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THE AQUARIIST
GOURMETS throughout Asia esteem the giant freshwater prawn as a delicious food. Nutritionists think of it as a fine source of protein, and would like to see it available to more people. Up to now, no one has been able to culture them in captivity. Now, after work lasting 2½ years, a fisheries scientist in a Penang laboratory has solved the scientific part of the problem. Although prawn larvae are plentiful in their natural homes their subsequent development has always been a matter for conjecture.

Dr. Shao-Wen Ling studied the giant Malayan freshwater prawn (Macrobrachium rosenbergi) to find the best conditions under which eggs, after a long incubation period, would hatch into healthy larvae, and then, to develop ways of bringing the larval prawns to maturity. At the beginning the thousands of larvae produced in the laboratory were reared in freshwater but they all died within 4 to 5 days after hatching. Dr. Ling added a small amount of sea water to the freshwater, and soon he had young larvae living for as long as a week. However, it takes almost a year for a baby prawn to become an adult. He started again, with a different percentage of salt. The prawns lived a little longer. He found that, by gradually increasing the salinity of the water, he could make them live longer, but each failure meant starting again, and it took 2 years for him to succeed in rearing the larvae to juvenile stage and from juvenile to adult.

Each larva had gone through 15 different moulting periods before it became a juvenile and the water had been increased in salinity until it contained 40 per cent of sea water. Then, he found, they could successfully be put back into fresh water. All this led him to believe that the larvae hatch up river in fresh water, and gradually move down river towards the sea until they become juveniles in brackish water round the coast. Juveniles then move back up the river to grow to full size and breed again. At this stage they can survive in rivers, canals, ponds or even rice fields, and it is in these places, in fact, that they are usually collected.
How to Sex Aquarium Fishes

by J. S. MACDONALD

How many of us know how to sex our fishes? In most cases the primary sexual characteristics are not visible, being inside the body, and it is only after the fish matures sexually that the secondary sexual characteristics start to show.

With the livebearers, from an early age sex is quickly discernible; the female, besides having a rounded anal fin, basics, in nearly all cases, a small dark patch just above the ventral fins called the gravid spot. This is noticeable in some cases at birth. Male livebearers are somewhat same in showing sex; sometimes as long as 8 to 10 weeks after before the anal fin starts to thicken into the intromittent organ known as the gonopodium.

However, as I said, livebearers are easy to sex. With some of our other fishes, however, there is no apparent difference between the male and female; we have a harder task to sex them. I shall take them in families and try to give a few pointers.

First the barbs. These are not a difficult group to sex because as a rule the female becomes very distended in the belly when full of roe. Also in most cases there is a colour difference between sexes and in some barbs there is the appearance of supralabial tubercles on the head or all cover. This is especially noticeable on Barbus aureolus.

Next we come to the characins. Sexing these fishes gives most aquarists a good deal of trouble. Apart from the obvious differences, like extended or larger fins and size and shape of body, the male characins have, in many cases, small projections on the anal fin known as the characin book. This can be used by the aquarist as a positive means of sex identification. This method is useful with black widow, Potწella riddles, blood fins and glowlows. The method used is to catch the fish in a fine nylon net and hold the fish in the net with one hand and gently rub the net against the anal fin. If you have a male the fin will almost certainly catch in the net.

If the males or bubble-nest builders are all very easy to sex, as, without exception, the males have longer or more pointed fins. This is not apparent until the fish reaches sexual maturity. So, if you go into a shop and buy some three-spot or lace gouramis ½ in. in length and expect to sex them, I am sorry, you will be unlucky. This brings me to one of the points about the whole business of sexing fishes. Don’t expect to sex them before they have reached sexual maturity.

The eggy-laying tooth-carp is quite easy as generally the males have longer fins and, in most cases, more colour. A good early indication of sex in species like Aplocheilus lineatus or Pencatus playfairi and blue puncta is a dark spot in the dorsal fin of the females.

Now we come to cichlids. Here again the sex can be seen slowly. With a good many of these fishes sex is apparent by the sex of the more pointed fins in the males; larger size of males and, again, their brighter colours. However, with some of the cichlids, there is no apparent difference between the sexes one can always study the smaller points — such as the genital papillae. These are the tubes that protrude from the vent of our cichlids. In the male they are thinner and longer than in the females, which are, by comparison, very short and thick. This is quite a reliable way of sexing angels and most of the other cichlid genera, however, before these genital papillae appear, the fishes have to be mature, in tip-top condition and about 8 to 10 inches long. It is always best to let the difficult ones choose their own mates.

In general, to sex your fishes the best way is to make a careful study of them, to see if there is any obvious difference. If there is not, give heavy feeding with mainly live foods for 2 to 3 weeks and then no food for 1 week; the fish that remains fat will in all probability be the female, seeing to the eggs keeping the shrimps pushed out. This plumpness is best viewed from above or below, so place your fishes in a glass or plastic container that you can see through. The guppies are bred in this way and the females diamond-shaped. This is one of the only ways I know to sex cichlids.

When studying your fishes for sex identification pay good attention to details. For instance, with some of the more transparent fishes, the position of the organs in the body may give an indication of sex, particularly the size and shape of the swim bladder. Also, by shining a strong light from one side and viewing the fish’s body from the other, eggs can sometimes be seen in the body of the female fish.

If you want to sex your fishes for breeding purposes make sure that when you purchase them you have at least four, preferably six. This guards against possible loss of some of the partners through mishap or disease. How often have you heard someone asking “Have you a large male and female?” Mine has died and the female is ripe for spawning.” By the time they have reared another male the female will be past it and they have to chase around to try and get another one, often unsuccessfully.

Anyway, good luck with sexing your fishes.

Rockwork

In choosing rocks for the aquarium it is essential to exercise some care. Many rocks, like granite and gneiss, which long experience has proved is best for most plants and fishes and is inimical to algae, can soon be rendered excessively by the introduction of lumps of marble, limestone, gypsium, spar, alabaster, chalk and similar calcareous formations.

Yet another point to observe is to soak all concrete ornaments in several changes of water before introducing them into the aquarium. In fact, some cautious aquarists go so far as to pickle well-soaked concrete ornaments for a while in vinegar or diluted hydrochloric acid, to make sure they are completely rid of free lime.

Among the most decorative rocks which will not alkalinen-approximately 44% are Westmoreland and Somerset stones, red, green and grey sandstone, the various charmingly-rillated granite and quartzites and some rocks of a greyish-blue to greenish hue, being the most popular. Many of these rocks can be used in all sorts of aquariums and for all sorts of purposes.

The AQUARIAN

J.M.
Breeding *Tilapia mossambica*

*by Peter Dendy*

The Hawaiian mouthbreeder, as *Tilapia mossambica* seems to be called in this country, is a prolific reproducer and so in this respect leaves even guppies in the shade. So if you are going to keep a pair you are in for trouble with tank space unless you twitch the resulting broods at regular intervals. A few common species is always interesting, but with this fish I think the novice will very rapidly wear off, and I don't imagine they will be particularly sought after in the near future. I think we all hope for the odd chance that breeds a new species our way, one from which we are able to breed without much loss of time. For a short while I have with such a species there should be a pretty good market for the young fish and it last might be possible to make a little money for a change. Happy dreams, and I had some about *T. mossambica*, but I was rudely awakened when I found that there was not too market anywhere for my lovely babies. The usual comment from dealers was "Why don't you raise a better fish?" In which comment it must be acknowledged there is more than a grain of truth.

*T. mossambica* seems to be ready to breed any time after reaching a length of 2½ inches. The female is always a little brown colour and the male usually looks the same, although both may possess markings of a darker brown. The male can be distinguished, as can most male cichlids, by a larger mouth and longer dorsal. When in the mood to breed the male undergoes a repelling change and becomes nearly black, with orange-edged fin and a red-tipped anal fin. Unfortunately, this attractive male coloration does not seem to last, and one only quickly the drab brown appearance returns.

*T. mossambica* seems to be quite the roughest fish on plant that I have seen, and although I provided a breeding tank with all the plants protected by stones, it was a waste of time. In short order the pair had stripped all the plants and even completely assaulted the substratum filter. As they seemed to prefer to carry out excavations at the back of the tank and to pile the gravel up at the front I let them have their way and replanted along the front, with slightly better results.

My pair were wild imports and very shy, so I added a flower pot with the end knocked out to give them some sort of privacy, which they seemed to appreciate. The male was responsible for all the heavy work and furniture shifting; the female was content to observe the going on without much apparent interest. However, it was not long before the female was doing her stuff, refusing food and incubating happily in her mouth. I could not be quite certain when incubation started but the process seemed to take from 10 to 14 days. After this period fry gradually escaped and were free-swimming in the tank. The new-born fry are surprisingly large and pretty to watch as they school and move about in a shoal all the time. The parents took absolutely no notice of the fry once they were free-swimming and made no efforts to protect them or to eat them. I deliberately frightened them to see what happened and the parents fed for the flower pot, without any protective instinct being shown towards the fry. The young are obviously left to feed for themselves in this species. I should imagine that in fully developed fish under natural conditions the breed sizes must be enormous, as my pair produced 70 to 100 fry and are themselves under 3 inches long. The interval between broods seems to vary from 8 to 10 weeks, and as might be expected is shortened by the copious feeding of live foods, of which white worm and *Daphnia* seemed to be the most enjoyed.

The fry are avid eaters and grow at an amazing rate if you can keep pace with their appetites. I feed with micro worm and brine shrimps for the first week, after which Grindal worm and screened *Daphnia* were eagerly accepted, the fry going on to white worm and anything else I could lay my hands on. Water conditions do not seem to be at all crucial, although for the record my water is nearly neutral and the temperature is round about 78°F (25°C).
How to Repair AQUARIUM HEATERS

by A. JENNO

The diagram with this article shows the construction details of the most popular type of aquarium heater. This is an immersion heater and, as such, should never be switched on unless it is immersed, as it is designed to operate under water and will burn out under any other conditions.

As will be seen from the illustration, the heater consists of six major components: element, former or element support, lead-in wires, mains supply cable, bung and tube (not shown in the diagram). These will be described individually.

Element

The element consists of a coiled coil of nickel-chrome wire. For those unfamiliar with the term "coiled coil," it describes a method of winding the element so that the wire is first wound into a helical spring and is then stretched so that all the turns are separated and equidistant from each other. This helical length is then wound around a grooved former, care being taken to keep all its turns separated. This stretching also ensures that the element holds itself tightly to the former. By winding the original helix into another helix, the "coiled coil" is obtained.

Somewhat lengthy calculations are necessary in order to determine the correct wire size and length and type of wire to use for a given required element, so unless one is familiar with those details it is wise to attempt to manufacture one's own replacement elements.

The former or element support is a hollow cylinder of heat-resistant refractory material, with its outside surface carrying a continuous helical groove from top to bottom, in which the element is wound. Holes are provided at each end for the lead-in wires.

Supply Cable

The two lead-in wires bring the supply current from the mains supply cable to the end of the element. In some heaters the lead-in wires are omitted and the element is connected directly across the mains supply cable. One lead-in wire passes down the hollow centre of the element former to the bottom end of the element; the other lead-in wire is connected to the top end of the element. At nickel-chrome wire is difficult to solder, the joints are usually made by twisting the wires together. The lead-in wires are usually prevented from coming into contact with each other by fitting small refractory insulators on them between the element former and the junction with the mains supply cable. As the lead-in wires and the mains cable are both usually of tinned copper, these junctions may be soldered.

The mains supply cable should be well insulated as it will be immersed in water for part of its length. It should be of sufficient size to carry the current drawn by the heater element. As a general guide it can be assumed that a 100 watt heater will draw approximately 0.5 of an ampere and a 200 watt heater 1 ampere and so on. This is, of course, assuming the normal mains supply of 200-250 volts (A.C.).

If a twin-core cable is used, with each core consisting of a single large strand rather than several small strands, it will be found that the cable has an added stiffness which is a great help in arranging it in a hidden position in a decorative aquarium. A single-strand cable should not, however, be run near the heater as there is a risk of it catching fire.

When the heater has been assembled and connected to the mains supply cable, a watertight method is required to seal the heater into its tube. A rubber bung is used for this. It should be of good quality rubber to prevent, for as long as possible, the effects of continuous contact with water, and should have a very slight taper from one end to the other so as to form a good seal when inserted in the tube. The hole through which the mains supply cable is drawn should be slightly smaller than the cable diameter so that a good tight fit is ensured.

The tube used with a heater must be of heat-resistant glass, such as that used for domestic ovenware, and on no account should ordinary glass test tubes be used, as these will not withstand the high element temperatures. Some tubes are made with a ridge around the inside circumference which helps to ensure that the bung forms a watertight seal with the tube. The seal between bung and tube should be so strong that it is impossible to remove the heater from the tube by pulling on the tube.

Repairs

It will be seen from the above description that an aquarium heater is quite a complex piece of apparatus when considered in detail, but if one reflects on the points mentioned it will be realised a good measure of common sense is enough to attend to all these details and only a very basic technical knowledge is necessary to understand fully the faults which occur in a heater in normal use.

The main point about aquarium heaters is that the most difficult part to replace, the element, seldom breaks or burns out if used in the correct manner and at the supply voltage for which it has been designed. This leaves a number of faults which do occur in normal use, especially after long periods of continuous operation. These will be treated individually.

1. Mains supply cable. Most heaters nowadays use p.v.c. insulated mains cable, which is able to withstand the disadvantages of long contact with water far better than the older rubber-covered cables. The insulation on these tends to become hard and, therefore, unnecessary.

Please turn to page 130
Crag Lizards

by ROBERT BUSTARD, B.Sc.

Photographs by the author.

daily by means of a pear electric light bulb of suitable wattage. This is switched off at night when the temperature can fall to between 30° and 60°F (10° to 15°C). The crag lizards occur in the southern areas of South Africa and are therefore accustomed to cold nights during the South African winter.

The common crag lizard is a very handsome animal when in its adult colours. The dorsal coloration is largely black but half a dozen bright yellow triangles are present on the flanks and these extend some distance on to the dorsal region. The contrast of black and yellow is most striking. The throat region is also black, the belly greyish and the underside of the legs are yellow. Young specimens are less spectacularly coloured. One youngster which lived for several years in my collection was a drab grey with several narrow cross bands of pale cream when he arrived. As the lizard grew, however, the grey darkened slowly and the pale cream changed gradually to the bright yellow of the adult... This particular specimen is illustrated when he was nearing maturity and measured about 8 inches.

I have been fortunate to keep some half-dozen of these delightful lizards. I say "fortunate" as they have several desirable habits, especially if the collector has a fair number of insectivorous lizards to feed. Crag lizards will readily accept the usual lizard fare of mealworms, maggots and bluebottles, but, in addition, they will soon learn to accept strips of raw meat, which is, of course, a great advantage. Also they soon become very tame and will take this food straight from the fingers.

When first received they may bite, and this can be quite a severe nip as they have strong jaws. Seldom, however, do they penetrate the skin and they do threaten with jaws agape to warn one! This defensive behaviour is quickly
lost, and they become exquisitely tame and seem to enjoy being handled. Many reptiles like the warmth of human hands.

Availability and Cost

The green and brown girdled lizard, Axanthosaurus stygia, is a fairly readily obtainable species in this country. I have been offered for sale for as little as 15 shillings, although they may cost £1. The other species, Pseudochalcides wislizenii, is more difficult to obtain. In my opinion, however, it is well worth the effort, because of its very fine colouring. Its specimen in my collection had a dark grey to black ground colour with a greenish suffusion on each of the ventral scales. The underside of the tail was bright yellow. The sides were reddish orange and the underside was also present on the jaws. Below they were greenish. I found P. subulatus to be an extremely shy lizard and this is borne out by those who have been lucky enough to see it in its native habitat. At first I kept my specimens in a community vivarium with skinks (Mabuya subflava and M. homophrya) and lizards, where they appeared to do well. Their smaller size, as compared with the common girdled lizard, also favoured their inclusion in this vivarium. After some time, however, I wondered if they were obtaining sufficient food. When put in a few sacks or moss balls, they were almost all consumed by the skinks and lizards. Besides the beautiful, rare girdled lizards had picked up enough courage to venture out from their hiding places. Finally I gave them a vivarium to themselves.

How to Repair Aquarium Heaters

Continued from page 128

(1) Cracking. Where single-strand copper cable is used, the wire will sometimes snap if bent in the same place repeatedly. Should either of these faults be present a new cable should be fitted and no attempt made to "patch up" the old one. It should be remembered when fitting new cables that the entire length of the cable must be through the rubber sheath and that the correct size of cable must be used so as to form a perfect seal between the cable and the bulb.

(2) Rubber burnt. The bulb does not usually cause faults. The difficulty is in removing it satisfactorily to repair or examine the heater. In a fairly new heater the bulb can usually be extracted by heating the tube around the top, over a flame, and then quickly pulling while the tube is hot. Another method is to insert a perfectly straight needle or harpin between bulb and tube and rotate the needle in the fingers so that it travels around the circumference of the bulb and breaks the seal between the bulb and the tube. In older heaters it will be found easier if the bulb has passed and has actually stuck to the tube. The only way to remove the heater in this case is to break the tube at the bulb, cut the mains cables on each side of the bulb and discard bulb and tube. The mains supply cable must of course be reconnected. (3) Lead-in wires. These are, in my own experience, the most frequent cause of trouble, particularly the one feeding the bottom end of the element. This wire passes down the cylinder of the refractory cylinder and is subjected to the full element temperature in this position. After a period of time this high temperature will often cause the wire to snap or burn out. The tinned copper normally used can be replaced with nickel-chrome or other temperature-resistant wire, but this will cause difficulties when making the soldered connections to the mains supply cable.

(4) Element and element former. These are usually damaged by misuse, i.e. by dropping, knocking against hard objects or by overloading the element by applying the wrong supply voltage. Both element and former can only usually be replaced by obtaining the correct spares from the manufacturer.

In some cases it will be found that the end of the element has broken away from the joint with the lead-in wire. This is usually remedied by twisting element and lead-in wire together again, remembering that the element should not be shortened by any appreciable length in doing this, because the heater will then only be used up to the length of wire used. If an element is shortened the wattage will increase to a point where the heater will burn out. If the element has, for some reason, burnt out and does not lie correctly in the grooves on the former, then one end can be disconnected and the element rewound, although it will be found difficult to do this successfully without a fair amount of practice.

Testing

The best method of testing after repair is obviously to use the heater in an aquarium. If, however, the heater is not required for use immediately, a quick test is to plug the heater into a suitable mains supply and hold the tube in the palm of the hand. If the heater is in working order it will begin to warm up. The mains should then be immediately disconnected or the heater will become so hot as to burn out. The repair of aquarium heaters is not a difficult thing to accomplish so long as common sense and patience are employed. One should always remember that safety is a prime factor and that the utmost care should be taken that good workmanship is used. Bearing this in mind, anyone with a basic knowledge of electricity and the ability to use a soldering iron and a pair of pliers should be successful.

Some people will, no doubt, decide that this is a great deal of time and trouble to spend on an article costing about 10 shillings from the local aquarium's suppliers, but in cases where a number of aquaria are owned, and people have a great number, then heaters can represent a large cash investment and are well worth maintaining in good working order.

THE AQUARIAT
How Sensitive are Fishes?

by DAVID GUNSTON

First, can fishes smell? Closely allied to that question is the one—have they any sense of taste? Smell and taste are connected faculties, as is well known; smell being concerned with a source acting from a distance, and assumed only when the taste organs are in contact with the object or liquid concerned. They are connected in the case of most fishes, and the angler who may sometimes wonder whether a fish can taste his bait at all may have no doubts on that score.

Fishes can taste quite well, many can detect food 1 ft down by smell. Yet neither sense is all-important, even in the case of the pike. Taste and smell are chemical reactions, special sense cells detecting a chemical impact into nervous impulses in the brain. The sense of smell in fishes lies, as it does in most animals, in the nostrils, but these are quite different from our own. Most fishes have two nostrils, and in all these they are merely small holes in the top of the head, leading down to the throat, but only into small tubes lying below the surface of the skin. Each sac is lined with densely folded sense cells, which react to the substances in the water that passes over them, guided by tiny whorls of hair. Usually there are two such concomitant and supplied with a constant current of water in through the nostril and out at the rear. There is an connection with the mouth, but the fish has a continual flow of smell.

Taste is carried up by the tongue, which, although stiff and insensible, instead of being muscular, erectile and sensitive in human beings, does have a number of papilae along its length. These are not relatively so numerous as the taste buds on a human tongue, but they are generally a good deal as at all times. Humans have been supposed to have four definite senses: sour, salty, sweet, and bitter, the rest being regarded as false tastes caused by minute particles of the foods entering the mouth. Experience shows that many fishes can tell salty, sour and bitter, and many are rather less subtle; sweet seems to be unknown under water, and some, perhaps, in freshwater fishes. Sea fishes probably cannot taste at all.

Secondly, the sense of smell directs a fish to its food, and the sense of taste tells it that the food is good to eat. Many interesting experiments have been made on fishes that feed much by smell, especially on the weaker haunts and small streams, and vice versa. Several fishes have both faculties in strong form, and most of the weaker feeders smell out their food. The olfactory nerves have shown that its nostrils lead it close to delicious food, when it swans around in a loose figure-of-eight, suddenly diving closer in and finally pin-pointing the spot when it actually strikes at short range. If the nostrils are plugged with petroleum jelly-coated cotton wool, no feeding is possible for the day, and if only one nostril is blocked, it swans round and round with the good smell opening on the inside, nearest the food. Many other fishes have been shown to have almost as good a sense of smell as this, but among the daytime sight-feeding fishes, the faculty of smell sometimes diminishes altogether. Trout and salmon can smell out food when they want to, but rise to a fly solely by sight. Congers and pollock, usually highly sensitive to smells under water, have been known to take food tainted with such things as camphor, quinine, iodine, alcohol and cyanide when they are really hungry. Thus the sense of smell may be a discriminating one, more useful when food is plentiful.

Taste in the fish, on the other hand, is more constant, telling the fish whether the morsel it has picked up by sight or scent is worth swallowing. There is some evidence that certain species of fishes, carps and several deep-sea blind fishes, for instance, have elementary taste cells scattered all over their skin surfaces, apparently to aid them in finding food amid darkness and mud. In general, there seems to be no good reason for the use of flavoured baits and ground baits, especially for coarse fishes; the bigger game fishes will be attracted more readily to strong-smelling or blood-filled baits.

Touch is the one faculty that is common to all members of the animal kingdom, from the most intelligent mammal down to the maggot and even the Amoeba. It seems quite feasible that many of the existing senses grow out of the elementary sense of touch. Fishes are no exception to the general rule, and have sensitive touch papillae, or sense cells, dotted all over their skin surfaces, so that they can register the impact of outside objects at once. This sensitivity to external objects applies only to solids, as far as we know, and apart from certain cells designed to tell the fish temperature and current changes in the water, a fish's touch cells in its skin do not register the contact of the water in which it is swimming.

Some kinds of fishes have this universal sense of touch specially developed to aid them in hunting for food. The East Indian mahseer, related to the barb, has silvery spines projecting from its jaws that are peculiarly sensitive to touch, obviously for picking up food, and touch, paddle-fishes, grey garfish, rockling, lungfish and many other bottom-feeders have touch organs in their snouts, barbels or fins, which first come into contact with food. The pectoral spines of the guniards are skillful touch organs, as are the long fin-rays of many deep-sea fishes. Sole and other flounders have minute sensory threads on their undersides, which first feel any food before it is eaten, even though they can see tolerably well. And the ticking of trout into a state of semi-stupefaction is probably yet another example of the way in which fishes can experience touch.

Lastly, can fishes feel pain? We have established that they are fully sensitive to the slightest touch—for this made on a dark ocean-bed by a minute morsel of food cannot but be very slight in many cases—and now we have to consider whether that sense is so well developed that fishes can actually experience pain, under various circumstances.

This is a question that has perplexed many people for quite some time, not a few of them being anglers inclined perhaps to a little self-extermination by the outcry of those who condemn their quiet sport on the grounds of its cruelty. Is fishing cruel? Do fishes feel the pain of the hook? Even Walton himself, for all his sometimes barbarous methods, often tells us to go gently, to use the live bait "as though you loved him", although the poet
Byron, in a fiery mood in Don Juan, called the immortal Izaak a "criminal corruption," and described how he would like to see a small trout pulling a hook in its gullet! Thus does alleged cruelty inspire its opponents.

But before getting too involved in the ethics of the matter, it is well to examine scientific facts. Fishes can obviously feel a hook should it penetrate their mouth, but whether they feel pain is another question. Although able to absorb many sensations, a fish's nervous system is nothing like so complex as ours. This has nothing to do with being cold-blooded; fishes lack the cerebral cortex of the human brain. Their brains are simpler, the dominating features being nothing more than thinking or imagining.

Therefore there is very strong evidence to suggest that fishes do not have physical sensations of anything approaching the human level. Therefore a hooked fish, although probably feeling a dull, aching pain in the actual spot, and a vague sense of discomfort and fear at being restricted in movement, has little else to worry it. Indeed, cases where fishes have been caught again soon after release are not numerous to mention.

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The Scales of Fishes

by R. E. MACDONALD

There are four kinds of scales—cycloid, ctenoid, ganoid and placoid, all of which have several different forms. Some fishes have no scales at all, most parasites among fishes being cycloid or ctenoid scales; some have both. When a fish has scales it is known as possessing an exoskeleton.

Scales are disc-like in shape and develop from the dermis (a layer of the skin). They are fixed on one side to the skeleton or cavity in the skin, in the body of the fish and overlap the scales behind and at each side.

Since the nature of the scales varies to some degree, they can assist in classifying the various species of fishes. More important than the type of scales in this respect, is the number possessed by each individual species.

**Scale Count**

The number of scales is determined as "flat" closely related species. This is known as taking a scale count and is achieved by counting the scales on a single line, from the upper edge of the operculum (fish's gill-cover) to the base of the caudal fin rays, as shown in the diagram.

This is an extremely good method to adopt when identifying fishes, as the number of scales, regardless of age,

remains the same throughout the life of each fish. If a scale is lost, perhaps through an accident or fighting, a new one will always grow in its place.

**Age and Scales**

During the development of a scale, certain visible marks occur in its structure. These marks are in the form of rings or circles that are proportional to the rate of growth. Whenever the rate of growth slows down, e.g. during the winter months or (as with certain fishes) during the breeding season, the rings fail to form a regular pattern on the scale and an irregular circle, known as an annulus, is formed (see diagram).

Obviously, if an annulus is formed each winter it is possible to determine the age of a fish by the number of annulus circles that an individual scale possesses. This ringing pattern is similar to that observed when viewing a cross-sectional cut through a tree trunk.
Black-lined Tetra

by JAS. STOTT

ALTHOUGH the black-lined tetra (Hyphessobrycon grammata) is not a colourful fish, especially when compared with such as the rosy tetra or the neon, it is an attractive species, which, in a quiet sort of way, has the ability to provide added interest to a aquarium when it is included. The back is a deep olive green with bronze tints on the underparts as well. There is a black line stretching from just above the eye to the tail, which diffuses over the area of the caudal peduncle. There is little or no difference in the sex of the black-lined tetra against a background of skillfully mixed aquarium plants and is thickly planted with banks of Ludwigia and a thicket of Vallisneria spiralis at each side. What a surprizingly attractive picture they make (and the tank was in the tickets as well).

When fully grown this species should be around 2 inches in length and they must be allowed to reach this size before introduction of a pair to the breeding tank. A diet consisting of mixed live foods such as finely chopped earthworms, Daphnia, white worms and shredded fish is needed to produce tip-top condition, and the same should be conditioned separately if this can be managed, for it seems to produce the best results.

The breeding tank should be the standard 24 in. by 12 in. by 12 in., one-half of which is planted with clumps of waterlilies such as Myriophyllum and the other half with all other plants for the gravel over the base; this provides an open area in which the breeders have plenty of room to move and to make their highly excited pre-spawning activities common to the tetras.

It is suggested that the water should be old, well matured and slightly acid. It can be filtered before it is put into the breeding tank to ensure clarity and freedom from infection. Temperature will be found satisfactory at 80°F (26°C). Allow the breeding tank to be set-up and unharvested for about 5 days before the pair are introduced.

Feeding Problems in the Garden Pond

Most ponds will contain a number of types of goldfish. These are very easy to feed as they will take almost anything edible. Either live food or artificial will be eaten avidly by any hungry goldfish. It will be well to remember, however, that these fish will eat plenty of vegetable matter in the shape of algae and any soft decaying leaves from the oxygenating plants. It is quite safe to assert that in the average sized garden pond containing water plants and a few goldfish, any feeding by the pondkeeper is unnecessary.

Many insects lay their eggs in or around the pond and the resultant larvae will be eaten by the fish. Fishes may drop in the water and be taken and worms can crawl in at nights. Frog tadpoles can provide food, as can small water snails.

If the pond contains many fishes it is probable that they
will require some extra feeding. Consideration must also be given to the age of the fish and whether you want them to breed. If you are growing on small fishes then obviously they will need plenty of food. The same will apply to fishes wanted for breeding. It is very important to make sure that such fishes get a good varied diet as although it is probable that there is a fair amount of natural food in the pond the needs of the fishes mentioned will not be satisfied if they have to grow or breed.

There are two types of fishes, the omnivorous ones and the carnivorous ones. The former will eat almost anything living or dead whereas the latter will eat mostly live food, especially the young of other fishes. These carnivorous types are not often kept in the garden pond, with the exception of the coldwater catfish. This can eat any fish small enough for it to tackle and I would say that any fish half its size would be eaten. The other kinds of fishes often kept with goldfish are golden orfe, golden and green tench, rudd, bigle carp, mummox and trout. All these fishes get along well with the same kinds of foods. The trout appreciate plenty of live foods but will take dried food as well. The trout also like small live foods but will take liver and meat, and they will eat the usual dried foods.

For all the above-mentioned fishes there are plenty of packet foods on the market, but for those who prefer to mix them the following can be used. For fry from a fortnight old make a mixture of fine Bemax (wheat germ), dried shrimp and dehydrated meat (dehydrated meat can be bought at pet shops in packets especially for cat food); put all the ingredients separately through an old-fashioned coffee grinder, and then sieve them through a nylon stocking. The large particles can be used for larger fishes and the fine ones can be mixed to a proportion of 2 of Bemax to 1 part of each of the dried shrimp and dehydrated meat. This same mixture can be used, but much larger in pieces, for older fishes.

For good-sized goldfish and most of the other omnivorous fishes mentioned there is little they like better than rolled sunflower seeds. The amount of this which medium to large goldfish can eat in a day will be a surprise to many. Fishes grow very quickly on this food. However, I do not recommend that it should be given without some variation; garden worms and the other usual live foods can be given at intervals. Regulate the amounts of foods by the way it is alighted on, and one of the easiest tests to see whether the pond fishes need feeding or not is to place a piece of dry brown bread on the top of the water. If this is not taken within 5 minutes the fishes are not hungry.

**Black Widow Fish** *(Gymnocorymbus ternetzi)*

by **JACK HEMS**

Water is a pretty snug. Although old fish often develop short tempers, and young ones indulge in some teasing and snapping among themselves, the species is quite suited to living in a community tank stocked with fishes that are not extraordinarily timid nor small enough to be swallowed whole—jerseybry fry, for instance.

*G. ternetzi* is not a ready breeder, but once a couple take it into their heads to start a family, and conditions are propitious for spawning, eggs will follow as a matter of course.

The fry are easy to rear on Infusoria and green water (like the first week or so), followed by larger live foods such as brine shrimps, micro worms or powdered Bemax and the like. As black widow fish are vigorous chasers, the tank for spawning them should be on the large side (at least 24 in. by 12 in. by 12 in.); the temperature of the water should be maintained at about 80° F (27°C); and masses of plants should be anchored to the bottom with stones or lead weights to offer a safe harbour for the scattered eggs. One other point: there is more likelihood of a well-fed couple spawning after they have been parted for a month or two than if they are left to share the same quarters day in and day out.

As soon as a pair have finished spawning they should be removed from the aquarium with all possible speed. Failure to carry out this advice will result in most, if not all, of the eggs being eaten in a fraction of the time that it took to lay them.

The eggs hatch out in 2 days, and 2 days later the fry should be free-swimming and snatch at every passing morsel of food. With plenty of the right sort of food (live food mostly); and no overcrowding, the fry will reach 1 in. long within the space of 6 to 9 months, but thereafter growth is not so fast.
Aphyosemion australe

by A. STEVENS

The African mouth-carp, which abounds in the west equatorial area of that continent, is one of a whole family of what may be termed 'annual fishes', that is, those born, mature rapidly, mate and die all within a comparatively short time.

In natural conditions they live in bodies of water that increase in size seasonally with the rainfall. Eggs, whose development is triggered off by the influx of new water, are hatching and the fry grow rapidly on insect life also abundant at the time. Maturity is soon reached and with a good supply of food they are easily capable of spawning ten or more times. Spawning takes place over a period of about a week, a few eggs being laid every day. The eggs are laid singly, the space between them may be found on any medium that is porous—surface plants, fallen leaves and twigs, and even mud at the bottom of the pool. As the eggs are quite unfertilised and take 2 to 4 weeks to hatch, a natural combination of the species is possible. Modifying conditions, such as those found on the feet of animals drinking at the pool, are also distributed shelter and is dispersed in other waters. When the water falls within the hatching period of the eggs the species lives on in that pool. In normal conditions eggs may lay dormant for double the normal period before hatching. If rain comes too late in the year hatching will take no course. Some pools may remain to less than half an inch of very muddy water, which in the full course of the sun reaches temperatures far in excess of those in which we keep fishes. The littoral fish managed are saved by a fall of rain—it is surprising just how transient life is.

The water the fishes live in varies very much also. Rain water is soft and in collecting in pools it runs over soil from which it dissolves chemical salts and may become quite hard. Fallen leaves make the water acid. With the advent of roads through the scrub the falls have spread to the drainage ditches at the road-side, and can be in water-filled ditches made by carts in primitive dirt roads. Temperature variations are considerable, too; small water-filled hollows in damp ground, despite a covering of shading grasses and broad-leaved plants, soon take in heat, giving high temperatures. Overnight the temperature falls rapidly from small expanses of water.

All these water and temperature changes take place in Nature, and how many of us keep our tanks at the same temperature year in, year out? Give the fishes a change—turn the thermostat up or down (by say 10°F; 5°C) in time with the season. The temperature rise will take place relatively slowly if a low-wattage heater is used. Cooling can occur too rapidly (as my electricity bill too often shows!) but can be achieved by reducing the temperature a few degrees per day. When topping up a tank just pour hot or cold water straight into the tank.

The fishes welcome the fresh water and will swim into the stream so as to be against the current (only natural!) and at the same time will rid their bodies of accumulated dirt obtained from stale water—i believe they actually enjoy such a 'bath' despite their living in water all their life.

Conditions need not change much when *Aphyosemion australe* is kept in aquaria. A tank, say 18 in. by 10 in. by 10 in., is filled with any fresh water available, hard or soft tap water, rain water or 'matured' (ugh!) aquarium water. Enough horticultural peat is added and allowed to soak and sink to give a layer about half an inch deep. In soaking the peat will acidify and colour the water. The temperature may be set anywhere between 70° and 90°F (21°-32°C), preferably controlled by a wide-differential thermostat.

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A trio of fish is added. One male can quite easily manage two females and as he can become quite aggressive, his attention is divided. A spray of dead willow root or a bunch of nylon wool just dropped in or suspended on a large cork completes the set-up.

The male will select a female and will court her by displaying his finery. He drives her into a suitable position amongst the spawning medium, where he will lay alongside her, and with much quivering an adhesive egg is laid. They drift apart and in a few minutes lay another. This continues with either female for about a week.

The eggs when first laid are slightly amber in colour and are about one-sixteenth of an inch in diameter. The eggs can be left in with the parents provided that the parents are well fed. To raise a number of young A. anomala quickly, the eggs may be gently picked off the spawning medium with the fingers and placed in a bare batching tank.

Infusoria is unnecessary for the newly hatched fry. Some shrimp is readily taken and the bare bottom of the tank ensures that the fry have no difficulty in finding the food. They grow rapidly on plenty of live food—Grindal worm, Daphnia, Cyclops, white worm, blood worm etc. Scraped beef and shrimp meat are also taken. One of the easiest methods of feeding mosquito larvae is to collect the egg rafts of this insect and float these in the tank. The lady of the house need have no worries about swarms of mosquitoes bursting about the home as hungry fish will soon deal with the larvae before they pass into the flying stage.

Sexing of the youngsters may be done in 3 to 4 weeks, as they colour up quickly. The accompanying photograph shows a male in all his courting glory. By comparison the female is drab, she doesn’t have elongated fins nor bright colours. Her basic body colour is a translucent brown, which is balsampered with very fine dots of dark brown, red and black, which spreads to some fins. The males do not do too well in a community tank as other fishes are apt to chase the white filaments on their fins. Males kept together will quarrel and this is another reason for loss of finery (but not so severe as with fighting fish).

To raise a team of these fish for a breeder’s entry I have found it necessary to rear the selected individuals separately in a partitioned tank so that each develops its filament. With such easily sexed fish it is a good policy to exhibit three of each sex, to show that both males and females are of good quality. To show them at their best, take along some of their own tank water and put them in warmer water than they have been used to—the increase in liveliness and colour intensity will be worth the effort.

As they are ‘annual fish’, a great longevity cannot be expected even under artificial conditions. Females last up to 12 months, depending on how many spawnings are made from them, and males may last to 15 months.

The Three-spined Stickleback

by LAURENCE E. PERKINS

Photographs by the author

The Aquarist
Courtship of the female (top fish) by the male stickleback, during which the female is driven into and through the nest where the eggs are laid and fertilised. At this time the colours of the male are at their greatest brilliance, rivalling those displayed by many tropical fish species.

Male stickleback and nest, which is made with portions of blanket weed in the form of a sloping tunnel.
etc., it is safer to keep to Daphnia because the mouth of the stickleback is extremely small for the body size and they can choke themselves through their greed and subsequent inability to deal with the capture.

When once the little community has settled down the male begins to prepare a site for the nest, in which the eggs will be laid and hatched. His initial actions consist of swimming slowly over the selected area close to the gravel and in an inclined position with his caudal peduncle bent so that it is parallel with the bottom of the tank. As he swims in this curious fashion his fins are fanned rapidly so that the resulting disturbances shift the gravel away to right and to left, leaving a depression. To increase the depth and extent of this depression he also removes gravel a piece at a time with his mouth, picking up each piece, swimming away and forcibly blowing the unwanted particle into a remote corner of the tank.

After a suitable depression has been made the male begins to seek pieces of material with which to construct the nest proper. Small portions of plant are carefully selected, carried in the mouth and placed into position, blanket weed being greatly favoured for 'knitting' the whole into a workable mass. Then, using his head as a tamping instrument, he butts and burrows into the pile of vegetation, eventually passing through and partly emerging at the other side. Carefully withdrawing himself in the reverse direction, our builder leaves a tunnel with a down-sloping entrance and an up-sloping exit. The nest is now ready to receive occupants and the male has next to coax his bride into the nuptial chamber.

During the whole of his active endeavours the female have paid neither him nor his activities the slightest attention, but have contented themselves with remaining aloof, gently moving their pectoral fins to support almost stationary postures. Now, however, their spell of ease will terminate, for the male darts among them, his colours increase suddenly in brilliance as he buffet them seemingly in aggressive attack; but his unerected spines belie this impression, for he has no wish to dismember them at this stage of the proceedings. His energetic efforts at length bear fruit and one of the females is coaxed, chased and guided into the nest, where she spawns before being quickly chased through and out by the male, who fertilizes the eggs at rest. The remaining females are each, in turn, persuaded to emulate the actions of their sister and the first phase is over.

The male now returns to the nest and employs himself furiously with his fins to aerate the eggs, breaking off occasionally from these duties to look around and ensure that nothing threatens his charges. Any interloper will be bravely challenged and driven off, including the mothers of his brood, and it is at this juncture that the females should be removed from the aquarium. To leave them there will result in their death and will also possibly distract the male to such an extent as to make him neglect the nest.

The duties of guarding the nest and aerating the eggs continue to employ the male's attentions for several days, and even after the young have hatched he continues to aerate by furiously. When the young are free-swimming and become venturesome, any that leave the nest are taken up into the mouth and blown back into the nest. By this time the nest little construction in which the females spawned has become reduced to an unhygienic heap of rubbish; but it has fulfilled its function, for soon the tiny fry will dart away before their elder's paternal ministrations are stretched too far and he recognizes in them their diocetic potential.

The male illustrated in the photographs with this article was continuously employed for over 3 weeks on nestbuilding, egg-aerating and guard duty and his uttering endeavours and astonishing energy were wonderful to witness, exemplifying an unswerving, if instinctive, sense of duty and parental care.

THE AQUARIIST
THE GOLDFISH AND ITS VARIETIES

(9) The Lionhead

by A. BOARDER

The lionhead goldfish may be likened to a fantail with the hood of an oranda. One characteristic, however, in this variety; there is no dorsal fin. This gives the fish an even stranger appearance than the lionhead hood that it bears. This fish may be all visibly scaled or completely scaleless like the shubunkin, although most of the lionheads seen in recent years at the shows have been scaled fish. The colour of the lionhead can be a self red or yellow and red. This variegated fish can have black and silver as well. The shubunkin type should have the colours of that variety.

Colour and Body

It is usual these days to have these fish red and silver, but the all-red one is very attractive and would stand a better chance of getting good points for colour than a variegated one. This fish should have a short thick body with the depth more than half the length, with the caudal peduncle set high. The head and gills should be covered by a raspberry-like hood, which should be almost completely round, starting at the nose and running over the whole of the head. It should also cover the gills. There should be no dorsal fin and any bump or false fin in this position will lose points for the fish at a show. The caudal fin is divided completely, as for the fantail. It should also have the deep fork at the ends as in that fish and the tail must be held well out from the body and not droop in any way.

Finnage

The pectoral and pelvic fins must be half the depth of the body. The anal fin must be double and each part held away from the other. The fish should be of a hardy type and appear quite cobby. Any lack of complete covering of the head by the hood would lose points for the fish. Under the new standards for the lionhead no points are allowed for the hood. This is a great mistake, as this feature is the very important one that differentiates it from an ordinary fantail. Under the old rules there were 28 points for the head of the scaled type and 27 for the shubunkin type. This enabled the judge to reward any fish with a good hood but now all that can be done is to include these markings under those for the body.

The keeping of the lionhead presents few difficulties; especially it is this with the scaled type. These can be kept in an out-doors pond all through the winter and they should come to no harm. The shubunkin type may stand the winter out of doors in a sheltered part of a garden and towards the south of England but they are not quite as hardy as the scaled types. They are not at all fussy about foods, and will take all the usual ones. A good general diet would be rolled oats, Bemix, dried shrimp and dehydrated meat (fodder or dog and cat). Live food is also much appreciated and garden worms, broken, can be given every day in the warmer months of the year. The other usual live foods such as white worms, Tubifex, and maggots can also be given. I always prefer to break the maggots before feeding them in the fish; I think this is safer but probably it is a mistaken idea of mine—just one of those things one does without any logical reason.

Although this fish is not difficult to breed it is not at all easy to breed fish of sufficient quality to win at any large show. In the first place the lack of a dorsal fin is often the spot on the back where a nasty hump or false fin appears. Many an otherwise good fish is spoilt by one or two nasty little humps where the dorsal fin is usually found on other types of goldfish. A good smooth back is needed and so any fish not having this quality should not be used for breeding purposes.

Hood

As to the hood, the difficulty here is that many fish do not develop the hood until they are 2 or more years old. This means that the breeder must hang on to his young ones for a long period in the hope that a good hood will develop. Many fish do not grow a hood even after many years and this can be very frustrating for the breeder. When sorting out the fry examine all for the completely divided tail. Then place them in an all-glass container so that the dorsal position can be seen. Do not keep any young with deformed backs as these fish will never make the grade; a bad hump or false fin will never go away.

As for the hood, the breeder must have plenty of patience, sort out the fish assessed as best at that stage and then wait for the hood to develop. Plenty of space and a liberal diet will at least hasten the growth of the desired hood.

October, 1962
our readers

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.

A Show for the South

I HAVE read your Editorial on the lack of an exhibition in the south of England, in the July, 1962 issue, with great interest. I also regret having missed your editorial comment one year ago. Had I read that I would also have liked to reply.

When I was active in the F.B.A.S. it was my earnest desire to see an exhibition in the south of England which would rival the very popular British Aquarists’ Festival. Of this Festival I can speak with some experience, having been intimately connected with it at the inaugural Festival in 1951.

There are to my mind only two problems to be overcome, both of which are very closely interwoven. They are capital and venue. London is notoriously expensive as a showground, but if one could find a venue which does not cost the earth, where would the funds come from? There are three possibilities: (1) To find a sponsor (either one person, a consortium of persons or a business house). (2) To be provided with funds on loan from societies, with suitable guarantees, and these societies should be prepared for losses. (3) To make revenue (show stands, entrance admission fees and entry fees) that would enable all loans to be repaid in full.

This latter course would not be all that acceptable, as a show must encourage the small men in the hobby. They are our successors whom we should foster.

Equipment, entries, technical know-how how we have in abundance. Let us have a team put together to iron out the ideas. We have the men able to do this. If the results find favour with the organised hobby, may we then ask you to put them over to your readers?

My views on organisation may be a little unorthodox, but many will no doubt agree with me when I say that a little honest to goodness work with plenty of initiative and a little move in the right direction will enable the southerners to see an aquarium show which is in keeping with our aquarist endeavours, which so say the least of it has earned a lot of respect from those who know how to recognise earnest endeavour.

R. O. L. LIV.
London, N.W.6

Fishy Friendships

Most aquarists have seen and read of fish that pair off and have eyes for no other. I have a trio of angelfish, two have paired off to the total exclusion of the third and have far outstripped it in size and bearing. I hope shortly to spawn them.

On another occasion I had a magnificent “pair” of angelfish which spawned in a community tank. The female laid many eggs which the “male” duly “fertilised”, all of which were, of course, eaten. About a week later the “male” of the first spawning, after much courtship, laid “his” eggs, the original female in close attendance—a “male” this time. I have read of “like-sex” fish pairing off but never of an actual spawning.

In my large community tank I have a female thicklip gourami which appears to be full of spawn (a young male is being brought up to size in another tank). This thicklip has formed an attachment with a red-finned shark. It seems to be mutual as each will seek the other out. They pursue each other about the tank and will stop and “court” each other by “shivering and moulding”. Also they rest side-by-side, nose-to-tail, shimmering and have on occasions sunk to the gravel in this position. There is no sign of damage to the shark so it is not being done with intent to damage. I don’t think the shark’s mouth is built for biting so I wouldn’t expect damage to the thicklip, but I have observed labios “moulding” other fishes, particularly angelfish, to what end I don’t know. In this case the attention of the shark is solely for the thicklip.

In this liaison a frustrated spawning need by the thicklip and attempts by the shark to discourage her or what is it? I would like to hear other readers’ opinions on this particular subject or any other stories of unusual “pairings”. The idea of red-finned thicklips has been dismissed!

E. G. ROCKETT.
Abingdon, Berks.

Fishing Birds

I HAVE been very interested to read the recent articles and correspondence on the subject of owls preying on fish. Like Mr. Boarder I, too, have lost several fish from my pond and I naturally fell to wondering whether an owl might be the cause.

The other day, while I was having breakfast, I was called by my wife, who said there was a large black bird by the pond and very likely this was the culprit who had been stealing my fish. I thought it rather amusing to entertain the idea that this bird (it was a rook or a crow) could be responsible but we decided to sit still and see what it was up to. It was, in fact, fishing! A large number of newts come to my pond every year and the bird actually fished out several of them which were apparently resting on the blacket-weed round the sides. The bird kept up this performance for quite a while, wading all round the pond and stopping whenever it saw a newt! The surprising
Nymph Goldfish

Mr. H. G. Berger (The Aquarist, August) caresses me he can have some young nymphs bred as specimens from my Goldfish this year, quite free. He can produce nymphs equal in quality to mine from any good strain of Goldfish I will give 200 to any other he cares to name. The fish must be scaled and teldl.

A. Boarder.
Ludlow, Middx.

Why not Centigrade?

On the subject of centigrade and Fahrenheit scales I should like to point out that most scientists use the former, as it is more convenient to use.

In schools only a very few experiments are carried out with the Fahrenheit thermometer, as it was found that the children find it so much easier to use the centigrade scale. I know in my own school only once experiment in the whole year from the eleven-plus to "A" level exams at the age of seventeen uses the Fahrenheit scale, and this is done in the first year. The children heat cans of water and compare the readings on two thermometers, one being Fahrenheit and the other centigrade. Since children of eleven find it easier to use the centigrade scale I should think Mr. Boarder (The Aquarist, April) should be able to agree with me.

Incidentally, nobody is forcing Mr. Boarder to change his equipment; as it wears out he can replace it with new equipment on equipment or keep using the same equipment and use a graph for easy conversion.

Now do I think it is repugnant to change over to a decimal system, as our present systems seems to me to be more, and just trying to make difficulties for both foreigners and schoolchildren.

Catherine Trevaldwyn (age 15 years),

Tank Pollution by Tubifex

I was interested to read Mr. J. W. Wilson's comments on Tubifex pollution (The Aquarist, August). As a dealer, I am most concerned with this problem, and have found it is easy to keep Tubifex alive and in the best possible condition by keeping it under running water until actually sold, when it is put into plastic bags with water. This ensures all the Tubifex, and I feel the additional expense is more than justified by the satisfaction of my customers.

With the ever-increasing interest in both tropicals and marine, it is vital that dealers pay attention to this matter and supply worms alive and in a fit state to be used.

R. A. Bassett
Proprietor, Regency Aquaria, Brighton, Sussex.

Ten-spined Stickleback

I am trying to collect data on breeding variations of the ten-spined stickleback (Pungitius pungitius), and would like, through the medium of your widely read magazine, to ask your readers for extra information.

I am especially interested in discovering whether any person has noticed a particularly high percentage of deformed fish after each spawning of normal parents, with special emphasis on the number of spines.

I will also be interested to hear of any specimens with only a few spines, say, up to four, found in natural waters, and also the approximate percentage of these to the normal fish. I will gladly refund any postage.

James Mc. M. Urquhart,
Secretary General, British Ichthyological Society,
Glasgow, S.4.

Esoxolos paradoxus

With reference to Mr. L. Lewis's letter in The Aquarist (August), he states that Esoxolos paradoxus has never been bred in captivity. By this I presume he means the young have never been reared to maturity. If, however, he means the fish have never spawned, I must refer him to the Encyclopaedia of Tropical Fishes by Axelrod and Vorderwinkler (page 649), who claim that Esoxolos has been spawned by Turwhistle. If this spawning was hatched and raised, then I hope Mr. Lewis gets a good price for his "full.

I. Harvey,
Baldon, Essex.

Success with Angel Fish

I am a newcomer to the hobby, having started in 1960 with a tank of guppies. I have two 24 in. by 12 in. by 15 in. tanks now. In the lower I have some angel fish. The largest was purchased in the summer of 1960. This proved to be a female, laying three batches of infertile eggs. Late in 1961, I purchased a further two fish from a local shop. One of these grew extremely quickly into a fine specimen but the other seemed stunted and had only reached a size of just over 1 inch (they were the same size when bought).

After returning from a fortnight's holiday this year I found these fish with Tubifex worms and the female soon began to fill out and bully the others. She is just over 3 inches long and the second fish, which is obviously a male, is only just over 2 inches long. When the lights were on the female chased him unsatisfactorily, but as soon as they were switched off the couple would begin to court vigorously and clean leaves. I removed the other fish and Monday 27th August at 10 a.m. the female began to lay her eggs on a Cryptocoryne leaf. These the male duly fertilised. The female began to eat the eggs so I divided the tank with a piece of glass, set up a diffuser stone by them and dripped in some 5 per cent. solution of methylene blue.

The eggs hatched on Thursday morning and by Saturday night the fry were free-swimming. I fed them with liquid fry food, graduating on to micro worms.

This is the first batch of fry I have had—apart from guppies. I have written to you because I thought your readers would be interested in the difference in size of the fish—the "books" say the pair should be the same size and over 3 inches.

I would like to get in touch with a hobbyist in my area for at present I do not know of anyone keen on tropica here.

I would also like to take the opportunity to thank you for your magazine, without which I would never have come as far as I have and enjoyed it—in my first 2½ years I have had only six casualties—thank you very much for your help.

Hilary Bishop (age 15 years),
Sittingbourne, Kent.

Skill in Breeding

Hyperbole is exaggeration for effect. My exaggeration certainly had an effect! Here I sit, shot down in flames. This time, I will try to be less light-hearted, and express myself rather better.
I have just had a glance across at my community tank. The male reviewer looks great, the N. anomala is a beautiful thing, the A. carinatum has just drifted magnetically by, I had great fun and not a little difficulty in breeding the last two. The red-tailed shark looks ready for a mate. Were I to get one, and then manage to persuade them to rear a family, I would be over the moon.

You see Mr. Lewis (The Aquarist, August), I keep them. I like them and take my hat off to anyone who can breed things like pommadaurs. The point I tried to make, not very well I fear, was this: given the time, the equipment, the will, the experience and a slice of luck, I believe that it is only a matter of time before someone comes up with a breed of silver sharks. Is it not well within living memory that angels were very nearly impossible? Now breeding them seems to me to be fairly commonplace.

The appeal of the guppy is quite different. Clearly the difficulty of producing a breed is not to be compared with the flakes you mention. The skill involved is a different one when one breeds to a standard shape. A knowledge of the genetic make-up of one's fish is necessary. Is this or that feature carried on the X or the Y chromosome, or has it crossed over? Very often I just don't know, but it is most interesting trying to find out.

The satisfaction of producing a line of standard fish is tremendous. The thrill that would come from breeding silver sharks might be even greater and might require a terrific amount of skill, but it would be a different kind of skill. Once you know all the answers, the interest would be gone for the purist, unconcerned with financial gain.

The legal qualities of the guppy, bred to standards, lie in the continued challenge which provides something for the aquarist to get his teeth into. I would sooner back the most experienced aquarist we could find to produce silver sharks, or one of the other "impossible" types, than guppies to F.G.B.S. standards starting with wild stock.

Incidentally, I have seen guppies like Alcyone, I should mention one, which compare very favourably with the American types. We'll still sign you up one day!

Dvd. Po. Poitou, Nottingham.

HOUSE-PLANTS IN THE FISH HOUSE

The Peperomias

by BARRY R. JAMES

BELONGING to the same family as the pepper plant of commerce, the peperomias contain some 400 species. All of the ones grown as house-plants have their origin in Central and South America, where they are often found at considerable altitudes. Consequently they appreciate cooler conditions and seem to thrive between 55° and 75°F (13-24°C).

Many peperomias possess thick, fleshy stems and leaves which have an incredible ability to resist drought. Although not advising that these plants be treated as cacti, watering should be kept to a minimum, especially during the winter months.

The flowers of the genus Peperomia are grouped together on a spike, usually white or yellowish in colour. Although grown principally for their dainty foliage these flowers spikes often provide an attractive contrast to the darker shades of the leaves.

Being woodland plants, peperomias should be given a good friable compost containing at least 40 per cent. of peat and leaf mould. Re-potting should be carried out very occasionally as the rooting system of plants of this genus is not very extensive.

*Peperomia caperata*. This tiny plant seldom exceeds 3 in. in height. The small wrinkled leaves are dark green in colour. Disliking direct sunlight, *P. caperata* does well in shady positions, provided that it is not over-watered.

*Peperomia hederaefolia*. Slightly larger than the previous species, this plant appreciates a warm moist environment. The leaves are a metallic grey with green veins. Although not completely smooth they do not have the exarated effect of the previous species.

*Peperomia magnoliifolia*. A very attractive *Peperomia* of shrub-like habit, this species reaches about 10 in. in height with broad ovate leaves some 2½ in. in length and 2½ in. wide. The stems have a reddish tinge and the leaves are matted in green and cream. A favourite with many of my customers, this plant is rapidly gaining in popularity owing to the ability of the thick glossy leaves to stand up to central heating.

*Peperomia sandersii*. A very striking house-plant; the almost circular leaves are thick, smooth and beautifully marked in silver and dark-green bands, which arise from the point where the leaf meets the stem. A relatively easy plant to cultivate; it dislikes draughts and cold, damp conditions.

*Peperomia scandens*. A trailing plant, *P. scandens* resembles another house-plant, *Phololobium scandens*, which has similar though larger heart-shaped leaves and trailing habit. However, here the resemblance ends, for this *Peperomia* has attractive variegated leaves, which at their largest are only an inch or two in length as opposed to the *Phololobium*, the leaves of which may reach 3 in. or more. Although a hardy plant when of a good size, smaller specimens are liable to sudden leaf drop, which is sometimes fatal, if they are exposed to a dry atmosphere.

Peperomias are excellent subjects for mixed bowls, where their similar requirements and quaint and attractive foliage lend themselves well to this kind of arrangement.

THE AQUARIST
from AQUARIISTS' SOCIETIES

Monthly reports from Secretaries of aquarists' societies for inclusion on this page should reach the Editor by the 9th of the month preceding the month of publication.

At the last meeting of the Yorkshire Section of the Fancy Guppy Association, an extraordinary meeting convened to a letter given by Mr. J. G. Hunt (T.) A.V. Coldwater Fish, 1, J. H. Hood (T.) Brandon's Clan (Bimba) and J. J. Hood (T.) B, B. Williams (T., Brandon's Clan (Bimba) and J. J. Hood (T.) B. Williams (T.) Brandon's Clan (Bimba).)

The table showed the following results:

- A. Williams, 79 points; B. Williams, 89 points; C. Williams, 79 points; D. Williams, 89 points; E. Williams, 79 points; F. Williams, 79 points; G. Williams, 79 points; H. Williams, 79 points; I. Williams, 79 points; J. Williams, 79 points.

A table was prepared by the Secretary and was placed on the table. The results were as follows:

- A. Williams, 79 points; B. Williams, 89 points; C. Williams, 79 points; D. Williams, 89 points; E. Williams, 79 points; F. Williams, 79 points; G. Williams, 79 points; H. Williams, 79 points; I. Williams, 79 points; J. Williams, 79 points.

One of the members of the Board of Directors, Mr. J. G. Hunt (T.), A.V. Coldwater Fish, 1, J. H. Hood (T.) Brandon's Clan (Bimba) and J. J. Hood (T.) B. Williams (T.) Brandon's Clan (Bimba) and J. J. Hood (T.) B. Williams (T.) Brandon's Clan (Bimba).

The British Ichthyological Society are pleased to announce the forthcoming publication of a new series of journals which will cover the entire field of ichthyology. The Society has decided to devote one issue per year to the study of tropical fish, and the first issue will appear in the Autumn of 1962.

Recently, the Hibernia and District A.S. had a very interesting lecture on "Long Live the River" by Mr. John Fulton, a society member. The speaker dealt with several aspects of ichthyological interest in the rivers of the area, including the problem of pollution and the need for conservation measures. The talk was well received and many interested members left the society meeting with a renewed interest in the aquatic world.

THE results of the 9th annual show of the North Eastern Federation of Aquarists was held in Dover, Kent. The show was held in the presence of Mr. D. J. Brown, President of the Federation, and Mr. J. G. Hunt (T.), A.V. Coldwater Fish, 1, J. H. Hood (T.) Brandon's Clan (Bimba) and J. J. Hood (T.) B. Williams (T.) Brandon's Clan (Bimba) and J. J. Hood (T.) B. Williams (T.) Brandon's Clan (Bimba). The show was judged by Mr. J. G. Hunt (T.), A.V. Coldwater Fish, 1, J. H. Hood (T.) Brandon's Clan (Bimba) and J. J. Hood (T.) B. Williams (T.) Brandon's Clan (Bimba) and J. J. Hood (T.) B. Williams (T.) Brandon's Clan (Bimba).

Owing to unexpected difficulties, the September meeting of the Lancashire Section of the Fancy Guppy Association could not be held at the usual Manchester venue. As a result, the meeting was held at the Royal Manchester Hotel. The meeting was well attended and the discussions were lively and informative. Several new ideas were discussed and some interesting details were shared by different members.

At the September meeting of the Bedford and District A.S. a table was held where Mr. J. G. Hunt (T.), A.V. Coldwater Fish, 1, J. H. Hood (T.) Brandon's Clan (Bimba) and J. J. Hood (T.) B. Williams (T.) Brandon's Clan (Bimba) and J. J. Hood (T.) B. Williams (T.) Brandon's Clan (Bimba). The table was well attended and many interesting discussions took place. The results were as follows:

- A. Williams, 79 points; B. Williams, 89 points; C. Williams, 79 points; D. Williams, 89 points; E. Williams, 79 points; F. Williams, 79 points; G. Williams, 79 points; H. Williams, 79 points; I. Williams, 79 points; J. Williams, 79 points.

The North West London Group of Aquarists held their annual Aquarium and Coldwater Glassware Show at the Walthamstow Town Hall. The show was well attended and many interesting exhibits were displayed. The results were as follows:

- A. Williams, 79 points; B. Williams, 89 points; C. Williams, 79 points; D. Williams, 89 points; E. Williams, 79 points; F. Williams, 79 points; G. Williams, 79 points; H. Williams, 79 points; I. Williams, 79 points; J. Williams, 79 points.
The Aquarist's Badge

Produced in response to numerous requests from aquarists, this award is made from silver and red and blue enamelled metal. The aquarist can now be adorned at one cost by all readers of The Aquarist. The design is pictured here (actual size). Two forms of the badge, seen fixing the lapel buttons hole and the other having a brooch-type fixture, are available.

To obtain your badge send a postal order for 3s. 6d. to The Aquarist, The Offices, Half-Acre, Bensford, Middlesex, and please specify which type of fixing you require.

To win a trophy one must have entered for 3s. 6d., to The Aquarist, The Offices, Half-Acre, Bensford, Middlesex, and please specify which type of fixing you require.

AQUARIST'S CALENDAR

11th-12th October: Scrooby & District A.S., Annual Show at Scrooby, Notts, President to be Mr. H. J. Hart, Exhibition Secretary to be Mr. I. A. F. Rees, Judge to be Mr. J. M. B. Westwood. All Monday and Tuesday.

20th-21st October: British Aquarian Festival, Belle Vue Zoological Gardens, Manchester. Schedules and special cards are available from the Secretary, Mr. W. E. Green, "Spring Grove," Radford, Bury.

20th November: Preston and Burn A.S., Annual Open Show, Charles Street Hall, Preston. Schedules will be available from Mr. F. P. Easton, Secretary, of 1, E. W. Road, Burnley, Lancs. All Monday and Tuesday.


21st November: Bracknell and District A.S., Inter-Club Open Show, Table at The Aquarist, Community Centre, Church Road, Bracknell. Schedules from Mr. K. Phillips, 1, E. W. Road, Earthyamstead, Bracknell, Berks.
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Rasbora (Hemichromis Bicinctus) 6s. each, 4 for 20s.

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Albino Paradise Fish 4s. 6d. each

Paradise Fish 4s. 6d. each

Rasbora 3s. 6d. each

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Superfish Homogenised Micro-Pellet Food - Medium | Giant | 8
Superfish Homogenised Micro-Pellet Food - Community | Giant | 8
Superfish Homogenised Micro-Pellet Food - Course... | Giant | 8
Superfish Homogenised Micro-Pellet Food - Extra Course... | Giant | 8
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Vitaliner - Medium | Large | 2.3
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Hi-Glow 10 Colourfood - Coarse | Ex. £.4-8
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Salmon Eggs | Small | 1.3
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Beef Meal | Large | 2.3
Bait Meal | Large | 2.3
Fib Meal | Large | 2.3
Fish Meal | Large | 2.3
Crab Meal | Small | 1.3
Cock Meal | Small | 1.3
Tinkers | Small | 1.3
White Worm Flakes | Small | 1.3
Starving Meat | Small | 1.3
Starving Meat | Small | 1.3
Conditioning Goldfish Food (Fortified) | Large | 2.3
Goldfish Special (Natural) | Large | 2.3
Turtle Food | Large | 2.3
Turtle Food | Large | 2.3
Glue Table (20 Tablets) | Small | 1.3
Banana Powder (1000g) | Large | 2.3
Cage Food | Large | 2.3
Cage Food | Large | 2.3
Fish Food | Large | 2.3
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Liquor Small Fry Baby Food (Eggplant) | Small | 1.3
Liquor Small Fry Baby Food (Eggplant) | Small | 1.3
Assorted | 8
Banana Starter Egg Pack | Hatchling Salts (60cm) | Small | 1.3
Starter Pack | 8

REMEDIES

Anti-Chlorine Crystals (Capped) | 2.3
Anti-Chlorine Tablets (100) | 2.8
Anti-Chlorine Tablets (100) | 2.8
Treasure Chest Neutraliser (Capped) | 2.8
Treasure Chest Neutraliser (Capped) | 2.8
pH Test Kit (cheater) | 16.8
pH Test Kit (cheater) | 16.8
Bufferised Blue (pH Indicator) | 4
Bufferised Blue (pH Indicator) | 4
Acetonic (general tonic and remedy) | 1.8 oz. | 3.3
Acetonic (general tonic and remedy) | 1.8 oz. | 3.3
Anti-Chlorine Compound (Liquid 25% chlorine neutraliser) | 2.8
Anti-Chlorine Compound (Liquid 25% chlorine neutraliser) | 2.8
Aquacure (clears cloudy water) | 1.8 oz. | 2.8
Aquacure (clears cloudy water) | 1.8 oz. | 2.8
Fungus Remedy (Polynomials, Staetins) | 1.8 oz. | 2.8
Fungus Remedy (Polynomials, Staetins) | 1.8 oz. | 2.8
Spray (Liquid plant food) | 1.8 oz. | 2.8
Spray (Liquid plant food) | 1.8 oz. | 2.8
Methylene Blue (Glitter pack) | 1.8 oz. | 4
Methylene Blue (Glitter pack) | 1.8 oz. | 4
Aquacure | 8 oz. | 10
Aquacure | 8 oz. | 10
Aquapower | 8 oz. | 10
Aquapower | 8 oz. | 10
Fungus Remedy | 8 oz. | 10
Fungus Remedy | 8 oz. | 10
Spray | 8 oz. | 10
Spray | 8 oz. | 10
Methylene Blue | 8 oz. | 10
Methylene Blue | 8 oz. | 10
Junior pH Test Kit | 7/8
Junior pH Test Kit | 7/8
Cerulic (cereamic substrate in the aquarium) | 8 oz.
Cerulic (cereamic substrate in the aquarium) | 8 oz.
Superchlor (Removes chlorine instantly) | 8 oz.
Superchlor (Removes chlorine instantly) | 8 oz.
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Al-K-Fix (Prevents algae in aquarium tanks) | 8 oz.
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We sell, buy, or exchange fish of any kind. We also purchase second hand tanks or complete set-ups.

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No fish of any kind by mail.

<table>
<thead>
<tr>
<th>Species</th>
<th>Price</th>
</tr>
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<tbody>
<tr>
<td>Silver</td>
<td>40-50</td>
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<tr>
<td>Redhead Black Shark</td>
<td>45-50</td>
</tr>
<tr>
<td>Black Shark</td>
<td>45-50</td>
</tr>
<tr>
<td>Redfin Shark</td>
<td>30-40</td>
</tr>
<tr>
<td>150 other species of fish</td>
<td>9.00 S.A.E. for list</td>
</tr>
</tbody>
</table>

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**PLEASE NOTE**

The above prices written by Theo. H. Marshall: Breeding the Egg. Breeding the Bloodsuckers. Breeding the Leafstems. Breeding the Coldfish. Aquarium Management and Fish Farming. Aquarium Plants and Seeds; we are all available from June 1st per volume, 10/- or a complete set for 4/- each post paid.

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October, 1962

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<table>
<thead>
<tr>
<th>Length of Tank</th>
<th>No. of to be Fitted</th>
<th>Filters Size</th>
<th>Price</th>
</tr>
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<tbody>
<tr>
<td>16 in.</td>
<td>1</td>
<td>&quot;S&quot;</td>
<td>12 6</td>
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<tr>
<td>18 in.</td>
<td>1</td>
<td>&quot;S&quot;</td>
<td>12 6</td>
</tr>
<tr>
<td>24 in.</td>
<td>1</td>
<td>&quot;L&quot;</td>
<td>15 0</td>
</tr>
<tr>
<td>30 in.</td>
<td>1</td>
<td>&quot;L&quot;</td>
<td>15 0</td>
</tr>
<tr>
<td>48 in.</td>
<td>2</td>
<td>&quot;L&quot;</td>
<td>10 10</td>
</tr>
</tbody>
</table>

### Windmill Consort External Filter
- **Windmill Regent Internal Filter**...
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All sizes of Windmill Filters can be manufactured to your special requirements.
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