brightwell. 7.30 p.m.

23rd February—"Aquarium Plants" by F. C. Katritzky. 7.30 p.m.

Crossword Solution

J	A	C	K	D	E	M	P	S	E	Y	S	
E	L	Y	■	■	L	E	A	■	N	E	T	
W	I	C	K	■	O	R	R	I	S	■	R	
E	■	L	E	A	D	■	A	■	I	■	I	
L	I	O	N	H	E	A	D	■	F	I	N	
F	O	P	■	■	A	M	I	G	O	■	G	
I	N	S	E	T	■	■	S	I	R	E	S	
S	■	■	R	O	E	■	E	L	M	S	■	
H	Y	D	R	A	■	E	F	T	■	K	O	
■	O	■	I	D	E	■	I	■	U	■	R	
P	L	A	N	■	A	S	S	E	S	■	F	
O	K	■	G	I	N	■	H	E	A	V	E	

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