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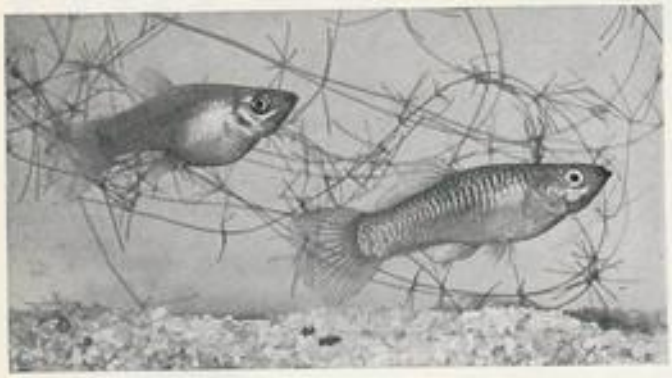
Editorial

AN acquaintance passed comment the other day about the extent of the "unknown" in aquarium-keeping. "With so many people keeping aquaria" he asked, "should not the problems be solved at a greater rate?" Two articles in this issue illustrate why this is not a logical inference. Dr. Myron Gordon shows in his article on reversal of sex in fishes how much careful investigation and enquiry are necessary before the often-made claim that a "change in sex" has occurred in a fish can be substantiated as a fact. Another article outlines some of the requirements of properly conducted experiments performed in attempts to supply answers to posed problems; careful technique and disciplined observation emerge as important aspects of such an enquiry.

The majority of aquarists have neither the time nor the facilities for exacting investigations, even if they have a problem that sets their bonnets a-buzzing. Many aquarists would be surprised to know how long it takes even well-equipped fisheries' laboratories with large-scale trials to begin to get answers from their work, and how even the conclusion of the work may prove not to be the end at all but the start of yet more tests and enquiries. Let it be freely admitted that not all of us have that most necessary quality for research—patience.

This is not intended to deter the curious from making their investigations, less still to try to create an impression that only those with a beautiful laboratory can provide any worthwhile contribution. There exist many lines which the part-timer can usefully follow with the hope of getting new information, some of them indicated in the article in this issue. It is most important too, that aquarists should not only continue to employ some method because it "works" but that they should also seek the "why" of its working and ways of simplifying and of increasing efficiency of the method. There is no doubt that greater awareness of the need for a critical analysis of theories that aquarists are tempted to propound as a result of their everyday observations would serve the hobby well.

Evidence for Complete Sex Reversal in Fishes



On the left is a normal female mollie (*Mollienisia sphenops*) for size comparison with the female guppy on the right which has developed an anal fin like that of a male. The guppy was incapable of mating either as male or female

A critical review of reports of "change in sex" of fishes

by Dr. MYRON GORDON

Geneticist to the New York Aquarium

Photographs by SAM DUNTON (N.Y.Z.S.)

AQUARISTS have repeatedly reported instances of sex reversals in some of their fishes. A survey of the reports reveals that the alleged "sex reversals" represent a great variety of changes in the appearance or in the behaviour of a fish of one sex in the direction of its feminine or masculine counterpart.

Under the heading of "sex reversal" many aquarists have reported that old female swordtails developed male-like extensions to their tail fins. Other aquarists have related how some of their female fighting fish temporarily became as brilliant as males in "war-paint," everted their gill membranes and in a reversal of behaviour threatened and charged males twice their size. These changes, either of a physical or of behavioural characteristic, are often brought about by the slight hormonal upsets that accompany advanced age. They are readily noticed, quite startling to the observer, but of little functional importance. Forthright evidence for *spontaneous and functional sex reversal* in any fish does not exist if by spontaneous and functional sex reversal the following is meant: the spontaneous change in the reproductive capacity of mother (not just of a female) to that of a father (not just of a male). This basic type of change is quite different from the superficial changes usually ascribed to examples of "sex reversal."

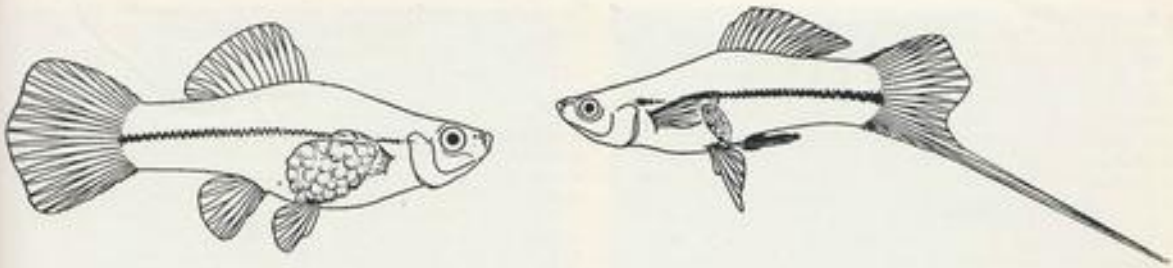
In order that a sex-reversed mother may eventually be able to produce effective spermatozoa like those of a potent and functioning male, her primary glands of sexuality must first be altered radically. Her once-functioning ovaries have to be destroyed or reduced to complete impotency. Then from the residual gonad and accessory organs, testicular tissue has to be regenerated. Even this is not enough. For unless the regenerated testes are capable of producing viable spermatozoa and unless the animal develops the proper sex drive to mate, and unless the secondary sexual structures make it possible to transmit the spermatozoa to permit insemination of the eggs of another female, it is most unlikely that complete and functional sex reversal can be accomplished.

In some female vertebrate animals the ovaries are sometimes destroyed by disease; in other females ovaries are sometimes removed by surgery. If one or the other happens to a mammal, the female becomes sterile. If one or the other happens to a hen, the bird becomes masculinised. This is because hens have rudimentary non-functional testes and male accessory organs. In some ovariectomised chickens the rudimentary non-functional testes begin to develop. When the ovaries no longer exist in a hen the former adequate supply of the feminising hormones is radically reduced. This oestrogenic (female sex hormone) deficiency in a hen apparently permits the testicular or insipient male rudimentary elements to start their growth. When this happens the once-rudimentary testes produce more and more male hormone that eventually masculinises the animal. This is the biological explanation for the once mysterious phenomenon of crowing hens.

In recent times two egg-laying hens were maintained under observation until they passed their prime as functioning females and mothers. Then, according to the report, the hens became masculinised so completely that they appeared to be similar to cocks. The transformed hens eventually attained sufficient masculinity to court and to mate with normal hens. The report said that the two erstwhile egg-laying hens successfully fathered broods of chicks.

If this could happen to chickens, why not to fishes? Well, in 1926 Dr. J. M. Essenberg of the University of Oklahoma claimed that two female swordtails which previously had many young, transformed into functional males and fathered the young of other females. Before evaluating the evidence for Essenberg's claims of the spontaneous and

This swordtail, after mothering ten broods, developed a sword and anal fin like that of a male. During the time it was in the possession of the author it never functioned as a father



Outlines of female (left) and male (right) swordtails showing positions of the ovary and testis respectively

functional sex reversal in two female swordtails some background information concerning viviparous fishes and their sexual behaviour and physiology of reproduction of both sexes is helpful.

In order to mate, the male swordtail must have not only functional testes, but the testes must be able to produce perfect spermatophores, that is, spermatozoa in "pellet" form. (Free spermatozoa cannot be transferred from a male swordtail to a female.) In order to deliver the pellet-like spermatophores to the genital pore of the female at the time of mating the male must have a perfect gonopodium, because insemination is internal in this species; that is, the tip of the gonopodium must be inserted within the female's genitalium. But even though the gonopodium may be perfect, this organ cannot function properly and precisely without its elaborate internal skeletal supports known collectively as the *gonopodial suspensorium*, and an accompanying elaborate set of gonopodial muscles.

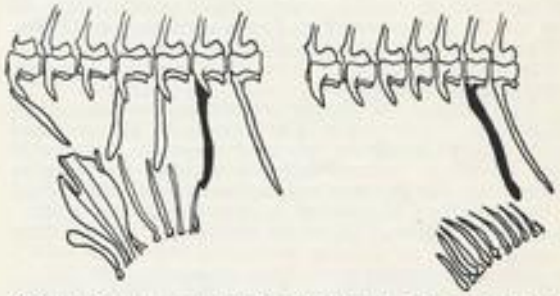
In the normal growth of a female swordtail many of the essential anal fin skeletal supports that might form the gonopodial suspensorium are dissolved at the time of maturity and then eliminated. This loss serves, in part, to make room within the female's body cavity for the many developing embryos (sometimes 200 of them) in the ovary. Without these internal skeletal supports to which in normal males special and powerful muscles are attached, it is unlikely that the gonopodium of the masculinised female could move with the extreme precision required of it at the time of mating.

Further, in testing a masculine-like female swordtail for its reproductive ability and potency virgin females are essential. This need for unmated fish is more easily stated and recommended than accomplished because the viviparous female fish has the ability to store spermatozoa within the folds of her oviduct for as long as eight months. Once the female has been exposed to a normal adult male swordtail, she should never be used to test the potency of a second male or male-like swordtail. Therefore the history of all test females used must be complete and must meet the rigid requirements demanded in studies of this sort. One sure practice for obtaining virgin female swordtails is the removal almost daily of potential males from a common rearing aquarium. Males when immature are characterised and identified by the thickening and lengthening of their anal fins and by the elongation of the lower part of their caudal fins. Another method used to obtain virgin swordtails, of course, is the solitary isolation of young fish almost from the time of their birth.

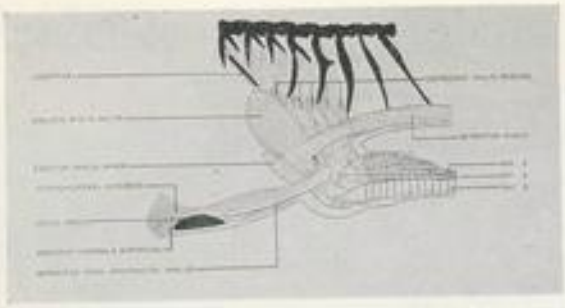
With these generalities as a background, let us examine the two alleged cases of spontaneous and functional sex reversal in two swordtails as reported by Dr. J. M. Essenberg in the 1926 *Biological Bulletin*. Their re-evaluation is particularly necessary because these two cases have been accepted widely and without qualifications in nearly every text-book in zoology that discusses the subject of sex reversal.

Early in the spring of 1923, Essenberg, then working at the University of Missouri Medical School in St. Louis, received some swordtails from two sources: from a stock maintained at the University of Chicago and from those raised at the Crescent Fish Farms of New Orleans. For some unexplained reason, the fish from these two sources were first mixed and then each fish was isolated. The number of females Essenberg isolated was not indicated.

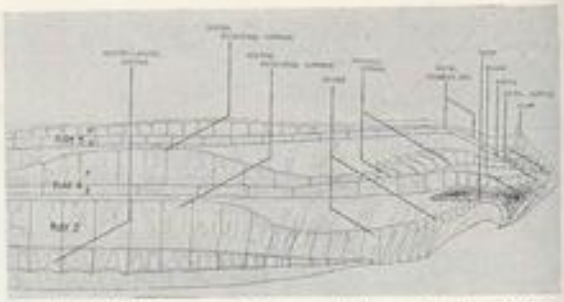
On 4th May, 1923 a female swordtail identified by the number "B16" gave birth to 53 young, and 40 more young about a month later, 2nd June; subsequently she did not produce any more visible young. On 12th September, 1923, according to Essenberg, swordtail B16 "reached advanced stages of sex reversal" but just what these changes were in B16 were not described. After this date a break in the continuous identity of swordtail B16 is definitely possible because Essenberg said that swordtail B16, together with other fish, was shipped from the University of Missouri Medical School to the University of Oklahoma School of Medicine at Tulsa. On 1st December, 1923 a swordtail



Profound changes occur in the skeletons of male and female swordtails during normal development. On the left are shown the complicated skeletal elements involved in proper functioning of the male gonopodium; on the right the figure shows that loss of some of these elements provides a space for developing embryos in the body of the female. In both figures the solid black line represents the fourth haemal spine (process of fourth caudal vertebra). The male has three other haemal spines before this one, the first being known as the ligastyle. It connects with the enlarged and fused actinost rays (gonactinosts 3, 4 and 5) at its lower end and illustrates just one part of the elaborate mechanism for moving the gonopodium that as well as enlarged and specialised muscles is missing in the mature female. Could these structures be regenerated during "sex reversal" by an adult and once functional female? Can other skeletal elements and muscles necessary to operate effectively a reconstructed gonopodium arise or be strengthened during "sex reversal?" Until simple proofs of such changes and others involving gonads and sex ducts accompany an assertion of spontaneous and functional sex reversal in swordtails or other viviparous poeciliid fishes such an event cannot be regarded as a scientific fact



Caudal vertebrae, modified haemal spines and powerful muscles which move the gonopodium in a normal male swordtail are shown in this figure. Before a "sex-reversed" female could act like a male these structures would have to develop within her and become functional



The distal half of a normal male swordtail's gonopodium. Before claims are made that a female swordtail has developed a gonopodium the structure should be compared with this figure, ray by ray and segment by segment. A perfect gonopodium is essential for transfer of sperms from male to female

male which he identified as B16 was mated to a virgin female swordtail. (At this point one could question the virginity of the fish used, since it is not explained what methods were used to obtain them.) On 25th February, 1924, according to Essenberg, the fish identified as B16 and its mate produced eight normal young; three of the eight were reared to sexual maturity; one was a male and two were females.

This is all the information that was published concerning the swordtail B16. Nothing was said about its reproductive behaviour in the presence of a normal female. Nothing was described of the condition of its gonopodium, nor of its gonopodial suspensorial system, nor of the condition of its reproductive glands. Therein lies good cause for doubt.

Essenberg's second alleged spontaneous functional sex reversal fish appeared in a second lot of swordtails shipped to him by the Crescent Fish Farms at an unspecified date. We were told that they were all "adult females not less than three years of age," but it is not clear how their ages were determined accurately.

Four of these old "female" swordtails were regarded by Essenberg as noteworthy. One "female," C32, which had not produced any living young subsequent to its arrival at his laboratory, "transformed into a male" according to Essenberg, but he described neither external nor internal changes in the C32 swordtail in support of his statement.

Another female, C14, which allegedly produced "three litters," later, according to Essenberg, transformed into a "male"; it, however, was unable to function as a male when paired with a "virgin" female swordtail.

The third outstanding adult female swordtail, C3, cited by Essenberg, gave birth to one litter, after which C3 transformed into a "male." When mated to a "virgin" female, Essenberg said, the pair produced two male and three female young.

In none of these three unusual swordtails were post-mortem examinations made of the gonads or other internal organs. This was not because there was a lack of facilities or lack of appreciation of the kind of evidence that would be required to substantiate the claims of radical sexual deviation. For example, another swordtail, C14, of undesignated history, was examined after death and the diagnosis was made that it had spermatophores in well-formed testes, but its sperm duct was obstructed.

That is all we have to go on to decide the reality of the alleged sexual changes in B16 and C3 and the other fishes. If I were a member of a jury assessing the evidence for spontaneous functional sex reversal in two swordtails and for somewhat less radical changes in four others, I would have doubts, lots of doubts, as to the validity of any of them.

From the thousands of swordtails and platyfish that have been reared (like guinea pigs) in various laboratories for more than a quarter of a century since 1926, and from the thousands of fishes that have been reared elsewhere, no additional cases of *spontaneous and functional sex reversal* have been reported and substantiated during the past 25 years. Many instances of reversal in *secondary sexual characteristics* such as changes in finnage and coloration and in behaviour have, of course, been reported in the swordtail and in other fishes, but these are no more significant of fundamental sex change than may be found in a bearded lady, or in a bald one for that matter; curiously, beardedness and baldness, apparently opposite abnormal conditions, are engendered by hormonal upsets. The same applies to fin changes in swordtails.

Categorical claims that a swordtail or some other species of fish had functioned as a female and then transformed into a functional male have been made, but investigations of alleged spontaneous and functional sex reversal reveal that either the female had never actually been a mother, or the transformed male had never actually been a father. It is quite difficult but essential to provide verifiable evidence on both of these fundamental counts.

In view of the looseness of labels used in describing sexual deviants it would be better to reconsider the usage of the term "sex reversal." Perhaps the expression "masculinisation" may carry all the meaning necessary to express the change in a particular character in an abnormal fish. For

In the normal male swordtail this is the complex picture of modifications in bones that permit the basal gonopodial suspensory elements to articulate with the rays of the gonopodium

example, the male-like anal fins or gonopodia are occasionally developed in female live-bearing fishes. In two instances that have come under my observation, the gonopodium-bearing platyfish females continued to bear young, just like normal females. This was not a case of sex reversal, but a case of spontaneous masculinisation of the anal fins. This condition may now be experimentally reproduced in female live-bearing fishes by first amputating their anal fins and then applying appropriate quantities of male hormones during the period of the fin's regeneration, although rarely are the anal fins true facsimilies of gonopodia.

When male hormones are carefully administered to immature female guppies or platyfish, the treated fish will eventually develop into fish that have all the appearances of males, including their urge to chase, to court and to attempt to mate with normal females. But they can go just so far in their newly acquired masculine behaviour. They cannot actually consummate mating and insemination because they cannot produce perfect spermatophores, although their gonads may produce some testicular cells. Although these fish are masculinised *almost* completely, that almost makes all the difference. Actually they are not males at all and never were.

It is conceivable that by finding just the right dose of a suitable hormone for treating immature viviparous fishes by beginning the medication at a sensitive age, some experimentor will be able to convert an otherwise potential female into one that functions as a male.

Just recently, Toki-o Yamamoto of Japan has demonstrated the possibility of doing the reverse experiment with young of the oviparous medakas, *Oryzias*. He converted young males into females by treating them with oestrone or with stilboestrol. He was able to identify the sex of immature males by their associated sex-linked coloured characters. Normal male medakas carried one X and one Y chromosome; females carry two X chromosomes.

Male XY medakas, after they were converted by oestrogenic hormonal treatment into female-like creatures, were mated to normal untreated males, which carry the XY chromosomes also. The feminised male and normal male produced many young, about three-quarters of which were males, one-quarter were females. In other words, when a mating was conducted in which both parents were XY (that is, XY times XY) about one-quarter of the offspring would obtain two X chromosomes; these were females. Most of the male offspring had the XY chromosome constitution, but some males had the unusual but theoretically expected YY chromosomal combination. When Yamamoto mated an unusual YY male to a normal female (which, of course, was XX) he expected to get all male offspring, since from the mating of YY and XX individuals the only possible chromosomal combination among the young has to be XY. Sure enough, Yamamoto obtained 72 males out of 72 young.

Yamamoto regarded his successfully feminised male medakas as examples of complete and functional sex reversal and so they were if the definition of that type of sex reversal is broadened a bit. Yamamoto made it quite clear, however, that the feminising treatment was started on the males at an early age, long before they were able to function like males. Thus they are not examples of *spontaneous and functional sex reversal*.

Perhaps we need a more precise definition to characterise those animals which function successfully first in the capacity of one sex and then at some subsequent time function successfully in the capacity of the opposite sex. That is why the term "spontaneous and functional sex reversal" is used here.

Credence has been granted to a few rare examples of this type of sex reversal among the fishes and birds, but unqualified acceptance, it seems to me, should wait upon more complete evidence. On the other hand, surgical castrations of female Siamese fighting fish have in several instances produced fish in which the regenerated gonad became a functional testis. Former female *Betta* with testes became more colourful, more aggressive and successfully embraced normal females during mating; they were fully able to produce viable spermatozoa which in turn effectively fertilised the ova released by normal females. These experiments were first performed in the United States by Noble and Kumpf in 1936. Later, the results of these experiments were fully confirmed in 1951 in Germany by Kaiser and Schmidt who apparently worked independently of previous knowledge of similar work done previously.

No doubt my remarks questioning the evidence for spontaneous and functional sex reversal in viviparous fishes, particularly the swordtail, will in turn be questioned by some aquarists. Some will insist that they have had a fish whose sex was changed from that of mother to that of a father. If these instances are brought to my attention I shall continue to ask the following questions in an attempt to get the fundamental evidence for a proper diagnosis:

1. How long did you have the sex-reversed fish in question in your possession and under your personal observation?
2. Did it come from a brood which was unusual in any other way?
3. Did the fish reach maturity at about the same time that its normal siblings did?
4. If the fish in question was first a female did it mate with a normal male and produce fertilisable ova (if the fish is an egg-layer) or did it give birth to living young (if it was a livebearer)?
5. How many young did it produce and what was the sex ratio among its progeny, that is, how many of its young were male, how many female?
6. What was the interval of time between the loss of the fish's femine attributes and its first external marks of masculinity?
7. Which secondary sexual characters were changed during the transformation period?
8. How long did the complete sexual transformation take?
9. How many progeny were produced by the completely masculinised female (now acting and functioning as a male) after it had successfully mated with a normal female? Among the progeny how many were male, how many female, how many were sterile?
10. Was the normal female that had mated with the alleged completely masculinised female a virgin prior to this mating? How old was it at the time of mating? What precautions were taken to insure its prior virginity?
11. Was a thorough post-mortem examination made of the alleged completely sex-reversed fish?
12. What were the findings of a microscopical examination of the condition of its gonads and accessory organs?

Scientific facts are constantly being subjected to verification and re-evaluation. Every fair-minded person must agree that unconditional evidence is required before the reality of spontaneous, complete and functional sex reversal in a fish should be accepted.

Advertiser's Name Change

We have been informed by Ascot Aquaria, Ltd. of London, S.W.4, makers of an artificial rock (plastic) background for aquaria, that it has been found necessary to change the name under which their product has been advertised. The name first used, "Aqua-Rock," was discovered to be already registered as a trademark by Weinbergs Weatherproofs, Ltd. for a different type of article. The new name for Ascot Aquaria Ltd.'s product is "Aqua-Strata" Plastic Back Rock.

Aquarium Cinematography Technique

by MASON SMITH

SOME years ago I was introduced by a friend to narrow-gauge cinematography. Up to that time I had always thought that the small-gauge cine camera gave results which were little better than some of the early silent films, with their jerky movements and poor photographic quality.

Imagine my surprise when a colour film he had taken of a tropical fish tank in an exhibition was projected, and I saw those same fishes, in all their natural colours, virtually come to life. From that day I decided to specialise in fish cinematography.

Around that time I had already bred most of the more common types of tropical fishes, their offspring had grown up, and passed away, and I was left with only the memory of weird, wonderful and clever breeding habits. Fishes of good size, colour and finnage had won a few awards in shows, but eventually these fishes had died, and all I had to show for my trouble was a piece of printed pasteboard. But now all this has been changed, through the medium of the cine camera. I can by the flick of a switch bring back to life some of those finny friends who resided with me years ago.

Equipment

Perhaps at this stage I should explain what is meant by the term "narrow-gauge cinematography." The professional movie maker uses film 35 mm. wide. Film of this width is very expensive, and the equipment (camera, tripod and accessories) would be far beyond the ordinary amateur's pocket. There are, however, on the market three other gauges of film, 8 mm., 9.5 mm. and 16 mm. Of these three gauges 8 mm. is by far the cheapest. Four-and-a-half minutes running time in 8 mm. colour film costs £1 9s. as against £3 17s. 1d. for the same time in 16 mm. colour film.

The 9.5 mm. gauge is only economical in monochrome film; colour film in 9.5, besides being as expensive as 16 mm. colour, has also to be sent to France for processing; this takes about four weeks. The above prices include the processing charges involved. The film comes back to the buyer on a reel ready to put on the projector and show.

Of the above mentioned gauges of film I chose 8 mm. This decision was made for financial reasons, otherwise I would have chosen 16 mm. One advantage of 16 mm. is the fact that it can be enlarged to 35 mm. in the event of the reader making a film which would be suitable for public showing in a cinema. Sound tracks can also be added, by magnetic or optical means, to 16 mm. and 9.5mm. film, 8 mm. being really too small for efficient sound on film, although there is on the market a machine which will reproduce sound from magnetically striped 8 mm. film.

After deciding the film gauge one proposes to use, the next thing is the buying of the camera and projector. As most people will undoubtedly use the 8 mm. equipment, I shall henceforth describe how I film, and the type of equipment I use, with this gauge film. Most of the details will apply equally well to either 9.5 mm. or 16 mm. film. The lighting details will also interest the still photographer.

A good secondhand camera for 8 mm. can be bought for around £28, and a projector (secondhand) for around £18. Your local photographic dealer will give you all the details, and be only too glad to demonstrate various types of apparatus.

When choosing the camera, one fitted with a focusing lens is almost essential, as the working distances will be from three feet down to about nine inches, depending on what type of shot you are taking, and to a certain extent on the size of the fish to be filmed. Of course, a telephoto lens can be used, but in my experience I have found that better results can be obtained with the normal 12.5 mm. focal length lens for 8 mm., or 1 in. for 16 mm. cameras.

A fixed-focus lens can be used by fitting supplementary lenses in front of it; these cost about 5s. each, and one for each filming distance is required. In this case a lens for each of the following distances of nine inches, one foot and two feet should be bought. This means that the supplementary lens has to be changed whenever the distance from camera to subject is changed. A fixed-focus type lens usually gives excellent results from approximately six feet to infinity.

The lens should have an aperture of at least *f*1.2:8, if Kodachrome or Agfa colour film is going to be used. A *f*1.3:5 lens is sufficient if one is going to use only monochrome film.

Filming Close Up

Owing to the fact that we are filming at close quarters a correction for parallax will have to be made; that is, the difference between the position of the lens and the viewfinder will have to be allowed for. On some makes of 8 mm. camera this is done by the viewfinder being marked, on others by the fitting of prisms over the viewfinder which correct parallax automatically for distances of one foot and two feet.

The buying of an 8 mm. projector is not so important an item, as most projectors work efficiently, and one with a 500-watt projection bulb is probably the best buy as this will give an adequate size of picture suitable for showing to audiences of up to 50 people. The picture on 8 mm. film is so small that the actual size of the projected picture should not be more than five feet wide, otherwise the film will appear very grainy. Projectors (8 mm.) range in price from about £18 secondhand to £70 new.

In the next article I will describe the method of setting up the tank, the lighting required and technique.

Cacti in the Fish House

DURING the hottest time of the year it is advisable to stand cacti in the windows so that not only do they get all the sun they love but are able to give shade for the fishes. Some aquarists use paraffin oil for heating their houses and may be afraid that any fumes might be harmful to cacti. This is not so, and, as a matter of fact, the slight smell would be a deterrent to any pests which might attack the plants.

If at any time it is found that a particular plant appears never to dry out, it should be removed from the pot and examined. It will probably be found that the drainage hole has become clogged; if the soil is continually wet the plant will soon die. When re-potting such a plant remove all the old soil and then see that the crock placed in the bottom of the pot is so shaped as to allow all surplus water to drain away readily. A good porous soil must always be used and a freshly potted plant should be watered sparingly until new growth is seen.

TROPICAL FISHKEEPERS' REFRESHER COURSE: *by Pisces*

Cherry Barb

(Barbus titteya)

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

FAMILY:—Cyprinidae, from Greek *kyprinos*—a kind of carp.

SPECIES:—*Barbus titteya*, from Latin *barbus*—bearded, and a native name.

THIS little barb, from Ceylon, is one of those fishes which are popular, then neglected, once more popular, and again overlooked, and it is difficult to know why. It is more streamlined than the average barb, its depth of body hardly ever reaching one-third of its overall length, and there are few fishes which excel it in beauty of colouring—provided that its environment suits it. Perhaps this is the solution to the mystery of people enthusiastically taking it up, and then dropping it—they supply the wrong surroundings, whereupon it becomes a drab little fish, hardly worth a second glance.

The male is more beautiful than the female, often being suffused overall with cherry red, with scintillating scales flashing back the light whenever it catches them. Dividing the body longitudinally, into two approximately equal halves, is a darker line.

Cherry barbs require a well-planted, light aquarium, and a fair proportion of live foods such as *Daphnia*, *Cyclops*, gnat and mayfly larvae, micro worm, enchytrae, brine shrimp, etc. But they also require a proportion of vegetable food, and there is a lot to be said for a sprinkling of duckweed at the surface of the water in which they are living.

Acidity and hardness of water do not seem to affect them unduly, and they have a good temperature tolerance, being happy at from 70° to 80° F. The best breeding temperature is between 77° and 80° F.

The male courts the female assiduously, displaying his startling beauty and parading before her until she responds to his advances. A wild chase ensues among the thickets of plants, and soon the female is scattering adhesive eggs as she flies before the male. These stick wherever they first strike—on weeds, glass, rocks, or sand.

Should a pair of these barbs fail to spawn they should be segregated, fed well for a few days and then replaced together. If still uninterested in each other, a fresh aquarium should be prepared, and fresh tapwater used to fill it. The new water seems to give just the stimulus necessary, and temperature being correct, spawning in most cases follows within hours of the fishes being introduced to the fresh environment.

Within 36 hours the eggs hatch, the fry hanging motionless upon the plants like minute splinters of glass extremely difficult to see, even with close scrutiny, so that a hand lens is invaluable when searching for them. Within a day or two, however, the fry are free-swimming, and searching for infusorians near the bottom of the tank. Green algae water is invaluable at this early stage of their existence, and it provides the vegetable substances necessary for their healthy growth.

With adequate food, growth is rapid, and to avoid stunting, distribution to other aquaria should begin as soon as the fry can be seen easily. A teaspoon is a useful aid to catch those at the surface, it being gently slipped beneath them and lifted out. Alternatively a saucer can be lowered, one side first, so that the water rushes into it, taking fry with it.

Cherry barbs are usually harmless in a community tank. In an unplanted exhibition container they lose a great deal of their beauty, and can be judged merely by their shape, size, and freedom from obvious signs of disease.

Experiments with Fishes

by BRIAN BRACEGIRDLE

EVEN a casual glance through the pages of this journal will bring home the fact that aquarists as a body are enthusiastic in the pursuit of their hobby. This enthusiasm leads them to wonder about the effects upon their pets of different treatments; and many aquarists are sufficiently interested to conduct some experiments.

Even the tyro is very well placed to do this, because the environment in which his charges live is precisely controlled as to temperature, light, space, etc., and it is very easy to administer substances to the fishes by simply putting drugs into the water, or else to with-hold other substances, such as minerals or food, by simply not adding them; both of these things are much easier to do to fishes than are the equivalent techniques with the more common air-breathing laboratory animals.

Unfortunately, however, it is more difficult than it would seem to conduct useful experiments with fishes or any other animals. In order to do useful work some basic requirements must constantly be borne in mind. There must be a clear realisation of the aims of the experiment, whether for some commercial end, such as breeding some unusual form, or for pure research; what do we seek to prove? There must also be precision in the measuring of quantities, and especially of drugs administered.

Far too often do we read that people have put, say, a lump of something into water, sloshed it about a bit, and then poured the resulting liquid (of entirely unknown composition) on to a fish! Even if the experimental treatment were successful, it may well be impossible to repeat the experiment. While few aquarists are likely to have access to precise chemical balances, retail pharmacists will often weigh out accurate amounts of substances purchased from them. As an alternative, many drugs designed for human use, are available in tablets of known strength, and are very useful for obtaining small amounts. In the last resort we may weigh a fairly large quantity, say

an ounce, dissolve it in say a quart of water, and use smaller amounts of this; one fluid ounce would contain one-fortieth of an ounce, or twelve grains. Even kitchen scales are quite suitable for this technique, which is quite accurate.

Another important requirement is that only one factor at a time should be varied. If length of time of action, concentration of drug, and temperature of water are altered at once, and a better result is obtained, it is impossible to say to what it is due, without repeating the experiment; it always seems to be the last test of such cases which gives the answer! Another, and most important requirement, is to make notes, at the time of doing an experiment. Human memory is notoriously fickle, and it is most galling to achieve a good result and to be unable to recall how it was achieved!

The foregoing, then, are the scientific bases for experimenting, but some mention must be made of legal requirements. All backboned animals used for experiments which might be painful are protected by law from needless pain. We must be careful not to read into the actions of a fish our own human interpretations of its actions; fishes and humans have many different patterns of behaviour and senses. It is not known if fishes can feel pain, but the law gives them the benefit of the doubt. Therefore, any experiment likely to cause pain can be performed only by licensed persons upon licensed premises. Licences are issued by the Home Office very sparingly, and applications need to be supported by a professor of medicine and a fellow of an exclusive learned society.

However, the present author feels that for the type of work likely to be done in the home of the average aquarist, a licence is not necessary, since pain, if appreciated at all by fishes, is not likely to be of the sensitivity associated with the higher animals. (It may be noted that it is not an experiment to cut off a cat's tail if you do it because you like Manx-type cats, but it is if you do it because you wish to discover if it can purr without its tail!) Therefore, with the relatively less-sensitive fishes, normal work is unlikely to give rise to pain, but that must not be taken to give *carte blanche* to expose fishes to potentially painful situations. Experiments with embryos are outside the provisions of the law.

When we come to consider the experiments which the aquarist can do, we find almost bewildering variety. To mention only a few, in order to suggest a few lines to follow up; the effects of temperature and of various concentrations of salts, thyroid, etc., on eggs may produce interesting results (remember that very small amounts of drugs may have very large effects). The tying of a hair round an egg, so as to constrict it (a delicate procedure) has been found to give Siamese-twin fish. Mechanical shaking and such disturbances give fantastic results at times. With older fishes much remains to be discovered in at least two fields, these being the treatment of disease, and the supply of live foods.

Much piscine disease is of unknown cause, and while much of the work will require advanced facilities, many cures have been found by trial-and-error methods; and some aquarists seem to have a flair for discovering worthwhile remedies. In the matter of food, principally live food, there is much to be discovered. Very little is known of the associations of fishes in their natural habitats, and therefore of the food they eat. The finest fish specimens may be expected to be found where their diet in captivity approximates most closely to their original wild diets. Live food is very desirable for all forms of animals, fishes included, and work done on discovering the acceptable and then the best kinds will undoubtedly repay. It is also quite likely that highly coloured food will affect the pigmentation of the fishes, and may well represent the only way of obtaining a particular colour of fish. The search for a pigment which, once deposited in the fish, is not removed when the diet is stopped, may well be worth a lot of money.

Finally, we must remember that it takes a most careful observer to note the possibly very slight effects of a treatment. Many small effects add up to a large one, and if these small effects are not to pass unnoticed, we shall need to observe and not merely to regard!

Travelling Tropicals

A JOB involving constant moves from place to place does not deter Mr. Jeff Rowena from being an enthusiastic aquarist. He is star quartette bandleader for Mecca Cafés, and when interviewed and photographed he had just arrived at Streatham from Blackpool. His first job was to unload the two 24 ins. and two 18 ins. aquaria that he carries round in his car on his journeyings. In the car all the tropical fishes travel in one half-filled 24 ins. tank with all the plants from the other aquaria. During summer and winter travels, over a period of 14 years, Mr. Rowena says that he has not lost more than half-a-dozen fishes. He has been keeping fishes for about 17 years, and at his home are many fishes he has found time to breed himself.

PHILIP DEE

Photo : *Laurence E. Perkins*

Microscopy for the Aquarist—20 *by* C. E. C. COLE

SO far the only substage apparatus that has been considered in this series has been the plano-concave mirror, and I have shown you how even this may be dispensed with on occasion. To ensure further progress, however, we must now give serious consideration to additional substage apparatus.

The mirror alone is not efficient enough to enable us to examine in a satisfactory manner a vast number of aquatic organisms in the micro-, as opposed to the macro-scopic, class. Although the concave surface of the mirror concentrates and intensifies light from our lamp into the area surrounding the organisms, the field of view with medium- and high-power objectives is much smaller than the area of illumination, so that a great deal of light is wasted and may give rise to poor resolution of detail through diffraction and, or, reflection. Ideal illumination is confined to the field of view, and by the proper use of a so-called substage condenser or substage illuminator, this condition can be easily obtained.

With brand-new instruments a condenser will automatically be part of the outfit, but a secondhand outfit may or may not include one. In such a case, it is as well to examine your instrument to see whether or not there is any provision for using one. This may take the form of a collar just beneath and surrounding the circular hole in the stage, into which a condenser can be slipped—a sliding fit. Alternatively, there may be screw holes into which a mount may be screwed, or finally there may be a rack and pinion, with a circular ring—the condenser mount—capable of being swung through 90 degrees under or away from the stage. For maximum utility this latter type of rack and pinion mounting is unquestionably best.

An additional refinement which is well worth having is a "centering" mount surrounding the ordinary condenser mount. This is, of course, unable to be used on models which are a sliding fit into a rigid collar screwed to the stage.

The centering mount enables the condenser to be moved into the exact optical axis of the microscope—an important detail for more advanced work. In fact, of course, *all* details of adjustment assume greater importance as we progress. If thoroughly used to elementary work, however, the principles and theory governing them become much easier to understand and put into practice. But let us get back to condensers.

Abbe Condenser

Substage condensers vary in design according to the work they are intended to do, but it is universally understood that for all general purposes one of the so-called Abbe condensers is eminently suitable.

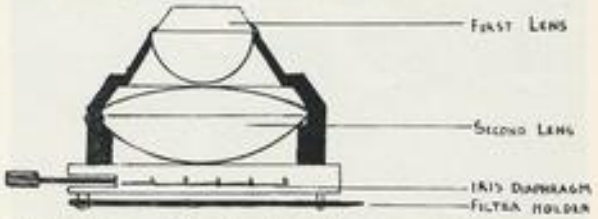
Why Abbe? Well, in 1866 a professor of that name, working at that time at Jena University, interested himself in optics, and formulated theories which hold good to this day. As a result of his interest, he became associated with Carl Zeiss, manufacturer of optical instruments, With Dr. Schott he invented a new optical glass—the Jena—and the first substage condenser. Modern Abbe condensers may be of superior construction and materials, but they conform to the original theories propounded by the professor.

The condenser itself consists of two lenses. The upper one is small, with a flat upper surface and a semi-circular bottom one. The upper lens can be unscrewed, revealing the second, much larger lens, slightly convex above, and markedly convex beneath.

The large second lens is the light gatherer, collecting a number of light rays from the mirror and concentrating them into a very small area, with a resultant great increase in intensity.

If the thickness of every slide or slip of glass or container which was ever to be placed on the stage was standard the need for a focussing adjustment would not manifest itself. In practice, however, we shall find we use innumerable different thicknesses of glass, so that the constant alteration of the position of the condenser must be anticipated and provided for.

Generally speaking, the distance between the top of the condenser upper lens and the object to be examined will be in the region of just over a millimetre ($\frac{1}{25}$ in.). Lowering the condenser will increase the illuminated area but decrease the intensity of light and is not considered ideal.



Sectional view of the illuminator for microscope substage, or "Abbe condenser"

Should the light be too intense when the condenser is in the correct position, a smaller-wattage lamp can be installed, a so-called neutral filter interposed, or the iris diaphragm just beneath the condenser partially closed. If the last-mentioned technique is adopted, watch carefully through the eyepiece as the diaphragm closes. It is extremely easy to interfere with the clarity of resolution by closing too far. At the same time, should the subject of examination be highly transparent or practically colourless, the closure might well make parts of it more easily seen. In such cases a mean between the two extremes is required, and this can only be found by experimenting with each separate case—there is just no hard and fast rule about it.

We are now in the position to obtain "critical" illumination—we have all the apparatus necessary—so next month we will experiment until we get it. Until then, closely examine your substage condenser; rack it up and down, noting the effects on the lighting of the field of view and the resolution of details. Examine small objects with and without it, and notice the differences.

Should your condenser mount have a centering device, usually two screws projecting from the mount, use it and note how great a measure of control you can obtain over the illumination through doing so.

Shortening the Chase

When catching fishes which are hard to net the best way is not to trust to luck but to wear the fish down by never stopping the movement of the net. This way they soon tire, if given no chance to get their breath as one might say. Another way is to make strong surges with the net which swirls the water so much that the fish itself is for the moment caught in the current formed. Use a big net. The other fishes won't mind—it is amazing how quickly fish realise that they are not the quarry and swim unconcernedly away.

In the Water Garden in JULY *by* ASTILBES

Photo : *Laurence E. Perkins*

THE water garden should now be at its best, with a wealth of foliage in and around the pond. No actual planting should be necessary at this time of the year as most of the suitable plants will be in flower, budding or seeding. It is only when certain kinds of plants do not thrive that some attention may be necessary.

Most of the iris plants will have flowered by now, but if some were planted in the shade they may be later coming into flower. Should some of the irises have failed to flower the soil may not be suiting them. Most like a moist, lime-free soil fairly rich in vegetable compost. The rhizomes should not be buried in the ground but should lie on the surface of the soil well exposed to the sun. It is found that some years irises do not flower as well as they should, but if left alone they may give a good show of bloom the following year. If they fail to flower well two years running it is a good plan to replant them in a better compost.

The type *Iris kaempferi* have delicate tall flowers very suitable for the water's edge, and these grow in a mass like a rush and appear to do quite well in the same position for many years. There are several types of iris very suitable for the water garden; some can be grown actually in the shallow water, and others in ordinary soil at the water's edge.

At this time of the year life in the pond will be very prolific. The fishes may have bred, giving you many fry, and other forms of life, some beneficial and others not so good, may have multiplied in the water. If any pond is kept for plants and no fishes are kept therein it is almost certain that before long many pests will be present in the water. The one that is almost certain to appear is the larva of the mosquito. These little wrigglers will float to the surface of the water and on your approach wriggle down again. When they develop into mosquitoes they can become a nuisance. It is then essential to have a few fishes in your pond to ensure that none of these larvae remains uneaten.

It is a great pity to see local authorities spraying ponds with insecticides, etc., to kill the pests, when the introduction of a few fishes would keep the water free from them. Mosquitoes are not the only pests which may visit your pond during the summer months.

Water beetles may appear and these can be harmful to your fishes. Unfortunately it is difficult to keep such pests out. They are able to fly quite strongly and so can travel easily from one pond to another. Although they do live mostly under water they have to come to the surface for air occasionally. This is when they can be caught with a net. They will breed in the pond and the larva which emerges from the egg is a very voracious creature, which feeds on any living thing it can catch. Very small fishes are eaten by these young water beetles. Another danger to fry are the larvae of the various dragonflies.

The large dragonfly with a long body is a familiar sight during warm weather. This fly lays its eggs in or near the water, usually singly, and the larva lives for a time on live foods and pupates when it can still eat and is very active. When ready it climbs up a stem and rests whilst the skin splits for the perfect insect to emerge. The short-bodied dragonfly lays its eggs in the water within a blob of jelly. The larvae are particularly repulsive looking and make short work of any young fishes they are able to catch. The other familiar type is the damselfly, these are far more delicate and the larvae not quite as harmful to fishes as the previously described types.

The pond skaters, spider-like creatures which skid about on the thin film on top of the water live mostly on flies which alight on the water, and they do not appear to be able to harm fishes in any way, nor do fishes appear to eat them.

Water boatmen can eat small fishes and so should be caught from the pond if seen. They can often be seen at the surface of the water at night by the aid of a torch, when they can be netted and killed. Most of the newts and other amphibians will have left the water by now after breeding, but it is probable that one or two frogs may remain in or near the water for most of the summer.

If the weather is at all thundery it is well to run some fresh water into the pond, especially if it is a small one. During such weather the water appears to lose a lot of oxygen, and those fishes which like a high oxygen content are soon in trouble. Among such fishes are trout and golden orfe.

If your pond is well established there is almost certain to be plenty of natural food for your fishes during the warmer times of the year. Therefore you should refrain from feeding them too often, especially with artificial foods. The number of fishes in relation to the size of the pond will regulate to a great extent how much food you may have to give. A well-run pond should be self-supporting during the summer months. Too much dried foods can soon upset the healthy balance of the water. If it is necessary to feed the fishes at all a small piece of garden worm can be thrown in at a certain spot, when it can be seen if the fishes take it readily.

Some pondkeepers are troubled by birds such as herons and kingfishers. Herons usually alight at the pondside and walk into the water. If some trip wires of fine blackened wire are placed about a foot from the ground at the pond edge this will often scare them away. Kingfishers like to have a perch of some kind on which to fish from, although they sometimes hover over water before diving for a fish. If they find your pond they can be very persistent, coming back soon after having been chased away. Cross wires or strong black thread stretched across the pond will often keep your smaller fishes safe from kingfishers. Where cats are troublesome it is a good idea to arrange a shallow ditch around the pond so that the cats would have to walk in water before they could reach the actual pond.

AQUARIST'S Notebook——

by

RAYMOND YATES

IT is quite possible to keep an aquarium for many years without ever removing all the fishes, plants and gravel for a thorough clean out. Even where the gravel begins to turn black, many months' respite can be obtained by adding fresh gravel. Even so there comes a time when even the best set-up needs a proper spring clean. This can only be done by removing everything, including the water. Many aquarists are doubtful when it comes to removing all the water from a tank as they fear this may result in a leak when it is refilled. In actual fact this is no worry provided that the period when the tank is quite empty is reduced to a minimum. First remove all fishes and plants, then scrape the sides with a razor blade and follow up with a wipe over with a soft cloth or, better still, cotton wool. Allow sediment to settle and then siphon off about seven-eighths of the water. Now remove the gravel —it is quite easy to do with a fish slice, and when almost all has been taken out add another two gallons of cold water. Give the tank a final swill round, allow to settle and then siphon off all the remaining water. The tank is now spotless and fresh water can be added immediately (or the old tank water returned) with almost no loss of time. This way no leaks occur, even in large tanks of four-feet length.

The gravel cannot be cleaned quickly and is best spread out on an old tin or other large flat surface and left to dry out in the sunshine, turning it over from time to time. The longer the better, but even so short a period as 24 hours will do. The gravel will have to be rinsed repeatedly under running water to remove detritus, the blackened effect (bacteria) having already disappeared in the sunshine. Aquarists should take care when a tank is without gravel, but in use, that the heater does not lie on the glass bottom of the tank, as then a crack can result. It is wiser to put the heater in a chair of rockery to prevent it touching either the bottom or side glass. Plants can be given a complete overhaul, old leaves being cut away and fresh cuttings taken. Where completely raw water is put back, the fishes rarely suffer (i.e. barbs, tetras, cichlids and anabantids), really conditioned water being only for a few less hardy species. One trick is to put a peat block in the tank. This will float on the surface but will at last submerge and will be ignored by the fishes. It does not disintegrate and materially assists in lowering the pH (i.e. gives acid conditions).

* * *

The well-known firm of Brosiam Ltd., have now put on the market a rather novel form of diffuser. This consists of a rubber cup or kettle into which fits the diffuser stone, and the air is fed into the bottom of the rubber kettle through a glass tube. This results in some air pressure being built up in the kettle below the stone and, in due course, an even distribution of fine air bubbles. Any leak round the rim of the kettle usually seals itself within a few hours. The rubber kettle (jade green) is non-toxic and, being filled with air, tends to float, so it is best anchored in position with a suitable weight.

* * *

Perhaps one of the most worrying aspects of the hobby is the fact that sooner or later a valued fish goes off its food. Nothing can or will tempt it to eat and the owner begins to get very hot under the collar as he realises there is little he can do. Some fishes are more prone to this habit than others, in particular angels and discus. It is never a good sign, but hobbyists should understand that it may be due to one or more reasons. With age many fishes tend to go off their food, others are mainly "after-dark" eaters and will not be tempted to change their habits. Imitation and copying other fishes can be a reason, as also is nervousness in new surroundings and the probability that the fish is scared of larger or quicker fishes in its tank. Then again, many fishes dislike intense light but get it nevertheless and can hardly be blamed if they fear to feed in such circumstances. Feeding the wrong food or lack of variety is all too often the reason. Finally, internal illness can be the cause and this is often the case with angels. What can be done for these fasters? Really very little. One can only hope for the best and try out a few tricks such as putting the faster with some really greedy eaters, in the hope that he will imitate them in time, or isolate the fish if nervousness is suspected. Unusually tasty tit-bits help, but as a rule hunger overcomes nervousness where this is the reason. A change of tank or of water sometimes helps but there is no hard and fast rule. You have to meet this difficulty yourself when it comes. Of course, the females of some species never eat when they are looking after their eggs.

* * *

Although 1955 produced the best summer for some years there was a drop in the number of visitors to the London Zoo, where the figures showed 2,078,460 visitors compared with 2,296,703 in 1954. The attendance for the aquarium also fell by about 20,000 to 358,647, from which it will be seen that approximately one in every six visitors to the zoo also looks in at the aquarium. This figure has remained more or less constant for some years, and is probably due to the fact that there is an extra charge for the aquarium. Running public aquariums is an expensive job, nowadays, the expenditure at Regent's Park for the aquarium (covering salaries, wages, exhibits, provisions, fuel, light and general maintenance) being over £10,000, happily offset by the income from aquarium admission charges, which topped £13,000. Alterations have been made to the freshwater circulation system and the manatee pool has been reconstructed and enlarged. An expedition to British Guiana produced many specimens for the zoo, including two electric eels. New additions to the aquarium include the scissor-mouthed characin (*Neoborus ornatus*), *Rasbora maculata*, *Mogurnda mogurnda*, snipe fish (*Macrorhamphosus scolopax*), *Eleotris fusca* and the puffer (*Tetraodon mbu*) from the Congo. A number of fishes were donated to the aquarium, these included five lungfish, three guppies, three mother-of-pearl cichlids, two black-dorsal catfish, two black sharks, one beacon, two black widows, one tetra, two zebras, one sucking catfish, four *Eleotis*, 44 common goldfish, one perch, four tench, one common carp, one golden carp, one golden rudd and one golden orfe. Last but not least, 46 wasp gobies. Donations of fishes are always welcomed, as also are books for the library, which is now valued at £100,000. Sir Winston Churchill was one of many notable visitors during the year. He came to inspect the tropical fishes which he recently deposited in the aquarium.

* * *

The manufacturers of the well-known Es-Es equipment set out very neatly in a small brochure the answer to the question "What size of heater do I need?" They point out that the governing factor is the lowest likely temperature of the surrounding air at night in winter time. If indoors, this figure would probably be around 40° F. To maintain

the aquarium at 75° F. the heater must be capable of raising the water temperature by 35° F. From this we can work to rule—14 watts will raise one gallon of water by 35° F. To find your own needs, multiply the 14 watts by the number of gallons capacity of the tank, which gives the heater wattage required. For example a 10-gallons tank would need 10 × 14 watts—you would need a 150-watts heater.

* * *

The blue acara is a very hardy fish and will stand a great deal of ill treatment. When these fish jump out they suffer the usual distress but often recover even if caked in dust and dirt and overlooked for quite long periods. They also seem immune on such occasions from attacks of fungus or fin rot which can often follow a jumping-out incident. Where a fish has jumped out a good idea is to put it in a net and swirl it round in the tank water (figure of eight fashion) which assists in removing the dirt it has picked up. An even better way is to hold it in the net in the tank and pour cupfuls of tank water over it until reasonably cleansed. Some time ago I had some surplus blue acaras which were very large (and therefore the sort of fish you cannot even give away) so I tried out an experiment.

I put one of the fish straight from a temperature of 80° into really cold water, just below 40° F. The fish coloured up, dashed about for a few seconds, turned over on its side and was dead in 90 seconds. A second fish given the same treatment produced exactly the same reaction. I now took two other acaras and gave them the shock treatment but only for 70 seconds, at the end of this time returning them to the tank water at 80° F. Although at first they were lying on their backs they immediately swam away on an even keel and showed no ill effects, apart from rather rapid respiration. Within 10 minutes they were eating *Tubifex*. No further troubles resulted, no white spot, no swimbladder trouble, nothing. Tropicals die in colder water because they become so numb that paralysis sets in, their muscles no longer work and breathing stops. If a current of water could be passed over the gills it might be possible to save some such chilled fish which die merely because the breathing action stops as a result of the numbing effect of the (to them) cold water.

* * *

Baby fishes can be reared in the community tank provided that they are cichlids and father and mother are with them. I have done this many times, but the other fishes have a miserable time keeping clear of the angry parents. Live-bearer fry, however, are doomed usually. However, I managed it recently with some yellow-wagtail platys which seemed to have been born with extrasensory perception to avoid many hungry enemies. I knew they had no chance but in this hobby one never can be dogmatic. They laughed at all the rules and survived in the top plants in the cheekiest possible manner. However, I had no angels, paradise fish or tetras in the tank, I rate these species as the surest baby-killers there are if given a chance.

* * *

Of all live foods, month in, month out *Tubifex* is the easiest to obtain if one lives within easy reach of a dealer. It is the main standby of many aquarists because it is so easy to buy (except perhaps in the very hottest weather), and there are very few fishes which do not accept it readily. Although aquatic it is sent out by collectors to dealers in tins containing very little water, so that the main mass of the worms is exposed to the air. This prevents the loss of much of the *Tubifex*, which occurs as a result of suffocation when they are kept in small quantities of water entirely submerged, or in warm water. Most of the commercial supplies obtained in Britain come from the lower reaches of the Thames, although the worms are found in vast quantities elsewhere, as for example in the Trent. Tins of *Tubifex* are dispatched to dealers by passenger train marked "To be called for" at the nearest station. The collectors charge about 3s. 6d. per pound for it, plus about 2s. carriage on the tin, which is not returnable. Two pounds of solid *Tubifex* just about half fills a small bucket, perhaps a little less. Most dealers sell *Tubifex* in reasonable portions but a few do not. I have seen 2s. 6d. charged for an eggcupful.

A reader (Mrs. Doris Stamp of York) tells me of her method for keeping *Tubifex*. The worms are put on an inverted bowl standing on the bottom of a pail. About 18 inches from the ground a large Winchester bottle is set up on a box or stool and from this a rubber tube leads out from the bottle. The external end of this tube is fitted to a fine catheter so arranged that drops from this will fall on the ball of *Tubifex*. Once the flow of water from the Winchester bottle is started (by suction) it is only necessary to tighten a metal clip on the rubber piping to obtain the rate of flow (drops) required. Experience will tell how often it is necessary to refill the bottle.

* * *

When you come to think of it, fishkeeping is just about the cheapest form of pet keeping that can be indulged in on a large scale which is really rewarding, academically if not financially. There is a pride in possession and the greater the numbers the greater the pleasure. There are limitations, and a Canadian magazine recently featured a cartoon showing a young couple blissfully regarding their first brood of young guppies. This was followed by a picture of "Their hundredth brood" and showed the young couple ditching the unwanted youngsters down the toilet. Most people like change, and tend to tire of too many of the same variety of fish, and this explains the anxiety of the fish breeder who wants to dispose of his fry long before they are sizeable just so that he can see some fresh "faces." Then again, most pets have very ordinary surroundings, but the fish tank can be a delightful picture of a tropical paradise. There is no noise, which is so often a drawback with canine, feline and bird pets, no odours, no risk of damage to furniture and fittings and no exercising walks to worry about. Friends need have no fears, the dustman and the postman are both safe and no seed or moult hairs increase the work of the housewife. I coined a phrase long ago—"Fishkeeping is Fun," and it is certainly a great deal more fun than looking after some of the pets people keep nowadays.

* * *

The hobby is no more immune from the leg-puller than other interests, and I have overheard some amusing efforts in this line at shows and even at club meetings. Generally speaking it is not the raw beginner who is the victim but rather one of those gentry who "knows it all." Rather than admit there is anything they don't know about fish they will agree with any tall story and swallow any yarn. Once upon a time speakers were plagued with tall stories and catch-questions, but this is rarely encountered now. A well known "fishy" leg-pull took place in 1818 in U.S.A., when the naturalist Rafinesque visited Audubon. Audubon told him about some unusual fish then to be found in the river Ohio, and he kindly supplied Rafinesque with some notes and sketches of these fish which were said to grow to some 10 feet in length. The story went that these fish were quite bulletproof, as their scales were as hard as stone and diamond shaped. Indeed, dried scales could be used for striking fire with steel. The victim duly entered up all the data supplied and when he returned home told everybody about these rare fish and even went to the length of saying he had seen one. Ichthyologists far and wide swallowed the story, but, as with the Piltdown man, the truth eventually became known. A few years ago the magazine *Life* printed some of the original sketches.

Is the Loch Ness Monster a Fish ?

by

Dr. J. L. CLOUDSLEY-THOMPSON

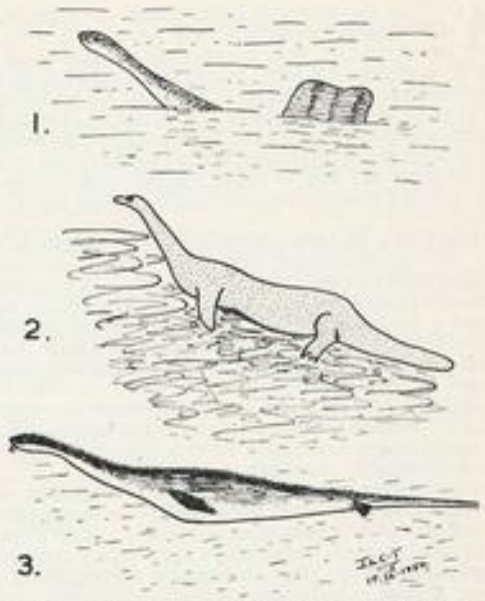
DURING August, 1954, a brief report appeared in the *Sunday Times* that the Loch Ness monster had been seen by a number of people, including the occupants of a motor coach. The discovery of the coelacanth may have tended to shake our healthy scepticism about the existence of undiscovered monsters, "living fossils" and the like. At any rate two well-known zoologists have recently suggested that the great sea serpent may actually exist, and have put forward identical hypotheses regarding its nature.

Dr. Maurice Burton points out in his book *Living Fossils*, that sea serpents have been alleged to have been seen by a large number of people over a period of many years and characteristically show a series of humps above the water-line when swimming. Now, Burton observed a conger eel at the London Zoo turning on its side and undulating its body vigorously, thus producing a series of humps from head to tail. He suggests that a giant eel carrying out the same manoeuvre would present an appearance similar to that of a sea serpent.

The larvae of the common eel, which measures up to three feet in length when adult, are only three inches long. Yet Dr. Anton Bruun, zoologist of the Danish "Galathea" deep-sea expedition, dredged up a larva six feet in length, and possessing over 430 vertebrae—three times as many as are found in the largest known eel. There was a dramatic moment while Dr. Burton was showing a film of the expedition during the XIV International Congress of Zoology at Copenhagen in August, 1953. After describing living organisms found at the very greatest depths, he asked: "If a chordate can live at the bottom of the sea, why not a sea serpent?"

It has been objected that nearly all the accounts that have been given about sea serpents are due to mistaken identity. No doubt giant squids are responsible for many of the stories that have arisen, for these creatures are known at times to come to the surface of the sea. One of their arms, 30 feet in length, one moment writhing on the surface and next raised aloft, must look very much like a serpent. Also sea serpents have sometimes been described as spouting water, an act that might well be expected from a squid. It has also been suggested that basking sharks, schools of porpoises, long strings of weed, giant ribbon fish and even flights of birds may at various times have given the appearance of a serpent.

It is more difficult however, to explain an unknown marine animal seen off the coast of Brazil not far from Parahiba by E. G. B. Meade-Waldo and M. J. Nicoll on 7th December, 1905, while cruising in the Earl of Crawford's yacht "Valhalla." This was described the following year in the *Proceedings of the Zoological Society of London*. The creature had a dorsal fin about four feet long projecting about two feet from the water: this fin was brownish-black in colour and much resembled a gigantic piece of ribbon seaweed. Behind the fin could just be discerned the form of a considerable body. "Suddenly, an eel-like neck about six feet long and of the thickness of a man's thigh, having a head shaped like that of a turtle, appeared in front of the fin." Unfortunately, the curious beast soon disappeared; but on the following night some animal made such a commotion in the water that it looked like a submarine travelling along just beneath the surface.



1. *"Sea serpent" seen off the coast of Brazil by E. G. B. Meade-Waldo and J. M. Nicoll in 1906*
2. *"Loch Ness monster" as seen by A. Grant in 1934*
3. *Most probable form of the "sea serpent" and "Loch Ness monster" according to A. C. Oudemans, 1934*

A firm believer in sea serpents was Dr. A. C. Oudemans, formerly director of the Zoological Gardens at the Hague. In a volume entitled: *The great sea-serpent: an historial and critical treatise*, Oudemans gave reports of 187 appearances, the suppositions and suggestions of scientific and non-scientific persons including 22 "explanations," and his own conclusions regarding the nature of the animal—that it was a huge, unknown, long-tailed pinniped. In 1934, he published a somewhat dogmatic pamphlet entitled *The Loch Ness Animal*, in which he stated that this creature was "nothing but a sea serpent."

If indeed there is a sea serpent and it has whiskers, a mane, two pairs of webbed, pentadactyl flippers, blows like a whale, its warm breath condensing in the air, and moves in a series of jerks, just as seals and sealions do, then Oudemans may be correct. Certainly a sketch by Mr. Arthur Grant, who claimed to have seen the animal in the road about eight miles from Inverness by the light of his motor-cycle lamp at 1 a.m. on 5th January, 1934, shows an animal that cannot possibly have been an eel but looks not unlike a seal.

On the other hand, in his book *Half Mile Down*, Dr. William Beebe describes a fish which he saw at a depth of 2,450-2,500 feet, that was at least 20 feet in length and deep in proportion. The whole fish was monochrome and he could not even see an eye or a fin. In shape it was a deep oval: it swam without evident effort and it did not return. This description certainly seems to be not inconsistent with that of a giant eel.

(Continued at foot of next page)

Starting a Tropical Aquarium—7

by AQUARIUS

MOST of the probable faults which can arise with a new tropical aquarium have been dealt with, but small troubles may occur with the fishes. If the tank is overcrowded with fishes, it is possible that an aerator will help matters but it seems to me to be rather silly to place so many fishes in a tank, that one has to keep constant aeration going to keep them alive. If an aerator is fitted it must not be presumed that all will in future be well. Even if fishes are able to obtain enough oxygen they still need plenty of space for them to be able to keep healthy and thrive.

When fitting an aerator there are several points to consider. In the first place there is no need to maintain a constant, strong stream of air into the tank. A great deal of exchange of gases will take place at the surface of the water. All that is needed is to create a slight circulation so that the water at the bottom of the tank can be brought up to the top. If your heater is well placed at the base of the tank this will promote a good circulation, for as the water warms up above the heater it will rise, and the cooler water above it will descend. Remember that the water at the bottom of a tank will soon become foul unless there is either a heater or an aerator to circulate the water.

An important point which is often forgotten when running an aerator is that the air which is being pumped into the tank should be as pure as possible. Therefore it is not of much use switching on an aerator in a room when heavy cigarette or pipe smoking is taking place. An aerator should only be on when the air in the room is reasonably pure. Where fish-houses are concerned it is often a good plan to see that the intake of the aerator is fitted outside the house so that only fresh air can be pumped into the tank. In cold weather it will mean that the heaters will be called into action more frequently, but this is a small worry when the health of the fishes should be the main consideration.

Many aquarists who are breeding find that some aeration is necessary when a large number of fry are in one tank. Aeration is often more necessary at night time than by day. This is especially so if the tank is well planted with a number of oxygenating specimens. These will give off oxygen during the hours of daylight but at night time they give off carbon dioxide only, which will not improve matters in the tank. A sign of insufficient oxygen is when the fishes mouth at the surface. Such a sign must never be neglected. Make sure that the tank is not holding too many fishes. The allowance might have been all right when first put up, but after some time it is reasonable to suppose that the fishes will have grown and a few may have been bred in the tank. Some aquarists never think of reconsidering the "fish-per-inch of surface" rule once the tank has been set up, but after even a month many tropicals can have doubled their size and so put out all the earlier calculations.

When fishes are mouthing at the top of the water it is possible that it has become foul, through the decaying of uneaten food, dying vegetation or dead snails. When the water smells and takes on a slightly milky hue it is essential that the tank be thoroughly serviced. As much mulm as possible from the bottom should be siphoned out, even if it means removing most of the water in the tank. Make sure that all the base of the tank gets a cleansing, and then when fresh water is added (at the same temperature as that removed) the fishes will soon recover and swim about as if nothing has happened. It is amazing how soon fishes can recover from lack of oxygen. I have known fishes on their sides, to all appearances at their last gasp, which have revived within a few minutes in fresh water and have shown no signs whatever of their previous distress.

Pests and diseases should not be troublesome in a tank provided that sufficient care is taken. Most fish troubles are imported into the tank either with fresh fishes, plants or live food. No fresh fishes should be put straight into the set-up tank with others until they have had about a week in quarantine. If then they look quite well they may be added to the tank. With plants it must not be assumed because no pests are obvious on them at the time that it is safe to plant them into your established tank. Again it is necessary to see that they are all clear first. Some pests may lay their eggs on the plants and these may later hatch in the tank and do damage; even argulids (fish lice), can lay their eggs on plants.

Although some troubles can be started in the tank by infested fishes or plants I consider that one of the worst sources of trouble are live foods, when certain precautions are neglected. There are one or two live foods which have always seemed safe to me, and the important ones are garden worms and white worms (enchytrae). If you are breeding your white worms under correct conditions I consider that they are one of the finest small live foods for tropicals. It is with live foods which must be reared or procured in water that trouble may occur. These are *Daphnia*, *Tubifex*, glass worms, mosquito larvae, and the like. When any of these are gathered from a natural pond it is quite possible that among them may be many harmful pests which can after a time do a considerable amount of damage. Before feeding such foods to the tropical tank it is a good plan to empty them into a white bowl so that any undesirables can be caught. Some may be of a fair size and easy to catch, but others may be very small indeed, and it is these which may soon grow on in the tank and give trouble. The larvae of the various dragonflies and water beetles may be fairly obvious, but some of the larvae of the smaller insects may be present but almost invisible to the naked eye.

You may see some small water lice, which are something like wood lice in appearance, and think that they will be good food for your fishes, but remember that only larger fishes can eat them and that they in turn can and do eat small fishes. They have been seen at night to attack a fish in small swarms, so that the fish is hidden by the pests, and it is soon killed and devoured. Water boatmen will also kill and eat small fishes and so the need for removing these from the water containing the live food should be thoroughly understood. *Tubifex* can be the cause of some troubles in the tank if fed to the fishes soon after having been collected. These worms should always be placed under running water for a few hours unless they have been purchased from a reputable dealer, when they have probably been cleansed.

It can be realised then that many of the troubles which some aquarists meet could have been avoided by taking reasonable care. Some diseases and pests appear even in the best regulated tanks, but they are very rare indeed, and it is almost certain that 99 per cent. of troubles can be traced to something the aquarist has either done or left undone.

Is the Loch Ness Monster a Fish ?

(*Continued from preceding page*)

Thus it may be that the great sea serpent does exist and is, in fact, an enormous eel. It is not impossible that more than one kind inhabits the depths of the ocean. If one of these creatures were occasionally to find its way into the restricted waters of Loch Ness, its appearance might well occasion reports of a fabulous "monster." So if that is the explanation, then the Loch Ness monster *is* a fish!

A Fine Marine Display at TORQUAY

by L. R. BRIGHTWELL

IT is all in keeping with the country which produced Alice in Wonderland, that whereas the eastern end of the English Channel has not one aquarium, the coast of South Devon is so richly supplied in this regard that one frivolous observer has declared Devon will soon have more fishes in tanks than in the sea.

But as with the Alice books, there is a certain logic in this. Only a century ago it was in South Devon that the austere Plymouth Brother, Philip Henry Gosse set in motion the machinery which gave rise to the Marine Aquariums, private and public, which now ring the coastlines of the world.

Every one of South Devon's lovely bays is a well-recognised holiday resort, the climate almost Italian, the water wonderfully clear and teeming with life, much of it insurgent from the Western Ocean and sunlit waters far south.

So it comes about that not only did Plymouth in 1884 found the first big marine laboratory, headquarters of the Marine Biological Association of the United Kingdom, but she has given rise to a thriving brood of small aquariums, at Looe, Fowey, Paignton, and now Torquay. Though the youngest of P. H. Gosse's chicks, as they may be called, Torquay has made a fine start which must inevitably lead to vigorous growth in the very near future.

The aquarium stands close to the harbour, overlooking one of the loveliest bays even in Drake's famous country. The building holds some 48 tanks. It is in the hands of a company known as Aquaria Research Ltd., with Mr. N. H. Dixon as chairman, and Mr. Horace Sinclair (Member of the Marine Biological Association) who designed the place, as curator and managing director. Mr. Sinclair will already be well known to readers of *The Aquarist* and brings to his very arduous task a wide experience.

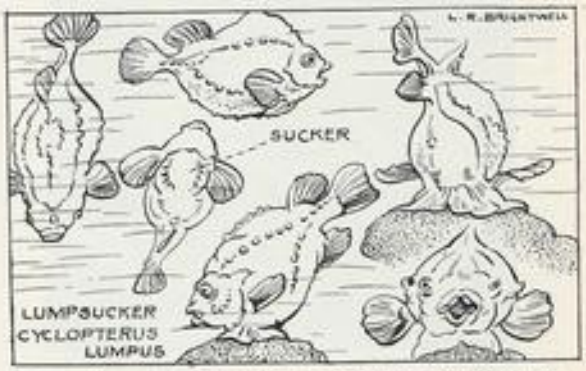
For some years he was in charge of the late Herbert Whitley's unique zoological and botanical collection at Paignton—the home of P. H. Gosse—and later set upon its feet the aquarium at Southsea. Being not only a naturalist, but a good seaman, he therefore has all the qualifications for what is beyond doubt the most exacting branch of animal keeping. Lions, elephants, or monkeys are simple creatures to control compared with the uncountable children of the sea.

The aquarium holds an interesting collection of cold freshwater fishes, and of course "trops," because if an aquarium displays whales and mermaids even, some visitor will write it off as "hopeless" if it does not also feature guppies and swordtails.

But Torquay very wisely lays greatest accent on the sea. It is a sound policy, for it demands no absurd wastage of money upon rarities. The commonest sea animals are highlights—if properly displayed. It comes as a revelation to the ordinary man to see for the first time an unboiled lobster, or a lemon sole unspoiled by lemon, melted butter and "chips." Utterly blasé to overplugged "trops," sick of swordtails and gorged with guppies, he gets a real kick out of a starfish, or seeing a covey of queen scallops "on the wing."

Devon waters abound in semi-exotic forms. Many of Torquay's marine tanks are literally lit up by that remarkable crustacean, the great squat lobster, *Galathea strigosa*. It is a glaring scarlet, streaked with "neon-light" blue. A quite unforgettable creature. Many of our Devon fishes also, such as the dragonet, dory, and wrasses are the equals of any fishes from far-eastern coral reefs. Anemones of many kinds garnish every tank. The water, rich in plankton, supports the most splendid of all our anemones, the plumose (*Metridium*), and amongst fishes can be seen such strange forms as the big lump sucker (*Cyclopterus*) and the little Cornish sucker, both capable of clinging to the glass by their strangely modified breast fins.

The hall-mark of a good aquarium is a good service gallery, and not all the £5,000 spent on the aquarium's instalment has been put in the shop window.



Torquay Aquarium features this remarkable football-sized fish. It deposits egg masses as bulky as itself in the tank

Back stage are spacious reserve tanks, sand filters, a very adequate aerating plant, and all such vital matters as control stop-cocks, wing-nut taps, etc., are clearly labelled for the guidance of the staff. A ¾ h.p. pump serves as the aquarium's "heart," pumping water direct from the sea. To prevent feed pipes becoming choked with mussels or sponges entering as plankton, they can be periodically flushed with fresh water. Neglect of this feature has caused much trouble from stoppage in more than one aquarium. Fresh sea water is of course the key to success.

In its first few months the aquarium was able to show no less than seven octopus. Finest of all this aquarium's assets perhaps is the possession of its own collecting vessel, a five tons, petrol-driven cabin cruiser, "Lady Ursula." During its first few months the aquarium one day welcomed 1,500 visitors, all well pleased at the modest charge for admission at one shilling per head, and children half as much.

It is not surprising that with so auspicious a start and excellent prospects, the aquarium will shortly issue a guide book, clearly illustrated so that all the many fascinating exhibits can be at once identified and more learned about their multifarious ways of life.

Torquay is well in step with a county that has shown for a long time by its fine west-country radio programmes that education can be fascinating—with the right people to do the educating!

What's New?

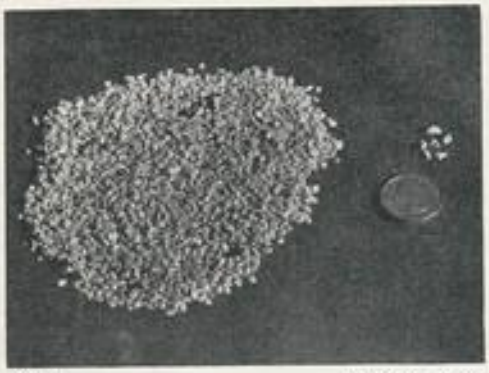
BRITISH Berkefeld Filters, Ltd., of Kent, the well-known water-purification experts, have produced an ionic-sterilising medium which can be used in any filter apparatus where water is raised, aerated and filtered before passing through the charge. It is based upon the principle of sterilising the aquarium by means of silver ionisation, and the medium consists of silver coated granules (from which silver ions are transferred to the tank water) and a sheet of porous plastic filtering material (about 18 ins. by 6 ins.) which can be cut to fit any filter. The advantage of using this material is that it can be washed in cold water and replaced. This new system has several effects. The transfer of silver ions to the tank water keeps the bacterial content to a minimum, thus ensuring healthier fishes. Sick or weakly fishes when transferred to these conditions rapidly become more active. A much larger fish population per inch is possible, and the development of algae is retarded. Plant growth generally is improved. No adverse effects are felt by fishes but the medium could not be used in a breeding tank, since any eggs laid would be rendered infertile. Similarly, in fry-rearing tanks Infusoria would be killed by the ions.

This product was demonstrated at the A.S.L.A.S. show last year, where it created something of a sensation. It is

"Sterasyl" porous plastic filtering material

now available to all aquarists and has been put on the market by the distributors, The Liquifry Co. Ltd., of Dorking. It is marketed under the trade name of "Sterasyl." The standard pack is intended for a tank 24 ins by 12 ins. by 12 ins. In an internal filter the granules are protected from the incoming water by one layer of filter medium, and themselves rest on two layers. Glass wool could be used but has obvious disadvantages. External filters can have the charge suspended in a bag from the air-lift discharge. This bag can be made of nylon but not cotton or artificial silk. Activated carbon is not recommended for use, and the granules should not be used with water which has been treated with any chemical agent other than normal base-exchange water softeners. It is worth mentioning that soft water is beneficial, and particulars of a simple method of treating hard aquarium water will be given by the manufacturers on request.

Raymond Yates



Photos: Laurence E. Perkins

The seven-eighths of an inch coin to the right serves to illustrate the size of "Sterasyl" granules

FRIENDS & FOES No. 47

Spongilla Flies

NEUROPTERA

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

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

SPONGILLA flies, of which there are only four known British species, all belong to the family Sisyridae. Little is known of the food and general habits of the imagines, which are considerably smaller than the Osmylidae and have comparatively few cross veins in their quarter-inch wings. The females lay small clusters of pale-yellow eggs, each with a tiny knob on top, and cover the clusters with several thicknesses of silken web. This habit possibly gave rise to the Greek name *Sisyra*, which means a skin-like covering.

The tiny larvae drop or crawl into water as the eggs hatch, but unless they can speedily find freshwater sponges they are doomed to die, for as far as can be ascertained, they feed exclusively upon the juices of the sponge. To enable them to feed they are equipped with long probosces for insertion into the

Sisyra larva

tissues of the sponge, which they seldom leave. Oxygen is obtained from the water, and this is agitated by the rapid movement of their seven pairs of leg-like gills, situated on the side or front of the abdominal segments.

I have no evidence as to whether fishes will eat the larvae. If any aquarist tries them it must be remembered that they will perish of starvation if they are uneaten and without freshwater sponges in the aquarium. When fully grown (nearly a quarter of an inch long) the larvae climb out of water to weave silken cocoons in which to pupate. These are constructed above water level and firmly attached to a support.

C. E. C. Cole

Experiences with the Moonlight Gourami

by MICHAEL WATSON, B.Sc.

DURING last summer I read of the arrival in this country of a "new" species of gourami—the moonlight, *Trichogaster microlepis*, which had been obtained by Mr. Gerald Iles for Belle Vue Aquarium. Just before Christmas, I was able, through the generosity and kindness of Mr. Iles to take two of these fish on loan to see if I could breed them. I searched the literature, both aquarium and scientific, but the only references I could find were vague and unhelpful, so we picked what we hoped were a pair, being guided by a German book which said that the male "probably" had more orange colouring in its pectoral "feelers" than had the female.

So in fear and trembling as to what would be my fate, despite Mr. Iles's assurances, if the worst happened and I lost the fish, I got them home and placed them in a 15 gallons tank that was heavily planted with *Cabomba* and *Myriophyllum*. This was the last I saw of them for several days, as they proved to be extremely shy, contrary to what one would expect of fishes from a public aquarium; the smallest movement in my fish room sent them into the deepest thickets of the plants. To try to cure this I placed a pair of leeri gourami and a very tame female snakeskin gourami in with them. This worked very well, and after another week they were as bold as the rest and could be seen in their full beauty.

The moonlights are quite the most graceful of the gouramies. They are a delicate blue on the upper parts, shading to silver blue on the sides and silvery underparts with the pectoral and ventral fins of the male a bright orange. The "feelers" of both sexes are the most outstanding feature, being at least half as long again as the body of the fish.

The fish seemed to be surface feeders and would not touch food after it had reached the bottom of the aquarium. However, they were easy to feed, taking dried foods, with a special liking for Bemax, *Daphnia*, *Tubifex* and white worms from a worm feeder, and to a lesser extent, for earthworms, but only if finely chopped as they seem to have relatively small mouths.

On this mixed diet they rapidly gained condition, and one fish developed a well-marked, interrupted black stripe along its lateral line, and on 15th January, I removed the other fishes from the tank and increased the temperature to 80°F. The water was slightly acid, pH 6.8, and fairly soft, 58 p.p.m. I also included a maximum and minimum thermometer to keep track of the temperature fluctuations. The next day a scattering of bubbles appeared all over the surface and the two fish were showing off to each other. They would position themselves side by side in the water and move around with fins extended for a time, and then one would suddenly break position and begin "kissing" the other along the side of its body. The fish being "kissed" would arch and curve its body, until finally they separated for a time, only to begin the whole procedure over again with, perhaps, the position reversed.

Four days later, I observed both fishes blowing bubbles at the surface of the water, but no constructive nest building took place. The next morning a pile of bubbles about the size of the nest of a mosaic gourami was blown, and the fish without any black markings on its side was adding to the pile; I assumed that this must be the male. By the end of the day the male had built quite a large nest, centred round a medium-sized floating fern and including several strands of *Cabomba* and *Myriophyllum*, which had been uprooted or broken off by the male and were from six to ten inches long. These had been curled and twisted round and crisscrossed to form a circular structure about three inches in diameter.

A large quantity of *Riccia* was incorporated between the strands of larger plants. From above the nest appeared as a circular patch of *Riccia* that was elevated in the centre by bubbles blown beneath the plants.

The male was still not satisfied with the nest and continually scoured the tank for more floating plants, so I introduced a fairly large quantity of bladderwort into the far corner, before turning off the light for the night. Next day the male immediately began to incorporate this new material into the nest. He would take hold of a few strands in his mouth and then, swimming backwards, shake his head and tug repeatedly until he eventually got a portion free, when he would carry it back and carefully place it under the nest, curving it round and pushing each piece about until its position absolutely satisfied him, and then returning for more.

By that evening he had added the whole of the bladderwort plus a few more strands of *Cabomba* to form an enormous nest which was almost exactly circular in shape and about six inches in diameter. It reached about half-an-inch above the water surface, being raised, I suppose, by the quantity of bubbles which were blown into it, and extended a good inch below the surface, making a nest which put all the other gouramies, etc., to shame and which made *Betta* nests appear nothing more than amateur jobs. The rest of the day the male spent in tucking in any untidy edges which spoilt the nest, circular outline of this nest, and blowing more bubbles under it. He took large gulps of air into his mouth at the surface and then swam below the nest and released a shower of tiny bubbles whilst he spun round in a tight circle, so that the bubbles appeared to come from all over his body. Also he made rather less frequent trips to the bottom of the tank, where he collected mouthfuls of mulm which were also blown into the nest. This latter action made me wonder whether if finer sand had been included on the floor he would have used that, or whether the gouramies are really more interested in mulm than sand for their nests, and if it is an instinctive attempt to provide a concentration of Infusoria round the nest for the benefit of the newly hatched fry.

The female during all this time was blowing odd bubbles all over the surface of the water, but was not allowed to help with the nest. Both fish ate greedily at the *Tubifex* and Bemax which I provided alternately in small quantities several times during each day. I was watching closely for a change in attitude of either fish to indicate that spawning had taken place, as it was obviously quite impossible to see any eggs in a nest of that size, but though the male spent much time stationed under his nest the female was allowed near at any time and the kissing went on as before. It came as a great surprise, although a very pleasant one on the Thursday morning, to find young fish scattered all over the tank when the lights were turned on. Neither parent fish seemed to be molesting them, but the lights had been off all night and I was going to be away all day, and so I decided that no chance could be taken; since the young were already swimming quite freely both parents must come out —at once. This proved to be easier to decide than to carry out, and the next three-quarters of an hour proved to

be one of the most frustrating I ever wish for, the adult fish proving themselves possessed of greater cunning at escaping capture than I have ever encountered in any fish before.

I fed two jars of green water in the morning and two more in the evening, leaving a 25-watt bulb all night. The fry were larger than, say, *Colisa* or *Betta* fry, and on the second day I put them into an Infusoria culture containing mostly small organisms. Two more days saw the fry greatly increased in size, and eating *Paramoecium* and prepared fry foods, and a week after they became free-swimming I fed micro worms to them by means of a slowly running drip tube, and alternated this for the next few days with feeds of newly hatched brine shrimps.

I now began to think that my troubles were over and that at the first attempt I had succeeded in rearing a batch of young from a "new kind" of gourami. But this was not to be, and the young began dying off in ones and twos until after another week only five were left. These five were taking chopped *Tubifex* and very small white worms and seemed to be thriving very well. Every time I went into the fish house my first job was an anxious count of the five. Then they decreased to four; I checked the pH, and it had not varied; the maximum and minimum thermometer showed a total temperature variance of 79-84° F. over the whole period, and a test revealed no copper to be present. In desperation I changed half the water, but a few days later was down to one youngster. This lived for a few more days and then one morning that too was gone.

However, at the present time, the male is once again beginning the construction of a nest, and I am keeping my fingers crossed this time.

More about Filtration

by JACK HEMS

FURTHER to my article on the subject of filtration, which was published in *The Aquarist* last year (November, 1955), I think a few notes and sketches dealing with some uncommon methods of filtering and circulating aquarium water may help and inspire some readers to devise and operate similar systems of their own.

Many aquarium keepers will have already sufficient odds-and-ends in their tool boxes to rig up a few of the systems discussed below. But the actual necessities include several feet of narrow-gauge rubber tubing, two or three pinchcocks, a few feet of glass or plastic tubing to fit tightly inside the rubber tubing, an automatic siphon or two, and, of course, the all-important air pump.

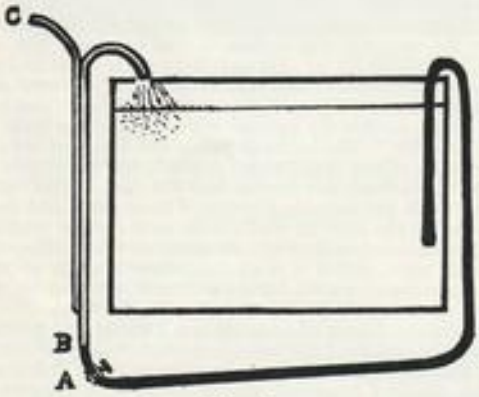


Fig. 1.

Fig. 1 illustrates the running-water system. This system guarantees bright, well-oxygenated water which is beneficial to such fishes as cichlids, harlequin fish, mountain minnows and the like. The incorporation of an interior-fitting filter box at the return end of the circulating system will extract a lot of suspended matter from the water, and is a worthwhile refinement.

To operate the running-water system, water from the aquarium is siphoned down the long length of rubber tubing and stopped by screwing down a pinchcock at A. Now slip the pinchcocked end of the tubing over the intake opening of an ordinary plastic air-lift (B), connect the air-line from pump to air-lift (C), switch on the pump, unscrew the pinchcock so that the water gushes up the vertical air-lift stem and is pushed to the top of the tube between the ascending column of bubbles—and hey-presto! away she goes.

Fig. 2 illustrates how three tanks set side by side may be kept well oxygenated and free from floating particles of sediment—yet all this is accomplished on one air-line. The running-water system, incorporating a filter box, is set up to operate between the two end tanks. The middle tank is linked up with the tanks on either side by automatic siphons. The sketches will show how the system works more clearly than any description in words.

Most aquarists know how to divide a tank by a sheet of glass so that two separate compartments are formed. Well, if such a glass partition is set across one end of a tank to form a narrow compartment, keeping the water crystal on the other side of the division becomes easy if an air-lift is so placed that an interchange of water is brought about between the two compartments; for, as the reader will readily understand, dirty water carried over the top of the glass partition by the air-lift will emerge thoroughly cleansed into the main body of water from the slight gap along the bottom edge.

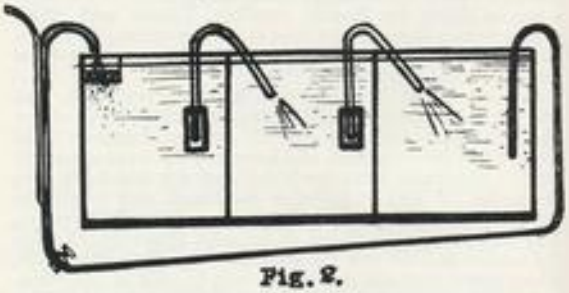


Fig. 2.

For this system to work satisfactorily, the glass partition must fit closely to the side of the aquarium; and every now and again the accumulation of mud in the narrow compartment must be dip-tubed or siphoned away to eliminate the possibility of an excessive multiplication of bacteria and other organisms.

On the other hand, if fry are being raised in the main compartment, it is a good idea to cultivate Infusoria in the narrow compartment, and reverse the position of the air-lift so that microscopic live food is pumped into the water containing the fry.

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.

Please will you give me the names of a few plants to grow in my new 36 in. by 15 in. by 15 in. tropical aquarium. As this aquarium is going to be placed in the lounge, I want it to look decorative.

We suggest the following plants, all of which should grow well in a properly lit aquarium: a double row of *Vallisneria spiralis* along the back to form a solid grassgreen background. Thickets of *Sagittaria natans* at both ends, extending from the back of the aquarium down to the front glass. The middle of the aquarium may be given over to tall-growing species such as *Echinodorus intermedius, Ceratopteris thalictroides,* tropical nuphars, and the like. In the shadow of the tall-growing plants set several *Cryptocoryne beckettii* or *Hygrophila,* the latter kept pruned to form a low-growing shrubby bush. If you use rockwork, be careful what you place in the aquarium. Marble, broken brick, cementwork, etc., cause no end of trouble. It is safer to use only granite, Westmoreland stone, and smooth-edged pieces of slate or quartz.

A few weeks ago I bought a pair of pale-yellow platys. Soon after I had installed the fish in a small aquarium, the female gave birth to some young. Much to my amazement, these youngsters do not resemble the parent fish. Some of them have black markings on the fins and body; some have golden-yellow bodies with red markings on the fins; some have dark blotchy markings on a pale-yellow ground. Can you explain this, please?

Probably your female was fertilised by another differently coloured male before you bought her. Unless fish of one colour or colour pattern are kept by themselves, and all deviations from the original breeding stock are removed from the aquarium before they become sexually mature, the different colour variations will interbreed and produce offspring unlike the parents.

I use two boxes of white worms to feed my tropical fishes. Recently, I have noticed tiny flies running over the top of the damp compost, and flying into the room whenever I lift the covers of the boxes. Please can you tell me how to get rid of these tiny flies without doing away with my white worms and making a fresh start?

Obtain a shallow tin and fill it with paraffin, taking care to wipe all the oil off the exterior of the tin, especially the bottom. Now place the tin on top of the soil and cover the box tightly with a piece of fabric or brown paper. The fumes will kill a lot of the flies. Repeat the treatment at frequent intervals until the flies eventually disappear. So long as you do not spill any of the paraffin oil on the culture medium, the white worms will not suffer in any way.

I have just bought a pearl gourami, but as I am a newcomer to the hobby of tropical fishkeeping I am rather concerned about the way this fish keeps coming to the top of the water for air. I feel sure the tank is not overcrowded.

You need not worry about your pearl gourami. Gouramies and other related fishes such as paradise fish and fighting fish breathe atmospheric air, and visit the surface every little while for a fresh supply of oxygen.

How can I get rid of planarian worms and tiny leeches which crawl over the sides of my aquarium after I have switched off the top light for the night?

Try suspending a small piece of raw red meat on a thread in your aquarium overnight. Remove it first thing in the morning. Planarians and leeches are attracted by meat and swarm over it. Another method is to remove the fishes from the aquarium, and introduce sufficient of a solution of crystals of potassium permanganate to colour the water deep red. After an hour or so, drain the water (or most of it) away, and refill with boiled water cooled down. A slight discoloration of the water will not harm the fishes, and in any case the water will clear of its own accord within two or three days.

I have bought several dozen *Vallisneria* plants over the last few months, but although they keep alive in my tank, they soon lose their long green leaves, and the new ones put out are yellowish and stunted. The tank is located close to a window, and, in addition to natural light, it gets about 10 hours of electric light every day. Where am I going wrong?

We think your plants are getting too much top light. This will cause a number of species of plants (*Vallisneria* among them) to stay dwarfed, or stunted. Try covering the surface of the water with a mantle of floating plants such as *Salvinia* or *Ceratopteris*, and prevent too much bright light entering the sides by covering the back and two end panels of the aquarium with tissue paper.

How can I get rid of a colony of *Hydra* which has become established in my 24 in. by 12 in. by 12 in. tank?

Remove the fishes to another aquarium, and raise the temperature of the water in the original aquarium to above 90° F. Keep the water at this high temperature for a week to 10 days before allowing it to cool down to normal. If extra heat fails to eradicate the *Hydra*, add about a teaspoonful of ordinary household ammonia to the water. After an hour or two, empty the water away, wash the compost, and refill the aquarium with boiled water allowed to cool down to about 75° F. If possible, allow the water to stand for a day or two before introducing any fishes. Before taking such a drastic step, however, it would be wise to examine your plants very carefully, for if the pests have taken up residence on just a few leaves, you can try cutting the leaves off and throwing them away before going to all the trouble of introducing ammonia and setting up the aquarium all over again.

I have been told that rain water is best to fill my aquarium with rather than ordinary tap water. I have a large galvanised drum in the garden which is filled by rainwater running off the roof. Will this water prove suitable for the aquarium?

Water taken from a galvanised container is not suitable for fishkeeping. It would probably prove poisonous. And while we are on the subject of rain water, do not use rain water which runs off a recently felted tar-felt roof, or a recently painted corrugated-iron roof, or a recently painted gutter or dirty gutter. Rain water for aquarium use is best collected in wood barrels (clean water-butts), or clean pot containers.

When I set up my aquarium a few months ago the pH of the water gave a reading of 6.8. But when I took the pH of the water a day or two ago I was amazed to find that the reading showed a pH of 7.4. Is it possible for the pH value of the water to change of its own accord? I have not added any salts, chemicals or fresh rockwork since the first reading was taken.

There are lots of reasons why the pH of the water will alter without the addition of chemicals. First of all there is the compost to consider. Particles of grit contained in the bulk might be of a calcareous nature, which would, in the course of time, rectify an acid condition. Even the glass sides of the aquarium, the cement used to glaze the frame, the sort of food fed to the fishes, the fishes' excreta, and so forth, all tend to alter the pH of the water one way or the other. The pH of aquarium water may give a different reading during the hours of daylight from that taken after dark, for the plant life influences the pH considerably. But too much worrying about pH is not wise. So long as the fishes eat well, look bright and healthy, and

breed without much trouble, it is best to leave well alone. Too much tampering with the pH of the water by adding rectifiers and the like often does more harm to the fishes than good. Fishes do not take kindly to sudden changes in the degree of acidity or alkalinity of the water.

A friend has told me that I shall never be able to produce fine male fighting fish unless I keep the youngsters isolated in small jars, one fish to a jar. Is this true?

The custom of keeping male fighting fish in small jars is based largely on the necessity of preventing damage to the long fins by other fishes. If a number of young fighting fish were allowed to grow on together, a certain amount of bullying, if not actual fighting, would be sure to take place, and ripped fins, though they heal, always show scars or light markings in the membranes and across the rays. All fishes develop better when they are allowed sufficient space to swim and exercise properly. A large aquarium divided into several compartments by sheets of glass makes the best developing tank for young male fighters.

Is it a good idea to remove the leaf on which angel fish have spawned and place it in another tank so that the eggs may hatch out without any danger of their being eaten or otherwise molested by the parent fish?

If the parent fish have eaten their eggs in the past, and show no signs of altering their behaviour, it is a good plan to remove the eggs from the spawning tank and hatch them elsewhere. But certain precautions must be taken, such as making sure that the leaf on which the eggs have been placed is not exposed to cold air, that the water of the hatching tank is the same temperature as the water in the spawning tank, and that no particles of sediment are allowed to settle on the eggs. The eggs should be shaded from bright light; artificial aeration is beneficial to the hatching fry; the tank water should be old, that is to say matured, and not very deep.

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

I have recently had trouble with two new fish in my tank. They approach a plant and flick their undersides against it. Is this gill-fluke trouble?

The fact that a fish occasionally flicks against the plants or rocks does not always signify that it is attacked by flukes. Some fish seem to do this as a pastime and may be in perfect health. When flukes are present the fish usually shows other signs and symptoms. It will go off its food and then later show some blood streaks on the body. It will then mouth around at the top of the water. The body becomes thin, and some affected fishes appear almost all head. This trouble is not usually fatal in a short period, which does give the aquarist a chance to kill the flukes and save the fish. I have always found that leaving the fish in a solution of a quarter teaspoonful of Dettol to the gallon of water for 15 minutes is a cure. A stronger solution can be used, but the fish must be removed as soon as it turns over and it must then be placed in fresh water.

I have converted an underground room into a fish house. There will be no natural light and I am wondering how much electric lighting I shall have to use?

There are two methods by which you can illuminate your tanks. Each can have a small-wattage lamp over it, as tanks could be regulated independently in this manner. Alternatively, you can have a strong lamp, say 150 watts, in the room, which would have to be on for about 10 hours each day. The fishes would not mind the subdued light very much but if you intend to grow many healthy water plants it is absolutely essential that some light is given. Only by experimenting with various wattages and lengths of time of illumination will you be able to get the desired results.

When I switch off the lights at night the fishes in my tanks sometimes panic. I have read of "dimmers" which enable one to lessen the strength of the light gradually, where can I get them?

Try some of the dealers who specialise in lighting and heating equipment for aquarists, and who advertise regularly in *The Aquarist*. Whilst waiting you might try the following method. Have a small lamp on at the same time as the main one, say a table lamp or bed-side lamp of low wattage. Switch off the strong light and then after a short time the weaker lamp can be put out. This will give the fishes a chance to accustom themselves to the change more easily. Most fishes soon get used to lights being switched off.

I am a member of the Coventry Pool and Aquarium Society. In the rules for showing fishes at table shows it is stated that fishes must be shown in glass rectangular jars. I have tried all over Coventry but cannot buy one. Where can I buy them?

It would perhaps have been better to have addressed your query to the society mentioned. Surely they would not make such a rule unless they knew that it was easy for it to be carried out? They are usually termed store jars and many multiple stores stock them.

Could you please tell me how it is possible to get rid of duckweed which is infesting my tank?

I rather doubt if the trouble is duckweed. You probably mean blanket weed. The former floats on the surface of the water only with its roots hanging down, it is very small and could be very easily netted from the top of a tank. The latter is a pernicious weed which grows on rocks, plants and sometimes the sides of the tank. It resembles stranded green wool. It is a growing water plant but if it gets too flourishing it can soon spoil the look of your tank. Much of it can be pulled out by twisting a broken stick into it. A blanket-weed remover is sold by most aquarists' dealers. Often if a tank is not in too good an order this weed will form, as it likes fairly foul conditions. Decaying food in the tank appears to encourage it as also does insufficient of other growing water plants.

I have an aquarium frame 36 in. by 18 in. by 18 in. Can you tell me if I should use 32 oz. or quarter-plate glass? Also how much cement compound should I require, and if I have all the ingredients can I make it myself?

The glass for the ends can be of 32 oz. glass, but the sides and base should be three-eighths. Ordinary white lead, linseed-oil putty, as used for glazing windows, is quite all right for the task, and you would need about a couple of pounds to do the tank. You can make it but I doubt if you will save anything by it, especially time. It is usually made from fine dry whiting or powdered chalk, linseed oil and white lead. Many types on the market are specially made for tank glazing.

I would be glad if you could put me in touch with any dealers who could supply me with eggs or fry of perch (*Perca fluviatilis*) **and pike** (*Esox lucius*)**?**

I doubt very much if the ordinary dealer would be able to supply you with the eggs or fry of the kinds of fishes mentioned. The most likely source would be one of the public aquariums where these fishes might breed. Perch usually spawn fairly early in the year and are one of the first British coarse fishes to spawn. The eggs are laid in a lace-like strip among water weeds. The fry hatch in just over a fortnight in average temperatures of 50° F. The pike also spawns fairly early in the year in shallow water,

and the eggs are not very adhesive. They later float just clear of the bottom and hatch in two to three weeks. The fry remain in very shallow water until the yolk sac is absorbed, which may take about 10 days. You might be able to collect some eggs yourself in waters frequented by these fishes, or get an angling friend to help you.

I have a tank 30 in. by 12 in. by 12 in. with two 15-watt bulbs for lighting. My fish spend most of the time with their fins closed at the surface of the water, with their mouths opening as if searching for air. I do not think the tank is over-crowded. What is the trouble?

In the first place unless the tank is getting plenty of natural daylight the lamps may not be strong enough to give you the flourishing growth in your plants which is necessary for them to be able to oxygenate the water. You may also have been overfeeding the fishes, when the water will soon become polluted. Fishes should not be continually mouthing at the surface; this is a sure sign of insufficient oxygen. They do, however, love to lie just under the surface of the water, especially when the lights are on, for they like the warmth. When they are doing this their bodies are usually horizontal, and not with the mouth at the surface with the tail some distance below. Test your tank water for odour, and if it is not fresh, change most of it and refrain from feeding for a few days, then increase the wattage of the lamps used and see if this improves matters.

I would like to know how to get the common goldfish for showing. Is it done by keeping the fish under special conditions?

There is much more in it than that. It is of little use showing a common goldfish just because it is in good condition. Under Federation rules there are certain pointings for such fish and you would do well to study the drawings, etc. in the Standards prepared by the Federation, which can be obtained from the secretary, Mr. R. O. B. List, 1, Coronation Court, Willesden Lane, Willesden, N.W.6. The common goldfish should be of a good-shaped body with no hump or pronounced snout, it should have medium-sized fins and a good colour. Condition and deportment also count and size can get 20 points out of a possible 100.

One of my large goldfish appears to be constipated; it is getting plump and does not stay upright in the water. I believe there is a cure for this trouble, can you advise me?

I am a bit dubious about this so-called constipation. I don't think I have ever come across such a case. Most fishes are able to void their droppings without much trouble, and I believe that in many cases where constipation is suspected it is something quite different. The trouble with your fish appears to be some form of derangement of the swim bladder. This fairly large bladder inside the fish is constricted, so that it appears as two bulbs joined by a narrow neck and then if one part changes size in relation to the other then the balance of the fish can be disturbed. This can be caused by any of many illnesses, a chill, overfeeding with unsuitable food or the sudden swelling caused by the formation of eggs in a female.

Some fishes are prone to bladder troubles from birth, and such cases rarely can be cured effectively. When an adult fish suddenly develops bladder trouble it is quite possible that it can be cured. The treatment usually given is to place it in shallow water; warm it a few degrees if possible and feed only on live foods.

I am about to glaze a tank, 30 ins. by 15 ins by 15 ins. The base will be of re-inforced wired glass and I wonder what size to use for the ends and sides?

You will be safe with quarter-plate glass. Where the depth of a tank exceeds 15 ins., thicker glass must be used (three-eighths or toughened plate).

I am about to set up a tank and find that my water supply is through copper pipes. On looking through *The Aquarist*, I noticed that copper can be dangerous to fishes. Is there anything I can do to make the water safe?

This question keeps cropping up and it is almost impossible to give a definite answer to the problem. So much depends on the water, whether it is soft or hard. So much also depends on whether the pipes are new or old. If the water contains some lime and the pipes have been in use for a long time there is far less danger. I think that if you let the water run for a time before you take some for the aquarium it may be all right. Where you take the *first* water from the pipes it may have been in contact with the copper long enough to be harmed but when this is run off the following water would not be likely to be contaminated enough to do harm, unless the pipes were quite new and the water fairly soft. Take some water as suggested and then put some snails or common fishes in the water. If they remain healthy your water should be safe.

One of my moors has a white spot in the middle of one eye. Up to now it can see all right and seems quite fit otherwise. Do you think it will get blind in time, and shall I keep it by itself?

This trouble often happens to the telescope-eyed fishes. The eyes protrude so far and are so delicate that they are very easily damaged. Any slight knock against a piece of rock or even the rubbing of the eye along a sharp gravelly bottom can do the harm. A slight attack of fungus often follows this damage. Try to bathe the eye with a little castor oil, occasionally, with some cotton wool; be very careful and do not rub too hard. Certainly the fish should be on its own. This applies to all ailing fishes, it is always best to keep any suspects by themselves, especially when receiving treatment.

I am a newcomer to fishkeeping and would like to know whether the breeding of golden orfe in an open pond presents any difficulty?

To a newcomer to fishkeeping I say yes to your question. Of all the usual coldwater fishes kept in ponds in this country I would put the golden orfe as one of the most difficult to breed. It is not, of course, impossible to do so, but a lot depends on the size of the pond and the fish. As a rule orfe will only breed in a fair-sized pond when they are about a foot at least in length. The water must be well oxygenated or they are not likely to breed. A good-sized pond with some form of running water or a fountain is more likely to suit the fish than any pond with stagnant water or water that is in any way polluted. Orfe spawn in the spring and chase similarly to the goldfish when spawning. The eggs are rather larger than the goldfish eggs, are adhesive and laid on fine weeds or roots of trees exposed in the water. Some roots of willow should be supplied in bunches to take the eggs. In any case, have a go, beginner's luck is well known in the hobby!

I would like to empty my pond and freshen it up by painting the inside with something in colour; how can I make a fountain using the pond water without having a fresh supply constantly running in?

You can clean out your pond to freshen it up but I do not think you will do a lot of good by painting the inside with colouring matter. It is very difficult to get anything to stick to concrete when under water. It is one thing to incorporate a colouring agent in the concrete when it is mixed but to try to put anything on after it has been filled with water would not be a very lasting job. Let it weather up on its own and the water plants growing in and around will soon improve the look of the pond. You can make a fountain to utilise the pond water by using one of the small electric pumps often advertised in *The Aquarist*. If you install one make sure that the intake pipe has a grid to prevent matter from clogging the opening, and do not use any copper piping.

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

Apparatus Faults

REFERRING to Mr. V. J. Singleton's letter (*The Aquarist* March/April) perhaps I may, as the person from whom Mr. Yates obtained several suggestions, be allowed a little space to reply. At the outset, I would point out that Mr. Singleton appears to have read many more implications into the article than were present, or ever intended, and seems to have been at very great pains to try and convince himself that his products were being unfairly represented. Taking his points by turn, and trying to be as brief and concise as possible, I would like to say the following:

(1) *Heaters.* I repeat that *many* makers will not repair their own instruments. The fact that the very few really large manufacturers will do so, does not detract from the truth of that statement, as there are infinitely more spare-time makers than large manufacturers. As regards suitable size, I am not so much concerned with the size of radiating surface as with the ability to produce a watertight seal, which even he will admit is much easier and considerably more efficient in a wider tube than in a narrower one, for the simple reason that a true seal depends not on cements and adhesives, but on the total degree of compression which can be obtained in the rubber bung. The design of an aquarium heater calls for much more than a mere consideration of size in relation to wattage. As possibly the largest repairer of aquarium equipment in this country, I feel justified in pointing out that my position is unique, in that I can take a completely unbiassed view of the whole run of such equipment, and can form my opinions on a mass of experience which is hardly likely to be enjoyed by any manufacturer.

(2) *Air pumps.* The article said that most plastic-encased pumps are far too small for the work required of them, and not for the amount of work which the makers recommend. The ignorance of electrical matters amongst the lay public, as also the inability to appreciate the limitations of small instruments, makes a very wide gap between the uses for which the makers recommend a product, and the actual uses to which it is very, very often put. As regards the plastic cases, I have no further comment to make, except that if the article led anyone to think that some of these were necessarily brittle, I am sorry.

(3) *Thermostats.* No comment whatever, as few *popular* models are indeed able to handle more than 200 watts. That is all that the article said. I would perhaps add that few popular models are restricted in use to 200 watts, where the opportunity exists to overload them rather than purchase another thermostat.

Finally, now that Mr. Singleton has, at some considerable length, shown that the remarks contained in Mr. Yates' article do not apply to products manufactured by Singleton Bros. (Instruments) Ltd., and now that I have stated that none of the remarks was so intended, everyone should be happy. As, however, I have the courage of my convictions regarding the ideal diameter, if not length, for heaters, I am now going to stick my small and humble neck out. I have before me as I write, a heater which is ⅝ in. diameter externally, and 5 ins. long. It is rated by the makers at 75 watts, 220-240 volts. This heater has become unserviceable owing to ingress of water, which is no reflection on the makers, as I do not know its age.

If Mr. Singleton will agree, I will make a 75 watt, 240 volt heater in a 6 ins. by ⅝ in. tube, and we will have a little friendly competition. If he will provide a heater ex stock, similar to that described above, we will try and arrange for both of them to be put in a small tank, connected in parallel to the same thermostat, and run at a fairly high temperature to give frequent switching. We will then see which is the first to admit a noticeable amount of moisture. The only stipulations I make are as follows: that the test should be carried out by a completely independant person, who shall be unknown to either contestant; that the heaters shall be guaranteed normal production models, which have not been in any way specially constructed or treated, and that the final result shall be published in *The Aquarist*.

If my heater admits water first, I shall apologise most sincerely to all manufacturers of narrow heaters, including, and especially, Singleton Bros. Ltd.

L. WARBURTON,
Warburton & Company, Romiley, Stockport.

Calling Canadian Immigrants

MANY of your world-wide readers may be interested to learn of the formation of the Ontario Aquarium Society. This society was formed in September of last year, and has steadily increased its membership at every meeting since its inception. It is run on the general lines of British aquarium societies, with films, lectures, question periods, raffles and a monthly show fish competition.

As secretary of this society, I was formerly with the Bournemouth Aquarium Club until moving to Canada three years ago. Many of our new members were hobbyists in Britain and have taken up the tropical fish hobby again after establishing themselves in the Toronto area.

If any British society would care to write, giving us the Toronto address of any former members who have emigrated to Canada, we will be happy to contact them and invite them along to meet fellow hobbyists from the "Old Country."

JOHN WRENN,
17, Edgewood Crescent,
Toronto 5, Ontario,
Canada.

Aquarium Decoration

HERE is a plant that thrives in poor light and near the humid atmosphere of the aquarium. The one illustrated is 14 feet from a window facing south and is now in its second year. Although of tropical origin, it has survived room temperatures as low as 45°F. It is desirable, however, to protect young shoots by covering with paper, if the temperature falls below 60°F. If this is not done, new growth is liable to cast its leaves for a short distance. This gives a bald appearance in places.

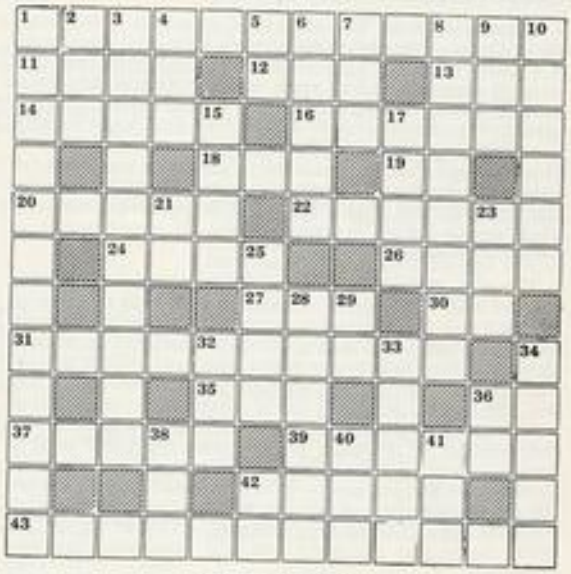
A mixture of peat and gravel appears to suit this plant, which is a member of the Aroid family. An abundance of water is required at all times, and a fortnightly dose of liquid manure during the growing season. As with all indoor plants, a weekly spraying is advisable. The leaves grow progressively larger as the plant ages. This plant is also amenable to training, but requires support.

There are a number of different varieties of *Philodendron*, and all are stem-rooting. In their natural surroundings they climb up trees; under house conditions, stem roots wither away and when artificially supported the plant stops forming them.

John Stanhope

The AQUARIST Crossword

Compiled by J. LAUGHLAND



CLUES ACROSS

1 These arachnids spin an air-conditioned nest under water (5, 7)
11 This is a gig and a gift (1, 3)
12 Could be Yag, but was it would be wasted (3)
13 Pay back the zelp (3)
14 Desirable implements for aquarists or fire tenders (5)
16 Another name for rudd (3, 3)
18 And another name for whale (3)
19 No credit for sailor in catching a crab (1, 1)
20 *Rutilus rutilus* (5)
22 Fish, for instance bred from two distinct species (6)
24 Long line of fish-hooks pegged on shore (4)
26 Male children (4)
27 Fish eggs (3)
30 Short week (2)
31 Dipnoi (4, 6)
35 Decompose. Tail this is a disease in fishes (3)
36 Objective case of I (2)
37 Last or perfect state of insect life (5)
39 Limb and tail for the inscription (6)
42 Ten before alternatively for continuity of state or a type of voice (5)
43 Find of the bloody weapon? No, an old aquarium favourite (3, 9)

CLUES DOWN

1 Aquatic plant sounds like one of the Royal Marines (5, 7)
2 Since (3)
3 Scientific names of tench (5, 5)
4 May be one unit of 27 across (3)
5 Little saint (2)
6 Common name of *Perca fluviatilis* (5)
7 These golden fish are nearly an idea for the garden pond (3)
8 Prominent facial features (8)
9 Could be 12 across, or large flat sea fish (3)
10 Uses, expends (6)
15 Sportsman's haloo or London district (4)
17 Small marine flat fish, not bad if it does not turn (3)
21 Little credit for this (2)
23 The sepia of the cuttlefish, perhaps (3)
25 Threesome (4)
28 Hustler, in a way (6)
29 What, rather crudely (2)
32 From the frog, and, in a way, from (3)
33 Fungus disease attacking certain plants (5)
34 Lad returns to me for reward (5)
36 Merchant Navy (1, 1)
38 Possible form of tank heating; certain product of decay in a tank (3)
40 Tail (3)
41 Age (3)
42 This to end (2)

(*Solution on page 89*)

Some Notes on *Elodea*

THE *Elodea* or anacharis species of water plants are very well known among aquarists and because of being rather common have lost favour in many places. Actually, they are among the best of the oxygenating plants and rarely fail to do well in the coldwater set-up tank. There are about ten species but one or two have been taken from the genus and placed in new ones.

Elodea canadensis, also known as *Anacharis alsinastrum*, water thyme, water pest, Babington's curse and ditchmoss, is a native of North America and was introduced into this country about a hundred years ago. Professor Babington brought some over and planted it in British waters, where it spread at an alarming rate. Many rivers and canals became almost choked with it and the position became very serious. However, after having caused many headaches in ministerial quarters it was found that the plant was gradually becoming less vigorous, and after a few years it appeared to take its place among the other water plants. It is not nearly as rampant nowadays.

The plant grows with long brittle stems, which are thickly clothed with tiny leaves. These are in whorls of three or four and each leaf is minutely serrated. When very young or in dark surroundings the leaves are inclined to be pale green, but they usually get darker with age. When a small mass forms in a tank it is an ideal place for spawning and fish eggs adhere very well to the leaves and stems. Being such a good oxygenating plant it is therefore a boon to the fish breeder. The stems readily make roots and so it is only necessary to place a piece of healthy stem in the tank for roots to be produced. It is better to lay the stem on the sandy compost and cover it with a small stone than to push the stem right into the compost. This latter method often means that the plant rots and does not make any roots at all.

If *Elodea* has a fault it is that it is inclined to run up to the surface of the water too quickly. This is, after all, its natural habit, as it is really a bog plant, or marsh one. When the stems have reached the top of the water and have started to twine around it is a good plan to nip off portions for re-rooting. If this pruning is carefully carried out at regular intervals it will be found that the plant will send out fresh side shoots near the base and so make a fine bushy specimen in the tank. The position should be towards the back of the tank or in the back corners. It makes a very good screen in such positions. In sunny weather it is possible to see many tiny bubbles of oxygen leaving the leaves. Whether much of this oxygen actually leaves the bubbles and enters the water is anybody's guess but it must slightly increase the circulation of the water. A very good point about this plant as far as its value in the tank is concerned is the fact that the strong action of the roots in searching for nourishment assists in keeping the water pure. As the roots take in most of the harmful matter in the droppings from the fishes it can be easily understood what a good thing it is to have this continual natural filtering taking place.

Other species are: *E. angustifolia*, which is a native of the streams of Florida. This plant has slender stems and the foliage is more elongated than the former species; it is more suitable for tropical tanks. *E. callitrichoides*, from the Argentine and Australia, has finely divided leaves with many small white flowers. It grows into a dense mass and so is good for a spawning medium. *E. crispa*, now properly named *Lagarosiphon crispa*, and *E. densa*, now *Egeria densa*, will be dealt with under their new names.

E. guianensis, an annual species from Guiana, is very tender and soon broken, and is not suitable for the coldwater tank. *E. linearis*, from the swamps of North America, has slender stems which are thickly covered with serrulated leaves and is suitable for the cold tank. *E. minor*, is a very small species, as its name implies, with very thin stems, small pointed thin leaves and tiny flowers. A native of North America, it can be used in coldwater tanks. *E. naias*, from Brazil is even smaller in form, having stems almost thread-like, and is suitable only for tropical tanks.

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.

A SMALL group from the **Bridlington and District Aquarists' Society** visited Ampleforth College, York, last month to study water plants and water insects at the pondside. At the College marine aquaria containing specimens collected by the local branch of the British Sub-Aqua Club were on view.

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TROPICAL fish studies made in India and Malaya was the subject of a talk given by Mr. C. D. Roe to members of **Bristol Aquarists' Society.** At the society's annual tropical fish table show points were awarded to winners towards a yearly total from three such shows, highest points receiving a trophy award.

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MEETINGS of the **Colchester and District Aquarist Society** are held on the first Tuesday of each month at the Gross Keys, Wyre Street, Colchester. Secretary is Mr. F. Robertson, 81, Harsnett Road, Colchester, Essex.

SCHEDULES for entries to the August show of **Corby and District Aquarists' Society** (see "Aquarist's Calendar") are now available. There are 19 classes for coldwater and tropical fishes, which are to be judged by members of the F.B.A.S. judging panel.

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DISCUSSION between Mr. T. L. Dodge (coldwater) and Mr. C. D. Roe (tropical) on the relative merits of the two main branches of the hobby formed the main event at the evening meeting of the **Coventry Pool and Aquarium Society** last month. During June an outing to Bristol Zoo was also arranged for members. Amended dates for the society's September show have been received (see Aquarist's Calendar).

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AT a recent meeting of the **Derwent Aquarist Club** samples of stone from the south coast, diagrams and coloured prints were used by Mr. W. H. Bratby to illustrate his talk on setting up aquaria for show purposes. Creation of perspective and the importance of harmony between rocks, plants, compost and background were points stressed by the lecturer. Last month a talk on breeding cichlids was given to the club by Mr. A. G. Lacey.

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WINNERS of the first half of a three-cornered contest between Shooters Hill, Greenwich and Erith societies were **Erith and District Aquarists' Society** (points: 20, 18, 23 respectively). Judging was by Mr. C. W. Credd (F.B.A.S.) and the second half of the contest will be at Shooters Hill on 18th October next.

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THE **Glasgow Eastern Aquarium Society** now meets on the second and last Wednesdays of each month, 7.45 p.m. at the Unionist Rooms, 351, Crown Street, Glasgow C.5.

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GOLDFISH and guppies formed the coldwater and tropical sections at a table show held by **Hampstead Aquatic Society** which was judged by Mr. R. O. B. List and Mr. F. Mead. When 15 members were later allowed to compare the results of their own judging with those of the experts only two agreed with Mr. List's placings and eight with those of Mr. Mead.

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MEMBERS of **Hastings and St. Leonards Aquarist Society** have been saddened by the sudden death of their president Mr. H. C. Pepper, a well-known Hastings aquarist. Recent activities of the society have included a table show for livebearers, a lecture on pH values by Mr. D. Kennard and one by Mr. C. W. Creed

on breeding fishes, plant growing and marine aquarium maintenance.

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SECOND annual show of **Kirkcaldy and District Aquarist Society** is planned for August; details and show schedule can be obtained from show secretary Mr. A. Blair 14, Miller Street, Kirkcaldy, Fife.

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GROWTH and propagation of *Cryptocoryne* was the subject of a talk given by Mr. D. M. Pullen of Nottingham to the **Leicester Aquarist Society** last month.

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WINNER of the open pond competition organised by the **Nottingham and District Aquarists' Society** last month was Mr. H. C. C. Carlton, of East Leake, Notts.

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MEETINGS of the **Reading and District Aquarist Society** are now held on alternate Thursdays, 8 p.m. at the Rising Sun, Forbury Road, Reading. Three table shows for livebearer, characin and labyrinth cups were held at a recent meeting, and all three awards were won by Mrs. W. Dolton.

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A TALK on judging methods and their application by Mr. A. Chapman was heard by members of **Rochdale and District Aquarist Society** at a recent meeting. Early this month the society visited the Belle Vue Zoological Gardens, Manchester.

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KINDLY act which gained the **Scottish Aquarium Society** publicity in a local newspaper was an offer to replace the goldfish pets of a Glasgow schoolboy who had risked his life to save his budgerigar and goldfish when a fire destroyed his home. His attempt was unfortunately unsuccessful, but when his family is re-housed the society has arranged to present him with new equipment and fish.

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AT a dance to be held by the **Southall Aquarist Society** on 10th August it is hoped that the Mayor of Southall will attend to present awards to winners of the show to be held on 4th-6th August (see "Aquarist's Calendar"). Mr. E. Sumnal has recently been elected chairman of the society.

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DISBANDMENT of **South London Aquarists** is announced, because of lack of support.

Aquarist's Calendar

7th July: **Lambeth Aquarist Society** open show, to the held at St. Luke's Church Hall, West Norwood. Show schedules are obtainable from Secretary Mr. A. F. M. Bartlett, 27, Beckwith Road, London, S.E.24.

13th-14th July: **Macclesfield Aquarium Society** fifth annual show in Brocklehurst Memorial Hall, Queen Victoria Street, Macclesfield. Show secretary is Mr. H. F. Cox, 24, Brynton Road, Macclesfield, Cheshire.

4th-6th August: **Southall Aquarist Society** annual show in conjunction with Southall Horticultural Show at Southall Grammar School

7th-8th August: **Leicester Aquarist Society** display in the horticultural marquee at Leicester Abbey Park Show.

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

10th-11th August: **Chelsea Aquarium Society** show "The Aquarium in the Home and Garden" at the Chelsea Community Centre.

11th August: **Romford Aquarists' Society** open show at Wycombe Hall, Romford Market Place, Romford, Essex. Schedules are available from show secretary Mr. C. E. Berkley, 37, Bridport Avenue, London Road, Romford, Essex.

16th-18th August: **Corby and District Aquarists' Society** second annual show at the Church of Scotland Hall, Occupation Road, Corby, Northants. Schedules available from show secretary Mr. D. Atkins, 363, Willowbrook Road, Corby, Northants.

17th-18th August: **Welsh National Aquarists' Society** Welsh Aquarists' Show at the Cory Hall, Cardiff (opposite Queen Street Station). Show schedules available from secretary Mr. R. B. Kennedy, 31, Blue House Road, Llanishen, Cardiff. Closing date for entries, 1st August.

17th-26th August: Guppy show in Berlin. Details from oversea secretary of the Federation of Guppy Breeders' Societies, Mr. H. Pearson, 41, Highshore Road, Peckham, London S.E.15.

22nd-25th August: **Midland Open Show (Midland Aquarium and Pool Society)** at the Minor Hall, Bingley Hall, Birmingham. Opening times: first day, 2 p.m.-10 p.m.; other days, 10 a.m.-10 p.m. Show schedules available from secretary Mr. T. L. Dodge, 48, Dunsmore Road, Hall Green, Birmingham 28. Closing date for entries, 31st July.

25th August-1st September: **Weymouth and District Aquatic Society** Show.

29th August-1st September: **Association of South London Aquarist Societies** annual show at Sutton Adult School, Sutton. Show secretary is Mr. A. Sayle. Society secretary Mr. H. J. Vosper, 23, St. Asaph Road, Brockley, London, S.E.4, will supply details.

31st August-1st September: **Walthamstow and District Aquarists' Society** exhibition of tropical and coldwater fishes at Hawthorne Road, Walthamstow, E.17. There will be no limit to the number of entries. Entry forms and further details can be obtained from show secretary Mr. D. E. Goodbody, 54, Somerset Road, Walthamstow, London, E.13.

7th-8th September: **Bethnal Green Aquatic Society** annual open show. Schedules and details available from show secretary Mr. L. G. Coombs, 14, Granville Square, London W.C.1. Closing date for entries, 6th August.

8th-9th September: **Willesden Aquarists' Society** annual show with open classes.

12th-15th September: **Coventry Pool and Aquarium Society** annual show at St. Margaret's Institute, Ball Hill, Coventry. Opening times, first day 7 p.m.-9 p.m., all other days 10 a.m.-9 p.m.

19th-22nd September: **Peterborough and District Aquarists' Society** fourth annual open show at St. Paul's Church Hall, Lincoln Road, Peterborough. Schedules and entry forms from show manager Mrs. S. Bean, 195, Eastern Avenue, Peterborough.

20th-22nd September: **Three Counties Aquaria Show** at the Oakley Memorial Hall, High Wycombe. Schedules available from show secretary Mr. K. H. Palmer, 3, Dedmere Rise, Marlow, Bucks. Closing date for entries, 31st August.

21st-22nd September: **Stoke Newington and District Aquaria Society** open show. Schedules and details available from show secretary Mr. W. H. Smith, 116, Lordship Road, London, N.16.

22nd-23rd September: **Federation of Guppy Breeders' Societies** annual show at the Zoological Gardens, Regent's Park, London N.W.

26th-28th October: **Blackpool and Fylde Aquatic Society** annual open show in conjunction with the Chrysanthemum show at the Olympia Winter Gardens, Blackpool.

Croydon A.S. Jubilee

AT the silver jubilee exhibition held by Croydon Aquarists' Society last month the chairman Mr. P. S. Boyes said that he believed the society could now claim to be the oldest aquarist group in the English-speaking world. No other society has come forward to challenge this claim, he said, which was tentatively first made by Croydon earlier this year in *The Aquarist*. Several council members of the F.B.A.S. were present, and the Federation had also supplied judges for fishes displayed and a silver cup for award to the owner of the best fish on show. This silver jubilee trophy was won by Mr. J. Penny, aptly enough, for he can claim the greatest number of years' membership. Altogether about 80 fishes of 50 different varieties were on view.

Teignmouth Aquarium

A NEW public aquarium at Teignmouth, Devon was officially opened last month. The building is leased by the urban council to Mr. L. A. J. Jackman and Mr. D. E. F. Halfhide, two school teachers who are also concerned in running another public aquarium at Paignton. The exhibition is designed to be educational as well as entertaining, and several new ideas are being tried; visitors can, for example, watch the tiny barnacles' movements through a microscope focussed on the animals.

Tifas

TIFAS is the name of the International Federation of Aquarium Societies, which held a convention in April this year at Chicago, U.S.A. This was its first convention since the one at which it was founded, in New York in 1955. The societies within this federation now number over 50 in America and Canada. At the convention guest speakers were Dr. D. L. Jacobs, Mr. W. Whitern, Mr. H. R. Axelrod, Mr. F. E. Dittrich, Mr. M. Hovlid, Mr. P. Hahnle and Mr. A. M. Fletcher. Next year's convention is to be held in New York City, when the Bronx Club will be host society.

New Society

Ringwood Aquarist Club. *Secretary:* Mrs. A. Heath, 45, Parsonage Barn Lane, Ringwood, Hants.

Holiday Invitations

AQUARISTS on holiday in the vicinity of an aquarists' society are usually made welcome at the society's meeting. Special invitations to readers of *The Aquarist* have been sent from **Blackpool and Fylde Aquatic Society** (contact the secretary Miss M. J. Fletcher, 13, King Edward Avenue, Blackpool) and **Exeter and District Aquarists' Society** (secretary Mrs. N. Crawle, 8, Clarence Road, St. Thomas, Exeter.

Crossword Solution

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

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