The AQUARIST
AND PONDKEEPER

Founded in 1924 as "The Amateur Aquarist"

THE BUTTS, HALF ACRE, BRENTFORD, MIDDLESEX

Telephone: HOUnslow 9301

PUBLISHED MONTHLY

SUBSCRIPTION RATES

The Aquarist will be sent post free for one year to any address for 19/6. Half-yearly 9/9. Canada and U.S.A. $3.00 yearly; $1.75 half-yearly.

QUERIES

Postal replies are made to all specialised queries accompanied by a stamped, addressed envelope. *This privilege is afforded only to registered readers and bona fide subscribers.* Subscription forms can be obtained on application. In all cases letters should be addressed to the Editor.

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The Editor accepts no responsibility for views expressed by contributors.

When two animals such as bitterling and mussel live together in close association but without full mutual dependence on one another, the term commensalism is used to describe the partnership (see page 75).

VOL. XIX No. 4 1954

Editorial

PROFESSOR J. J. Duyvené de Wit, in his enlightening article in this issue which deals with the relationship between bitterling fish and freshwater mussel, raises a particularly thought-provoking point in describing research work being carried out in the hope of discovering how this queer relationship ever came into existence. The nicety and fairness of an arrangement whereby the fish employs the mussel as an incubator for its eggs and the mussel uses fish to aid dispersal of its larval brood appeals to the imagination. It has a quality of the make-believe world of children's stories, where animals can talk and bargain with one another. Yet the bitterling and mussel partnership is fact, and it really does defy the human to explain its foundations.

The feeling of helplessness in trying to elucidate the problem grows if the scope of this "when and how?" enquiry is extended to the habits of other fishes. Why, for example, should some fish at one stage of their evolution have taken to incubating their eggs in the maternal mouths? What could have brought about the utilisation of bubble nests by the gouramies? How was the archer fish able to develop the trick of shooting down his meals? Being aware of the advantages of such specialised habits or even being able to show conditions in the particular environments of the fish which made such adaptations desirable does not make it any easier to solve the queries "when?" and "how?"

Comprehension is baffled because we are examining developed and perfected systems, systems which have had infinite time to arise and persist because of their success, and seldom is there any evidence remaining of experimental adaptations which were tried and have disappeared because of their failure. It is like trying to understand the origin of the jet aircraft with no knowledge at all of its progenitors and developmental stages. This leads to another query. Are conditions now so stabilised that further adaptations in fishes do not occur, or are new habits in the slow course of development amongst some before our non-comprehending eyes? But then, looking into the future is notoriously less productive than speculation about the past.

Don't let Expense be a Deterrent!

THE enthusiasm of many beginners may have evaporated rapidly when on visits to established aquarists' fish houses they have been confronted with rows and rows of tanks and what seems to be innumerable expensive-looking gadgets. All too often the would-be hobbyist is frightened off by visions of an initial cash outlay far beyond the amount he can afford.

People do spend large amounts on aquaria, equipment and fishes; believe me, they are definitely in a minority. Quite often, everything is too easy for this type of hobbyist and he soon tires of fish-keeping and seeks a fresh field of interest. One very new member of the club with which I am connected used to boast that he had spent well over £200 on tanks and exotic fishes and was at that time even considering the construction of a special brick-built fish house complete with all modern conveniences. Needless to say, all the aquaria were chromium-plated. . . and "seats" (at this time they were not readily obtainable and were making £2 or £3 each) were as common as guppies in his tanks.

An enthusiastic and regular attender at club meetings for about four months, his attendances suddenly ceased. On making enquiries a month or two later it was found that a bad dose of "white spot" had to some considerable extent dampened his enthusiasm. He eventually sold his tanks at about a fifth of their value, and gave away the few hardier fishes that had survived his unskilled handling.

Another beginner of my aquaintance saw in tropical fish breeding the opportunity to make immense profits by concentrating on such species as neon tetras and some of the *Corydoras* sp. catfishes. Ambitious plans were soon being put into operation, one of which was to convert one of his greenhouses (he was in business as a nurseryman and horticulturist) into a breeding and rearing house. Very soon, of course, our hero realised that there was a little more in this fish-breeding lark than meets the eye; some of the "guaranteed" pairs sold to him failed to live up to their owner's hopes, and even when they did produce spawn he found it was a little more difficult to bring the offspring to maturity than he had imagined. A few months later I heard that he had sold his equipment, lock, stock and barrel, and that the greenhouse was back at work again producing prime tomatoes, cucumbers and other crops in their season.

Even cathedrals have to have foundations and you'll do well to start in a small way with a correspondingly small outlay. A modest coldwater outfit need cost no more than twenty or thirty shillings even if you buy the tank from a dealer. As you gain experience you will find ways and means of increasing your stock and number of tanks and gradually adding heaters and other equipment if your fancy turns to the more exotic fishes. Two keen amateur breeder friends are still using the original tanks with which they first started fish-keeping, in both cases smaller than 18 in. by 10 in. by 10 in. Both started with coldwater fishes and progressed to tropical fishes. In the same way their breeding operations commenced with the more common and prolific livebearers and as they acquired experience (mostly of the bitter kind) they attempted the egglayers that are the easiest to breed and so moved on to more difficult species.

Ingenuity Saves

The moral of these stories is to walk before you run, or more briefly, take it easy! As a general rule you'll find the enthusiastic fish-keeper makes do in many ingenious ways. For instance, he has probably made most of his tanks himself, or at the very least glazed them. His stands are more likely to be of the scrap bed-iron welded type rather than the very desirable but expensive decorative wrought-iron stands that one sees advertised. Light shades are a simple job for the average handyman and some hobbyists, with the aid of hints and articles that are published in *The Aquarist* from time to time, even construct their own heaters and thermostats. So to the beginner I would say, don't let the question of expense deter you from keeping fish; a really extensive layout can be managed on quite a modest budget. Others do it, why not you?

Simplicitas

Mr. Henry A. Nichols (left) with Mr. Gene Wolfsheimer, Fellows of Aquarists Internationale, seen by the garden pool of a Beverley Hills, California, aquarist Mr. Allen B. Davies

A.I. Member on Visit from U.S.

THE internationally known aquarist and writer on aquatic subjects, Henry A. Nichols, F.A.I., arrived in this country from the United States on a brief visit at the end of May. His visits included an inspection of the South Bank Aquarium and a visit to the National Aquarium Exhibition. Mr. Nichols met many old friends during his stay and, if time permits, plans also to travel to Paris, Monte Carlo, Antwerp, Amsterdam and The Hague. For the benefit of those readers who do not know what "F.A.I." denotes, a brief explanation may be of interest. Mr. Nichols is a fellow member of the Aquarists Internationale which was formed in 1951 for the rapid and accurate exchange by correspondence of news and views on fish-keeping problems and all aquatic subjects. Gene Wolfsheimer of California was primarily responsible for its formation and the society now has members in many countries including England, United States, China, Saudi Arabia, South Africa and Alaska. Membership is strictly limited and the society is unusual in that it has no officers, subscriptions or meeting place. Mr. Nichols is hoping to look up several English and European members of the Aquarists Internationale during his visit.

R. W.

The Story of Bitterling and Mussel

by J. J. DUYVENE DE WIT, D. Ph. Nat.

(Professor in Zoology, University of the Orange Free State, South Africa)

THE bitterling (*Rhodeus amarus*) is a fresh-water fish occurring in Western Europe. Bitterlings are, however, not common in European aquaria. With the three-spined stickleback it shares the fate of being a "common" fish in that continent.

Thanks to the well-known investigations of Professor N. Tinbergen, at present ethologist at Oxford University, it has, however, been shown that this very common stickleback displays very uncommon behaviour during the spawning season. The male builds a tunnel-shaped nest of algae and other fragments of vegetation, it performs the most fantastic sham-fights, it stimulates the female to deposit her eggs, it cares for the nest and it fans oxygenated water over the fertilised eggs, and cares for the offspring after hatching. In short, the stickleback displays a highly spectacular scene during spring and it has already furnished an important contribution to the understanding of behaviour in animals in general. Incidentally, the bright red colour of the belly and the light-greenish shade of the dorsal side of the male during spawning time, puts many a tropical fish in the shade. But, we agree, the stickleback is not very attractive out of the season. It shows an unfriendly face and it is most intolerant towards other fishes. Therefore, back to the ditch!

The bitterling is also a common fish in Europe but with this difference: it is a very friendly, sociable animal, which charms by its graceful movements and the fine silvery gloss of its scales during the whole year. It is related to the carps but it has a maximum length of three inches. This size is, however, rarely attained in nature as it would by that time have fallen prey to a pike or perch.

The bitterling is a most interesting fish, specially during the spawning period, when the male displays almost all the colours of the rainbow. The head and the upper part of the body assume a rosy colour, which is continued on either side of the lateral iridescent line, which becomes an emerald green. The dorsal fin becomes black with a red triangle at its foremost tip and the anal fin rose with a black edge. Two groups of white wart-like outgrowths above the nostrils are the last to appear.

In this drawing of a thin section of mussel gill under the microscope embryo bitterling are seen (after Olt)

Female bitterling in the act of depositing eggs in the mussel, with the male in close attendance

Still more interesting, however, is the female. In spring she develops a long tube-shaped appendage just in front of the anal fin. This tube is the ovipositor with which the eggs are deposited in the exhalent siphon of fresh water mussels.

When you look at a mussel, with its upper part projecting out of the sand, you will find the two valves connected at the upper side by a joint-like hinge. Between this hinge, which is covered by an elastic ligament, and the end of the projecting valves, the valves are a few millimetres apart. Here a small oval slit is visible: the exhalent siphon. Next to this is another larger opening, surrounded by thin projections: the inhalent siphon. A steady flow of water circulates from the inhalent to the exhalent siphon via the gill cavities.

The mussel feeds on very small food particles which are filtered from the water by the gill apparatus. Due to the presence of mucus the food particles collect together to form larger particles which are then conveyed to the mouth of the mussel by the movements of cilia.

At the lower part, where the valves are separated, the "foot" of the mussel projects into the sand. With the aid of this organ the mussel moves slowly through the substrata, usually mud.

The mussel serves as an incubator for the bitterling eggs. The relatively large, oval, yellowish eggs, after being laid fall down between the ridges of the mussel's gills without doing any harm to their host. Here they develop for about three to four weeks. Finally, slim little creatures leave their host to lead an independent life.

The mussels in turn utilise their foster children in the following way. Those species of mussels (*Unio* and *Anodonta*, epitomised: najads) with which the bitterlings live in commensalism, retain their eggs within their outer gills for some time. Here they are also fertilised by the

sperms of male najads which enter the inhalent siphon of the females with the respiration water. From these eggs small bivalved larvae develop which in appearance differ greatly from full-grown mussels. They are called glochidium-larvae. They are provided with barbed hooks along their valves and a sticky thread or byssus projects from between the valves. They are expelled by the mother mussel in small groups which sink to the bottom. If a passing fish disturbs the water immediately above them, they are whirled upwards and come in contact with that fish; they then adhere to it with the aid of their byssus and hooks. Fish which have been infected in this way react to it by developing a thin mucous membrane over each larva. The larvae becomes encysted and are visible as small knobs. Within these knobs the definite mussel develops. When the vesicle bursts open and the young najad appears, it falls to the bottom and becomes self-supporting. In this way the bitterling aids the distribution of the mussels.

The relation between freshwater mussels and bitterlings has taken a long time to understand. The occurrence of fish eggs in mussels was first observed by Cavolini in 1787. A hundred years later a physician, Schoot, had the idea of putting mussels, presumably containing fish eggs, in a basin without other fishes. His experiment was successful. A school of about hundred young fish was found swimming in his pond some weeks later and all of them proved to be bitterlings.

The ovipositor then, is the organ with which the bitterling deposits its eggs in fresh water mussels. The long, slack tube is introduced into the exhalent siphon of the mussel by means of a special device. The ovipositor originates in a cone-shaped, muscular organ, present in the abdominal wall just before the anal fin. In this wall is an oval hollow and during rest this organ is largely retracted into it. The cone-shaped organ may, however, be actively moved forwards to a vertical position, the apex then pointing downwards. The anus opens at the apex of this cone. The ovipositor begins just behind the cone, behind the anal opening and is in connection with a cavity lined by a muscular wall into which both oviduct and urinary bladder open.

During oviposition the following occurs. The cone-shaped organ is projected downwards just above the exhalent siphon of the mussel. One or more eggs are moved to just before the entrance of the ovipositor. Behind the eggs the cavity is filled with urine. When the bitterling female suddenly swoops down and introduces its cone-shaped organ into the opening of the mussel, the muscular wall contracts. The urine is then under pressure and forces the eggs through the whole length of the ovipositor as it would any other plug. As a result of this, that part of the ovipositor through which the eggs have passed becomes rigid, as a "water-axis" is formed. Thus, the ovipositor reaches deeply into the gill cavity of the mussel. As soon as the eggs have been ejected the urine flows away and the ovipositor becomes slack again. The whole oviposition process is enacted within a fraction of a second and can only be analysed with the aid of a film.

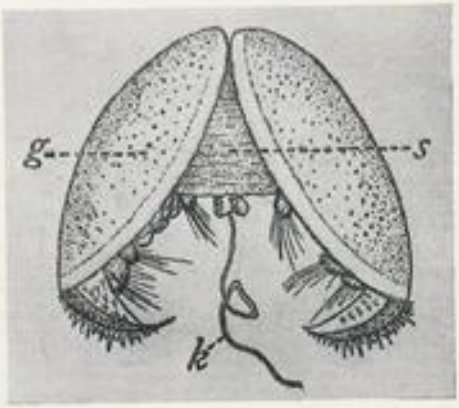
Some twenty years ago an article published in the U.S.A. brought the bitterling to the attention of the public, as it was believed to be a reliable animal for pregnancy tests. After the spawning season the ovipositor shrinks to a hardly visible nipple. But when urine of a (pregnant) woman is added to the aquarium water the organ may develop to a length of one centimetre and more within twelve hours. From further investigations, however, it appeared that ovipositor growth may be caused as often with the urine of non-pregnant as with that of pregnant women. As a means for detection of pregnancy this method is therefore of no value.

We mentioned earlier that a long ovipositor develops only during spring. The organ, however, does not remain the same length during the whole season and its length shows a distinct cycle. On a certain day the ovipositor is very long and eggs may then be deposited several times. After this, six or seven days follow during which the organ is much shorter and then no spawning occurs. After these days the ovipositor again grows out to its full length and an oviposition-peak occurs.

If all the mussels present are now removed and only a male remains with the females, then the intervals between oviposition-days are doubled. If only the male is removed and the mussel is left in the aquarium, then the number of inactive days are again doubled. If now the male and the mussels are both removed, then an oviposition-peak occurs only once a month. Apparently the female bitterling has a mechanism which registers the stimuli, originating from the male and the mussel qualitatively.

Our knowledge of the sensory capacity of the bitterling is still very fragmentary. It is known, however, that the stimulus coming from the mussel has chiefly to do with the water-current leaving the exhalent siphon. When a small glass tube is set up between the valves of a dead najad and a slight current of water is circulated through the tube, then females deposit their eggs between the valves in the usual way.

The spawning behaviour of *Rhodeus amarus* also provides fascinating ethological problems. In spring the male establishes a territory around a mussel. In fact his territory is a moving one, for if the mussel moves, the territory goes with it. All fish, including female bitterlings with long

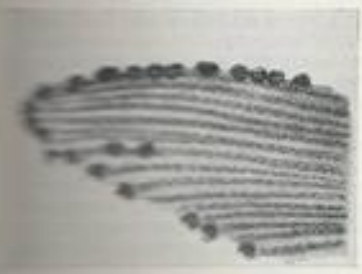


Glochidium larva of mussel (Anodonta) **g**: *valve* **k**: *byssus* **s**: *retractor muscle (after v.B. Jutting)*

Successive stages in the bitterling spawning act from a film (Ned Onderwijsfilm)

competitors, intruding in the territory, are immediately chased away. The aggressive behaviour of the male is the same to all intruders, but if a female which is ready to spawn intrudes and does not flee, his behaviour suddenly changes. He stops threatening, spreads his fins and trembles. He then turns and leads her to the mussel. If she does not follow him, he again remains stationary and trembles once more; if this does not induce her to follow, she is immediately chased away.

When the female reaches the mussel she determines the direction of the water current and then again makes way for the male which then performs a movement resembling that of fertilisation, i.e., he swoops over the exhalent siphon. The male then again moves to the back of the mussel and the female approaches it. She takes up a position above the siphon with her body-axis at an angle of about 75 degrees to that of the mollusc and her tail directed towards the ligament. She then slowly turns until the axis of her body is parallel and above that of the mussel. She then suddenly swoops down over the mussel and pushes the cone-shaped



Mussel larvae seen attached to the fin of a carp (after v.B. Jutting)

ovipositor into the exhalent siphon, the slack ovipositor still dangling behind.

The oviposition-mechanism is then brought into action in the way already described and the eggs are expelled. After this movement, which lasts only a fraction of a second, the female swims away and the male, who has been motionless during the female's performance, expels numerous sperms into the water and these come in contact with the eggs via the inhalent siphon of the mussel.

Also very interesting from an ethological point of view is the phenomenon of ambivalent behaviour shown when two females are kept with a mussel in the absence of a male. It is known of some tropical viviparous fishes that females which have already given birth to young, may change into males. In these cases the ovary is transformed, for unknown reasons, into a seminal gland. They are then, however, definitive males and are incapable of reverting to the other sex again.

When, however, two female bitterlings are kept with a mussel, one of the partners may assume a male behaviour pattern. Ovipositor growth ceases and this masculinised female adopts "his" partner to the mussel in the same way as a male. If we remove the partner which has retained her female behaviour, so that the masculinised female is alone with the mussel, then the female behaviour pattern returns completely and manifests itself in a resumption of the ovipositor growth-cycle and the performance of pseudo-oviposition movements. In this case we thus have to do with a change of sex which is limited to the psychical sphere, the bodily substratum remaining unchanged.

In Holland the bitterling spawns during spring only. We received two shipments of bitterlings from the Dutch governmental fish hatcheries by Royal Dutch Airlines in autumn and spring respectively. These fishes spawned in the South African spring and again in the following autumn. The general opinion that the prolonged daylight would be the main cause of the induction of the spawning activity in fish seems to be doubtful.

One of the most fascinating problems represented by the bitterling is the question which we are deliberately stating in a paradoxical way: how did this species of fish ever "come to the idea" of depositing its eggs in a mussel? To make this possible, firstly, an ovipositor and an adequate oviposition-mechanism must have developed. Secondly, an instinct must have arisen by which the organ could be used in this way. Thirdly, in the male an instinct for establishing a territory around a mussel and leading the females to this incubator must have developed. Inversely these instincts would be quite useless when the oviposition-mechanism is not present. How have these numerous and essentially different factors come together to produce a "survival value" to the species by functioning as a harmonious entity? The usual answer to this and similar questions, which are repeatedly found in nature, is that these phenomena have been accomplished by "evolution." As long as we have not the slightest idea of the way in which the highly intricate mechanisms of *this* kind of evolution came into being, this explanation elucidates nothing at all.

Perhaps our understanding of this process, which suggests an example of evolutionary adaptation, but which surpasses our capacity of imagination to such a large degree, may be advanced by a comparative investigation of all known species of bitterling. The European bitterling is the only species which, in prehistoric times, has come to Western Europe, via Manchuria and Siberia. During this migration the presence of najads was probably essential.

The actual place of origin of the bitterlings is East Asia, where 40-60 different species, belonging to three or four genera, occur. Due to the wonderful assistance of the S.E. Asia Science Co-operation Office (Unesco), at Manila, contacts have been made with prominent ichthyologists in Japan, Formosa, Hongkong and even Korea and Peking-China, so that these species may be collected and shipped to South Africa. With the aid of the Royal Inter-ocean Lines Ltd., three shipments of Asiatic bitterlings have already arrived safely. Just like the European species, they too content themselves with South African najads and propagate in them.

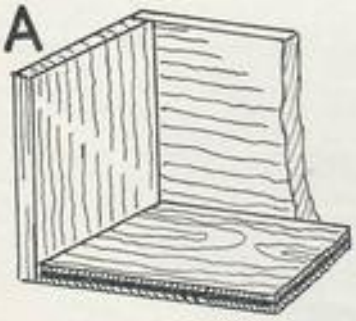
A comparative investigation of the biology of these different species as to their embryological, anatomical, ethological and zoögeographical aspects may perhaps give us some insight into the way in which the marvellous commensalism between bitterling and mussel originated.

A Home-made Mantelshelf Aquarium

by NICHOLAS BROWN

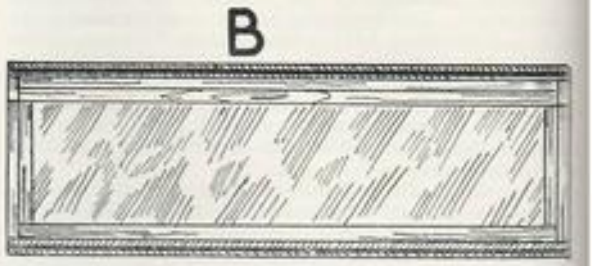
THE details given below show how a home-made aquarium was constructed to a rather peculiar specification. It was designed to stand on the top of a fireplace, and with the exception of the front glass panel, the visible parts of the tank had to be of polished hardwood. It was hoped to avoid the use of paint on the inside, which meant that it had to have a glass or similar lining to be waterproof. No elaborate joints were to be used in the construction, lighting was to be of the strip type, and above all the cost had to be kept to a minimum. With care in construction there is no reason why any reader should not make an equally successful tank. The dimensions given below need not be adhered to too closely.

The desired finished size was 3 feet long, 6 ins. wide and 11½ ins. deep. Construction was started by fixing the back (2 ft. 11 ins. long, 11½ ins. wide) on to the base, which was of the same length but only 5½ ins. wide. For these two members ½ in. thick plywood was used: the appearance was of no great importance, but a resin-bonded ply was used as it would be waterproof in the event of leaks. The bottom edge of the back was drilled at intervals of four inches for brass screws, and the vertical back was screwed to the rear edge of the base so that the lower edges were level. The screwheads were well countersunk, and before the two pieces were assembled some waterproof glue was put along the meeting edges.



Solid oak of ½ in. thickness was used for the two ends, each being 11½ ins. high by 6 ins. wide. These strips were glued on the appropriate edges and secured by oval-headed nails. The nails were punched well down into the wood (a nail punch was thinned down on a grindstone for this purpose so that too large a hole would not be made) and the resulting holes above the nail heads were made good with plastic wood. The plastic wood was mixed up with a little oak stain so that whitish patches would not be left to show where the nails were driven. A view of one corner of the tank at this stage is shown at A. The tank was then given extra rigidity by nailing a ½ in. plywood panel on the top, level with the outside edges. The oval-headed nails on this were treated in the same way as on the ends.

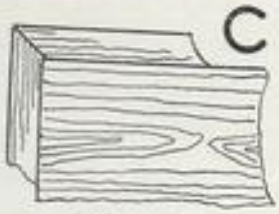
Two ½ in. thick solid oak strips, one 3½ ins. and the other 1½ ins. wide were required, both being 2 ft. 11½ ins. long. The necessary screw or nail holes were drilled in the appropriate edges of each, and they were glued and fastened into position, the narrow strip at the bottom. These strips fitted between the inside edges of the sides, with the upper and lower edges of top and bottom strip hard against the inside of the plywood top and base respectively. As



before, nail and screw holes were made good with stained plastic wood.

On completion of this stage the lid was sawn off. This was done by marking a line on the wider strip at two inches from the extreme top, carrying this line around the two sides and back. It was quite an easy matter to saw round this line with a tenon saw and so remove the lid. By working in this way the lid must be a perfect fit for the tank, which is far from easy to ensure if the two parts are made separately. Two ½ in. square strips of oak were fitted between the inside edges of the two front rails, one on each side hard against the inside edge of the end. These strips were glued before being nailed from the outside.

The tank and lid were given a thorough glasspapering, both inside and out, and both items were stained inside and out. The next step was to fix the front glass panel which was of ¼ in. thick plate glass. It was simply bedded into place with aquarium cement, and a front view of the tank then began to resemble drawing B. Ordinary thin picture glass was used for lining the base, back and sides of the tank. This was cut to size as accurately as possible, the back was given a light coating of one of the colourless waterproof glues that are on the market, and each piece of glass in turn was pressed into position against the appropriate wooden



member. As soon as the last piece of glass was in place, the tank was filled with water. The pressure of the latter held the glass firmly in place while the glue set and would also have drawn attention to any leaks that might need treatment.

To hide the raw edges of the plywood on top and base, some ½ in. square strips of oak were fastened round the sides of these members. The strips were glued and nailed into place but were cut across at an angle of 45 degrees at the corners so that they would fit neatly with no end grain showing. Drawing C shows (in plan) how this appeared at

(*Please turn to page* 82)

AQUARIST'S Notebook——

by
RAYMOND YATES

WHILST in Blackpool recently I had the opportunity of being shown over the large public aquarium which forms one of the main attractions of the famous Blackpool Tower. Admission to the Tower buildings includes admission to the aquarium and as just about everyone who visits Blackpool in the season visits the Tower it is reasonable to suppose that this aquarium is the one which has the greatest number of visitors of any public aquaria in Britain. This being the case a high standard will be expected by the aquarist, and he need have no fears, as this aquarium is certainly one of the best in the country.

The original aquarium was opened over seventy years ago and round the original square block the present layout has been built. At present about 130 species of fish are on show in roughly 55 tanks of varying sizes, of which about 30 are given over to tropicals and thirteen to marine exhibits. Some of the tanks are very large indeed, one holding 6,000 gallons, another 4,000 gallons and four others 2,500 gallons each. On these the plate glass is one inch thick. For the marine tanks a pipe-line connects with the town's salt-water main and there are two large filters as well as two similar filters for the fresh water tanks.

The curator, Mr. Raymond Legge, is well known in northern aquatic circles as a judge and lecturer, and he has charge of the Tower Zoo, which includes many of the larger animals, so that he has something of a full-time job. As far as the aquarium is concerned he has four assistants and one of these, Mr. Beaumont, the assistant curator, went to a great deal of trouble in showing me behind the scenes. Blackpool Aquarium is one of those where each tank contains a large number of specimens and it is worth mentioning that one coldwater tank alone contains over 70 twelve-inch brown trout. Some very gratifying exchanges are made periodically with Regents Park and some fine swallow-tailed wrasse and several varieties of sub-tropical bream are on show which came from there.

Another marine item of interest was a tank of castanets (*Glyphisodon luridus*) which look rather like large cichlids and display wonderful violet and indigo hues. Before our very eyes they were spawning on the rock sides of their tank, a gesture I appreciated. A fine lobster is an unfailing source of attraction and it is remarkable how many people cast doubt on it being a real lobster because "Everyone knows that lobsters are red." There are a number of good-sized dog-fish and in their tank are some thirty-odd egg capsules of this species (about three weeks old when I saw them) and all quite transparent with a living, moving baby dogfish sealed up inside, these being about one and a half inches long.

Tropicals are in good condition and there were some fine scats, which, I was told, prefer diffused light or they tend to go off their food. Orange chromides on show were in first class condition and had none of that dejected look so often seen with this species. A feature of some of the tropical tanks is the background, which is quite unlike anything usually seen in tropical aquaria. Mr. Legge had the brilliant idea of using blue perspex to produce an effect of space and distance. This is moulded to fit the tank so that the three non-viewing sides are completely covered. The shade of colour which has been used is approaching ultra-marine and the effect, in conjunction with the varied and interesting rockwork, has to be seen to be fully appreciated.

Behind the scenes there are many tanks and many fish, and an instructive section is situated on the roof of the Tower building. Here in the small hatchery comprising about thirty tanks the great majority of the tropical fish exhibited in the Aquarium have been bred. The many aquarists who have been privileged to visit this rooftop sanctum will be familiar with the splendid breeding record of this tiny hatchery. In the Aquarium the tanks for tropicals are electrically heated. Overhead jet aeration is used in all marine tanks and gives good results. Disease is almost unknown but, as with so many lesser aquarists, trouble is constantly experienced with blue-green algae.

A number of aquarist societies have been shown over the Aquarium in the past but it must be stressed that anything in the nature of a conducted tour during the busy season (May to the end of October) is quite impossible. Societies wishing to visit the Aquarium as a party should arrange to do this in the period November to April. Aquaria at seaside resorts are always crowded during the summer and individual aquarists who want to go round in comfort and at leisure will generally find evening and particularly late evening the best time if they want the tanks to themselves. Feeding time at Blackpool Aquarium is 11.30 a.m., except on Sundays. Any aquarists in this vicinity during the summer are well advised to look-in on this fine set up. They will find a great deal of interest, well stocked and well set up tanks and many unusual specimens and features.

* * *

The report for the year 1953 of the Zoological Society of London gives some interesting aspects of the cost of running large public aquaria. The expenses of the aquarium at Regent's Park for the year are shown as £7,667, representing salaries, wages, fuel, light, provisions, exhibits and general expenses such as maintenance. Admission charges for the year totalled £12,509 so the aquarium showed a surplus of approximately £4,800. The surplus for the previous year (1952) however, was much smaller, being only £2,700 or thereabouts. The attendance of the public at the aquarium remains disappointing as only about 18 out of every 100 visitors to the Zoo are sufficiently interested to pay the extra shilling. The actual figures for 1953 are 1,972,222 visitors to the Zoo and 346,800 of these also went through the Aquarium. (The 1952 figures were 1,970,050 and 322,902 respectively so there was a slight increase in the proportion of visitors to the Aquarium.)

One event of note during the year was the award of the silver medal of the Society to the curator of the Aquarium, Mr. H. F. Vinall, for over fifty years' devoted service. For once in a way no books on fish life were presented to the famous library of the Society, the value of which is estimated to be in the region of £100,000. Several books of vivarium interest, however, are acknowledged. New additions to the aquatic collection were *Cynolebias nigrofasciatus* and *Nannochromis nudiceps*. Fish donations included 18 barbel, 2 golden carp, 2 perch, 1 common carp, 4 bowfins, 1 catfish, 3 blue cichlids, 8 croaking gourami, 2 rainbow cichlids, 6 torpedo fish, 5 garfish, together with 21 vestlet anemones and a score of murex snails.

* * *

Some time ago I decided to try the effect of liquid D.D.T. on swordtails, as it has long been supposed that this was injurious to fish. Accordingly I filled a large tin with aquarium water (about three pints) and added liquid D.D.T. to a strength of about one part in 200. I put three small swordtails in and noticed that there was no immediate reaction. This was in the middle of summer and no heating

was attempted. I looked the next morning but the swordtails seemed very happy and after a day or two I came to the conclusion that D.D.T. in this form was harmless. I put in some surplus and rather weak plants and forgot all about the tin and its occupants. Six weeks later I remembered the "guinea pigs" and pulled out the tin expecting to find the fish dead from neglect, low temperature, or the D.D.T.

Judge my surprise to find them all swimming happily around, all double the size they were when introduced. The water plants had just about faded away but not the swordtails. I immediately removed the fish and within a day they were back in a tropical temperature showing no ill-effects. It would seem that liquid D.D.T. is not harmful to this fish, although it does not follow this might happen with more delicate varieties. Powdered D.D.T. in dried fish-food may prove more harmful, and it should be remembered that it is powdered D.D.T. which is most likely to come into contact with aquarium fish in summertime.

* * *

Some time ago I had the unenviable job of thinking up a name for a new Society, and I decided to look through the existing names of clubs as a guide. In all I checked through roughly four hundred clubs and the results were certainly interesting. I discovered that by far the most popular description was "Aquarist Society," even though one still meets people on occasion to whom the word "aquarist" means absolutely nothing. My record showed that almost 300 Societies were listed compared with only 40 Clubs, 16 Associations and four Circles. The word "Aquarist" appeared in 260 instances as against a mere 40 for "Aquarium," and 24 for "Aquatic" and in only 27 cases was any mention made of "Pond" or "Pool." Worse still the word "Fish" appeared only four times. Unusual names are rare but a few outstanding ones occur such as "Tropicold," "Aqualife," "Scalare" and "Pisces." There are two references to "amateur" and "tropical." Apart from "Scalare" and "Guppy" the only other specific fish-name which occurs is "Goldfish." If you meet anyone who mentions he is a member of "The Goldfish Club" it is as well to remember that he is probably no aquarist as this is the name reserved for R.A.F. personnel who have come down in "the drink" (the sea). Finally, although specific fish are rarely mentioned, some club titles bring in Reptiles, Rabbits, Cage Birds and Poultry.

* * *

Where the aquarist uses a pump for aeration purposes he can also run a filter or filters off the pump, and these can be very useful. The type most commonly used is probably the inside fitting corner filter, and where this is attached to a back corner of the tank it is not very obvious, particularly if screened by rockwork or tall plants. The filtering mediums vary but generally they consist of sand, glass wool, cotton wool and charcoal. Some aquarists use all these in layers, others a combination of two and a few only one. The disadvantage of filling the filter portion too full is that little room is left for the incoming water, as the faster the rate of intake the quicker the effect on the tank water. If the rate of intake is fast the filter must absorb the water fast or it will overflow, some of which will find its way over the rim of the tank to the world outside with horrid results.

This can also happen if the filter is choked or clogged up so it is preferable to have only one filtering medium, thus allowing about two-thirds of the holder space for the incoming water to collect. Charcoal is not necessary in a well-set-up tank and in time is detrimental to the well-being of the plants. Sand and grit tend to choke the filter (in time) and impede the quick passage of the water, whilst cotton wool very quickly absorbs dirt and within a day or two offers such resistence that flooding is quite a possibility. By far the best medium to use is glass wool—it is easy to use and to clean and it does a good job with no risks.

The diffuser stones sold by dealers for aeration purposes are excellent when new but tend to lose their power with age. Brushing or scraping these seems to make little difference to their effectiveness but their life can be prolonged by immersion in peroxide of hydrogen for five minutes or so. Any diffuser can be improved in performance by pouring a stream of water on to it whilst it is in use under water in the tank. Pour the water from immediately above the diffuser and the result is instantaneous.

* * *

Newcomers are often at a loss as to which type of thermometer to buy. Undoubtedly the best is the mercury variety as this has greater accuracy than the spirit type. Trouble can also occur with the alcohol varieties which are impossible where mercury is used. The cost is usually a little more but well worth it in the long run. Floating thermometers have their attractions although restricted to a particular depth of the water. The sucker type are most used and these can be fixed anywhere to the tank glass, although in course of time a weak suction disc results in the thermometer constantly falling to the bottom, a most annoying happening. The sort which has the graduations contained inside the glass tube on paper is the better, those which are marked outside on celluloid wear off in time and then it is quite a job to know what the reading is. It should be remembered that two thermometers will often give different readings for the same water and it is wise to use only one thermometer when testing several tanks if fish are being moved from one tank to others.

* * *

Successful exhibitors at shows are often asked how they condition their fish. The answer is, of course, that they don't—the fish are always in condition. It is an impossibility to keep fish any old way and then suddenly transform them in a matter of days or weeks into show specimens. Show fish should be kept as such all the time. They should have a varied diet with plenty of live food, but do not overdo the *Daphnia* feeding. The offering of white worm will help to counteract the slimming tendencies of the former. Obviously, show fish must not be kept in constantly aerated tanks or they will suffer when put into strange quarters at shows where aeration may be lacking or insufficient. They should never be crowded as fish are never at their best in a crowd, and there is always the chance of injury, fin nipping and other forms of damage. Roomy tanks are best but show fish have to be acclimatised to small tanks for the period of shows and it is a good idea to put them in such tanks two or three weeks prior to showing so that they find nothing unusual in their show surroundings.

Show fish must never be shy and for this reason your best specimens must be kept in full view where they will be quite used to being looked at, having the glass tapped and otherwise given little privacy. Chemical treatments of show fish are doubtful in so far as, although many of them are remarkably good, they tend to upset a fish for some time thereafter, particularly if the fish is moved about. If a fish has to be given chemical treatments it should be withdrawn from showing. Show fish must be capable of putting up with a fair differential in the temperature of their tank over twenty-four hours. Even eight or ten degrees is not too much. Show conditions are not always all they might be and fish which are brought up to a steady temperature are likely to be upset when they experience the chill or hothouse effect found at some shows. The ideal way is to take your own water with you if at all possible; it can be and is done by the wiser, and therefore more successful exhibitors.

Air-lifts and Siphons for Aquarium Use

by W. H. MACEY

THE airlifts and siphons in general use are rather clumsy, and often exceedingly difficult to make. The T-piece type airlift takes up quite a lot of space, while the "two-tube" type (with the end of the air inlet tube bent upwards and inserted into the base of the airlift tube) is rather awkward to use, and it requires unnecessary additional power from the air pump to force the air to the bottom of the airlift tube.

The airlift shown is very efficient, simple to make, compact, and it has the novelty of being adjustable by simply raising or lowering the air inlet tube until the correct depth is obtained. It is a straight length of tubing, or garden hose, fitted at one end with a two-hole rubber stopper, or a good cork stopper may do. A straight length of small size tubing is inserted into each hole. One, the air inlet, is forced through and adjusted to the required depth, while the other, the uptake, is flush with the bottom of the stopper. When this airlift is in position, the top of the stopper should be just below the water level.

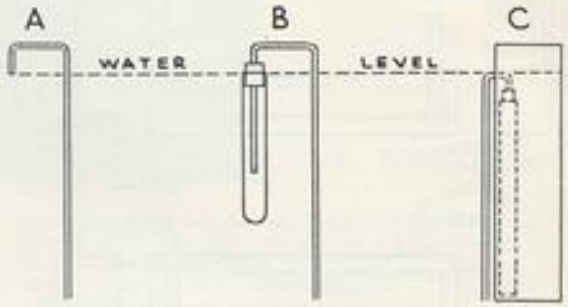
Tubing having a bore of ¼th inch or less should be used for most uptakes, as larger tubing tends to allow the bubbles to slip when lifting them to a great height and there is considerable air pressure behind them.

Constant Level Siphons

The well known S-shaped constant surface level siphon is an exceptionally difficult thing to make, and rather clumsy to use. It has to have an air hole made in the apex of its outer upper bend, while its inner lower bend acts as a preventer to lessen the chance of water running back.

The simple-looking L-shaped constant surface level siphon in diagram A is equally as efficient, simple to make and very compact. The mouth of its outer arm has to be in line with the water level in the aquarium, so it may be necessary to raise the level slightly before it can be filled and placed in its position, but once filled it will remain so indefinitely while operated, and as long as any other siphon

The simple air-lift described at the beginning of the article. It is made from a length of hose fitted with a stopper carrying two small tubes

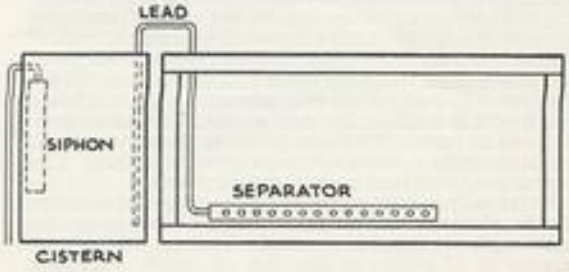


Three types of constant level siphons

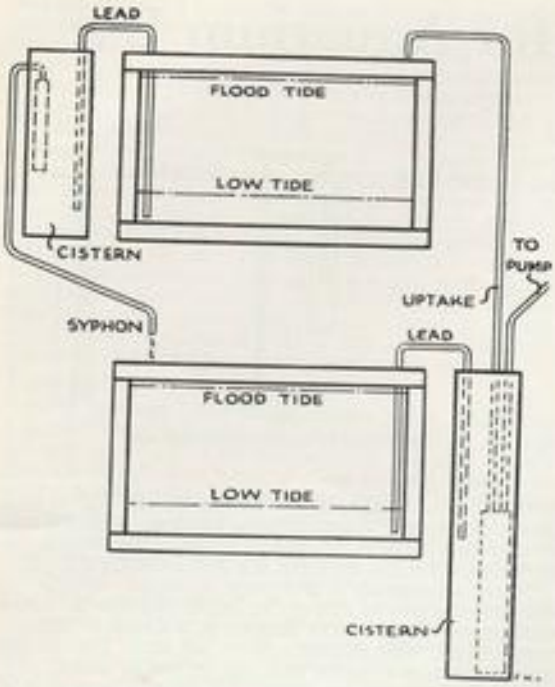
when left idle. The main reason why an idle siphon runs back is due to an air bubble forming inside the tube, and not, as is so often believed, to the evaporation of the water in the aquarium, although, of course, this does assist slightly.

Where a preventer is necessary, a similar siphon, but with its outer arm an inch or two longer, and inserted into a small test tube as shown in diagram B, is simple to arrange, compact, and very efficient. Even the water level in the aquarium can be adjusted with this syphon by simply raising or lowering the test tube. To fill this syphon it is submerged inverted, a finger placed over the mouth of the inner arm, then it is lifted into its position with the outer arm inserted into the test tube. When the finger is released the water in the tube will immediately rise until it is level with that in the aquarium. The test tube is now lowered until it is completely full, and secured in that position, either with string hung over the angle iron of the aquarium with a small weight at the other end, or a one-hole cork stopper which fits the tube mouth is slipped on to the outer arm (cut two or three deep slots in the side of the cork). A light-weight phial can be used instead of a test tube. Any water added to the aquarium now, will overflow the tube.

The siphon shown in diagram C, with its large-size tubing for the inner arm, and its small-size tubing for the outer arm, appears to be the only kind that will operate a cistern being filled by a slow rate of drip to a light trickle. If a siphon for this purpose is made throughout with tubing having a bore a quarter inch or less, it will make, but when it breaks, sufficient drops of water will cling to the inside of the tube to cause it to make again when only a little water has been added, so the cistern will not refill. On the other hand, if the siphon is made with tubing throughout having a bore larger than a quarter inch, it will not make, the cistern will remain full and the water will drip away to waste. As



A "cistern" formed by an old fish can at the side of the aquarium can be used as a sediment collector when the tank is receiving a continuous drip as described overpage (right)



An arrangement for marine aquaria allowing the provision of high and low tides

shown, the one-eighth inch rubber tubing for the outer arm ensures that it will make, while the large size tubing (a straight length of garden hose) for the inner arm allows sufficient air to enter when it breaks to remove most of, if not all the drops of water clinging to the inside of the outer arm, so the cistern refills, and the operation is repeated.

Junction between the outer and the inner arm is made with a one-hole rubber stopper, or a good cork stopper may do, fitted at the top of the hose; this joint must be perfectly airtight. The two arms are connected together with small-size tubing bent at right angles. A hole is made in the wall of the cistern about an inch from the top, and large enough for the rubber tubing to pass through quite freely. The end of the outer rubber tubing is passed through the hole while the angled junction tube is pushed into it, thus expanding its walls while in the hole and making a perfect watertight joint, so no soldering is required.

High and Low Tides

This is a siphon to interest the marine aquarist, as it enables high and low tides to be arranged in the aquarium as shown. In this case the two arms of the siphon must be connected together with one-sixteenth inch rigid tubing. The lead connecting the aquarium to the upper cistern must be made of large-size tubing (two inch pipe should suffice) to allow the water to enter the cistern as fast as it will leave. The mouth of the inner arm of the siphon is in line with the low-level tide mark, while the outer arm is 15 ins. below high level tide mark in the upper aquarium, and the length of the airlift tube in the lower cistern is 12 ins. or more to enable the water to be raised to the upper aquarium. The cisterns are drawn large in the sketch for clarity.

Where only one aquarium is used, a large receiver can take the place of the lower aquarium, and both siphon and airlift can be operated at one end. Each aquarium has a capacity of 12 gallons at the high tide mark, and three gallons at the low tide mark. The airlift is regulated to raise the water into the upper tank at a gallon an hour, and the siphon suggested will remove the water at about three gallons an hour, so it will take four hours for the water to reach low tide in the upper aquarium, and to reach high tide in the lower, while it will take nine hours to rise again in the upper, and fall in the lower aquarium, making a total of 12 to 13 hours, which is comparable with natural tides.

This siphon can also be used where the aquarium water is aerated and circulated by a slow rate of drip entering one end of the aquarium and passing out through a surface constant level siphon at the other. In this case the power of the drops of water can also be used to remove the sediment from the bottom of the aquarium as shown. Here, the cistern is a large fish can, or a biscuit tin, and the lead connecting it to the aquarium must be made with tubing no larger than that used for the outer arm of the siphon so that the water can leave the cistern much faster than it can enter. The mouth of the inner arm of the siphon is only five inches in depth; the two arms are connected with one-eighth inch rigid tubing, and the outer arm is 24 inches or more in length, all with a view to increasing speed, and removing as little water as possible from the aquarium at each operation. The aquarium end of the lead is connected to a separator—a length of tubing riddled with one-eighth inch holes—hidden behind the lower angle iron of the aquarium. The drops of water falling into the aquarium aerate, circulate, and raise the level until the siphon makes. Then the water passes from the aquarium into the cistern, carrying sediment with it. The sediment settles down in the bottom of the cistern and can be removed periodically. When the siphon breaks, the cistern refills and the operation is repeated.

This siphon may be used for many other useful purposes, as considerable power can be obtained at an exceptionally slow rate with a heavy float moving up and down in a cistern.

A Home-made Mantelshelf Aquarium

(*Continued from page 78*)

one corner of the top. After treatment with stained plastic wood the nail holes could not be seen and did not mar the look of the base or top.

There was ample room inside the lid for the fitting of a strip light, and the installation of this was simple enough. To enable wires for a heater to be brought into the tank without having the lid resting on them, a small slot was taken out of the centre of the top back edge of the tank. This was done by sawing down the sides of the slot and chiselling away the waste wood between.

All that remained to be done was to polish the exterior woodwork, which had previously been stained. Varnish would have made a cheaper finish but its use was not considered advisable.

Synthetic Detergents

THE recently issued 1953-54 Report of the Council for the Preservation of Rural England states that following many complaints regarding the possible offensive effect of synthetic detergents discharged into streams and rivers in England a careful investigation was being made by the Pure Rivers Society. An interim report suggests evidence of the growing use of synthetic detergents but does not foresee any immediate alarm for drastic action by users or the public health services.

R. W.

A page for the beginner contributed by

A. BOARDER

PROVIDING you have been feeding your pond fish with discretion they should now be in the pink of condition. Also they should have spawned by now. My own fantails spawned in the open pond on 11th May, and there were many hundreds of eggs. The following day the fish were again busy spawning but the number of eggs was much smaller than on the previous day. After about two days most of the eggs laid on the first day were infertile; it was impossible to find a good one amongst the bad ones. Only a small number of fry hatched from this spawning but although far fewer eggs could be seen from the second spawning there were hundreds of fry hatched out. It is very difficult to find an answer to this problem. On the 11th, all the fish were engaged in the chasing and spawning and several males were always forcing the females through the water plants. I think that 98 per cent. of the eggs were infertile and yet on the second day, with apparently the same fishes taking part, the ratio was reversed and almost all the eggs were fertile.

On the night previous to the spawning I had taken the temperature of the water and found it to be 69° F. By the weather, very warm and settled looking, I anticipated a spawning on the following day. I was not disappointed and then found that the temperature was 62° F. It is about this region that most of the spawnings have taken place. As to the supposition that the fast-rising barometer could be responsible for a spawning, I do not think that there was any reason to think that it was enough to make any difference. The barometer had certainly moved up very slightly but not enough to show any appreciable difference. It had been warm for a few days, but on the 12th, some thunderstorms developed and the weather turned colder.

This affected the hatchings as I was in the throes of converting my accommodation for fry and had taken down the old greenhouse which was used for fry hatching and rearing. I had not completed a new frame and so had to cover the hatching tanks with sheets of glass in an endeavour to get some extra warmth. I think that too much was obtained and possibly some of the eggs were almost cooked. The first fry were seen on 16th May, late in the evening. The usual time for hatching is four days at a temperature of 70° F., and the cooler the water the longer do the eggs take to hatch. I could find no reason for the large number of infertile eggs laid on the first day. This is one of the things which we do not understand, like the actual conditions necessary to ensure a good spawning.

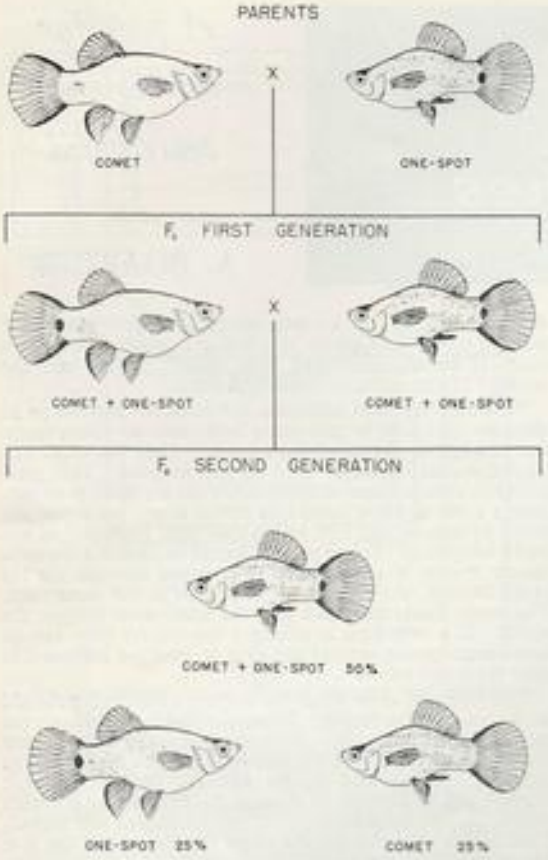
The fry made fairly good progress once I had the frame glazed and conditions became warmer. This extra warmth for the fry is very essential, as they are able to move around and feed much more than when the water is cooler. Infusoria was used for the first food and a constant examination of the water was made to see that the added water actually did contain some Infusoria. After a few days some dried egg and yolk of hard-boiled egg was added. When using the former it is advisable to mix some with some warm water and shake it up well before feeding. It then remains in suspension in the form of a cloud and after a few minutes the coloured egg can be seen inside the fry. The boiled yolk of egg is best given by placing a small portion in a piece of handkerchief and then squeezing this into the water. Large pieces should not be given.

Providing fry have sufficient Infusoria for a week or 10 days they are able to take other foods such as micro worm and mashed or shredded earthworm. Only the small and tender worms should be used for this purpose. It is good policy to change some of the water of the fry tanks each day. Also a sheet of paper should be drawn across the top of the water to remove any film which may have formed. If one had a fairly large healthy pond it would be ideal if a constant steady stream of water could be pumped through the fry tanks from it, warming it up somewhat at the same time. The water could run back into the pond after leaving the tanks. If a drip feed is arranged for the fry they can be seen congregating around the drip to take the Infusoria as they enter the water.

The question as to when the warmth given to fry should be decreased often arises. I consider that it depends on the type of fish being reared. With types of goldfish it can vary with the varieties. For the highly developed types such as veiltails, orandas and similar varieties, I consider that warmth can be kept up all through the first winter but with others like the common goldfish, the shubunkin and fantail, I think that once the fish are about two months of age it is better to reduce gradually the temperature of the water to that of the outdoor pond. I have made several experiments and have found that if fry of fantails are kept in a temperature of about 70° F. once they are over two months old, there is a tendency for the finnage to grow too long at the expense of the body. The tail of the fantail should not be long and flowing like a veiltail, but when fantail fry have been reared under cool conditions I have found a shorter tail and a corresponding shortness of the other fins. It is then apparent to me that if fancy goldfish are kept in warm conditions the fins grow out of proportion to the rest of the fish.

Watch your pond for excessive growth on the water plants and prune where necessary. Do not allow too many leaves to form a complete cover to the water. Some must be kept clear or you will be unable to see your fish. You may find that the fish may not become as hungry at this time of the year. This will be because they can find plenty of food in the pond, where many larvae may have hatched, and there will always be plenty of vegetation for them.

Fish in a tank must, however, be fed at fairly frequent intervals when the water is in the sixties as long as they are ready to take it. Always test them with a small portion first to see if they are ready for a feed. Then do not give much at a time. See that you remove some of the fish from the tank if the occupants have grown so well that the necessary limits have been reached. Fish can double their size in a year when young, but grow more slowly as they get older. Only by giving them plenty of space will they remain healthy.



New type of inheritance in the platyfish. The comet pattern is dominant to **no** *pattern—so is the one-spot. When a comet platyfish is mated to a one-spot, all their first generation offspring have* **both** *the comet and the one-spot patterns. When the comet-one-spot platyfish are mated, brother to sister, they produce in the second generation three kinds of fish as indicated in the figure in the ratio of 1 : 2 : 1*

A Type of Inheritance "Multiple

by DR. M

(Genetics Laboratory of the A

WHEN the writer uses a new term, the editor, thinking of his readers' interests and requirements, sometimes suggests, sometimes demands, that the author define the word, immediately. In introducing the new hereditary feature known as *multiple allelism* to the reader, I thought perhaps that its definition could be postponed until the process it defines is explained. The meaning of an *allele* and *multiple allelism* may be made clear by relating how a problem involving it arose in a routine analysis of the comet, the wagtail and related patterns in the platyfish.

The reader will remember, from previous articles in *The Aquarist*, that when a pure-breeding, comet-patterned platyfish, *CoCo*, was mated to a wild platy without a pattern, *coco*, all the members of the first generation had the appearance of comet, *Coco*. (The F_1 hybrid is designated as *Coco* because it is heterozygous for the comet gene.) When two comet heterozygotes of the first generation were mated, brother to sister (*Coco* × *Coco*), the members of the second generation were divided into two phenotypic and easily separated groups: there were three times as many platys *with* the comet as there were with *no* comet. This showed that comet pattern may be referred to a simple dominant Mendelian factor.

The reader will also recall that exactly similar results were obtained when a pure one-spot platyfish was mated to one without a pattern. A similar conclusion was drawn from the evidence, the one-spot, *O* gene, like the comet, *Co*, gene behaved like a simple dominant Mendelian factor. Now I will outline the unusual results that illustrate the phenomenon of multiple allelism, a type of inheritance that Mendel never knew.

Analysis of Two Dominant Colour Patterns

When the pure-bred wild comet platy, *CoCo*, was mated to an equally true-breeding one-spot platy, *OO*, all their offspring had both the comet *and* the one-spot patterns, which may be expressed genetically for the time being as *Coco Oo*. The one-spot and comet patterns were expressed in equal strength. This kind of hereditary behavior pattern may be indicated in the shorthand of Mendelian inheritance as follows:

P_1	Comet × One-spot
	CoCo oo × *coco OO*
F_1	All comet and one-spotted
	Coco Oo

That is the way Mendel would have indicated a cross involving *two pairs* of independent, contrasting characters, and this is the way we will indicate it at present, although we may modify it later on. When an F_1 female comet and one-spot patterned platy (*Coco Oo*) was mated to its comet and one-spot brother (*Coco Oo*) the actual results I obtained in the members of the second generation may be compared with those that I expected on the basis of *two factor* inheritance:

Expected in 16 F_2:	Observed in 16 F_2:
9 *Co O*, Comet and One-spot	8 Comet and One-spot
3 *Co o*, Comet (only)	4 Comet (only)
3 *co O*, One-spot (only)	4 One-spot (only)
1 *co o*, No pattern	0 No pattern
16	16

As indicated above, the frequencies of the various colour types I obtained in F_2 were not in accordance with those I expected. The discrepancies from what I expected may appear not to be great, for out of every 16 platyfish born in the second generation I obtained 8 comet and one-spot platys instead of 9; 4 comets instead of 3; 4 one-spots instead of 3; not a single non-patterned platy appeared although I expected 1 in every 16 fish born. These deviations from expectancy, though not great, persisted with repeated matings and with additional second generation offspring. I was obliged to regard them as significant. Mendel's explanation in its original form alone would not account for them. I was forced to seek some other explanation.

hat Mendel Never Knew Allelism"—I

N GORDON

... New York Zoological Society)

During the past many years since Mendel's day geneticists have found similar examples of the new type of inheritance and they have been able to work out an acceptable explanation for them. The new situation may be stated in this way. Instead of one hereditary factor or gene having just two phases, one dominant and one recessive, that is, the simple relationship of *O* to *o*, the gene may have two or more expressions in its dominant phase, that is *O* and *Co* may both be dominant to a common recessive. We could, if we so desire, represent the recessive to *O* and *Co* by the "+" sign. Thus, *O*, *Co* and + may represent *three* different expressions of a *single* gene. Geneticists have a term for this interesting kind of inheritance that involves a series of genes; they refer to them as *dominant multiple alleles*.

An *allele*, then, represents one of several alternate phases of a gene. Ordinarily, a gene, or a simple Mendelian factor, has *but two phases*, the *recessive* form like *golden*, *g*, in contrast to its dominant wild grey phase, *G*. In a series of dominant multiple alleles, the recessive phase, represented by "+" may have, as its dominant alleles, the comet, *Co*, the one-spot, *O*, and, as we shall see, five other dominant alleles, all expressing themselves as tail patterns.

Multiple Alleles

Let us now go back to the results obtained from inbreeding the F_1 comet and one-spot hybrids with the realisation that we are not dealing with two simple dominants and two simple recessive genes, but are concerned with a series of multiple alleles. The comet, one-spot F_1 hybrids cannot be represented in genetic terms as *Coco Oo*. Since *Co* and *O* are alleles, the cross between them must be expressed as follows:

P_1 Comet × One-spot
Co/*Co* × *O*/*O*

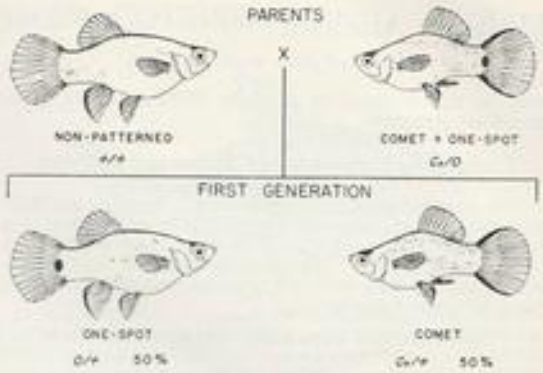
F_1 All Comet, One-spot
Co/*O*

By inbreeding the F_1 comet, one-spot hybrids (brother to sister), *Co*/*O* × *Co*/*O*, the Punnett squares may be used to predict the results in the second generation by this new concept (the calculations are below and to the left):

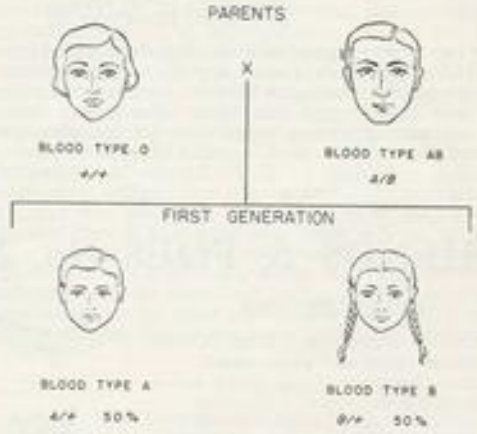
	F_1 Male Gametes:	*Co*	*O*	F_2 Genotypes:
F_1 Female gametes:	*Co*	*Co*/*Co*	*Co*/*O*	2 *Co*/*O* Comet, One-spot
	O	*Co*/*C*	*O*/*O*	1 *O*/*O* One-spot

Observe these facts:

1. The members of the second generation are found in the ratio of 1 comet, to 2 comet, one-spot, to 1 one-spot.
2. There are 3 comet-patterned platyfish (1 *comet* and 2 *comet*, one-spot) to one without the comet pattern (1 one-spot).
3. Similarly, there are in the same group 3, one-spot patterned platys (*one-spot* and 2 *comet*, one-spot) to one lacking the one-spot pattern (1 comet).



The type of inheritance shown in the illustration on the opposite page has its parallel in man. This may be illustrated by comparing the method of inheritance of two tail patterns in the platyfish with the inheritance of two types of blood in man. The examples shown involve the use of a "backcross." One parent has a duality of pattern, the fish comet ***and*** *one-spot, the other parent has neither (it is the double recessive). In humans, the father has the combination of two dominant blood types A and B, the mother has neither; she is a double recessive. Note that the results in fish and man are identical in that half the offspring receive one type of pattern or blood type while the remaining half receives the second type of pattern or blood type*



These results, although they do not conform to Mendel's original results (when based upon the two-factor interpretation), are nevertheless explainable on his basic principles. This becomes evident when the results are properly related. They are merely a slight variation of the fundamental 3 to 1 ratio.

Mendel never reported an example in which there were two different dominant characters with a common recessive trait. Geneticists now know of many examples of inheritance in which the genes involved belong to a series of *multiple alleles*. One of the most famous examples of a multiple allelic series is involved in the inheritance of the fundamental human blood types: A, B, AB, and O. The O factor here is the recessive; it might better be written as +. I wish it were possible to take the time to show the parallelism in patterns of inheritance between fish and man, not

Multiple Allelism

(Continued from preceding page)

only in this instance of multiple allelism but in other hereditary processes.

Comparing Human Blood Types and Platyfish Patterns

One example must suffice at present. Suppose the dual-patterned comet, one-spot platy (*Co*/*O*) was mated to a non-patterned one (+/+). How many types would there be in their offspring? Now that we know the *Co*, *O* and + are alleles, we may write the genetic constitution of each platy parent as follows:

Dual Patterned Type Platy *Co*/*O* × No Patterned Platy +/+

F_1

50% *Co*/+, Comet
50% *O*/+, One-spot

Only two types are possible in the F_1: the *Co* pattern type or the *O* pattern type, each of which appears in equal numbers.

Now let us work out the heredity of the children born from the marriage of a man having the blood type of *AB* with a woman having the *O* type. We will write *O* as it should be written genetically, ++, because ++ represents the common multiple recessive of *A* and *B*.

Dual Blood Type Man *A*/*B* × *O* Blood Type Woman +/+

Children:
50% *A*/+, Blood Type *A*
50% *B*/+, Blood type *B*

Only two types are possible in the F_1: the *A* blood type or the *B* blood type, each of which appears in equal numbers.

Compare the inheritance between man and fish and you will note their essential similarities. For further information concerning human inheritance let me recommend Amran Scheinfeld's book entitled *The New You and Heredity*, published by J. P. Lippincott, Philadelphia, U.S.A.

Gudgeon in the Aquarium

ALTHOUGH many pondkeepers include some native fishes in their ponds, few aquarists appear to keep English freshwater species in aquaria. Many of them, of course, by reason of size and nature are unsuitable for close confinement but some of the smaller fishes will live quite happily in a small tank.

Early last Autumn the writer was concerned with the excavation for and laying of about half a mile of water main. The line of the main crossed a fast-running stream about twelve feet wide by two feet deep and it was necessary to lay the pipes three feet below the bed of the stream, which although deceptively covered with sparkling gravel, was actually composed of deep soft mud. After a dam had been built and the main stream diverted, a rough trench was excavated across the stream and motor pumps were brought into action to clear the now liquid and evil-smelling mud.

During this last operation a flash of silver was noticed in the rapidly diminishing mud and groping in it for a few moments the writer succeeded in grasping a small wriggling fish, which proved, on closer examination, to be a gudgeon (*Gobio gobio*) about five inches in length. A discarded paint can made a temporary container and as soon as possible the catch was placed in a coldwater tank along with three or four small goldfish. The gudgeon soon settled down in the new surroundings and seemed to be none the worse for its adventure.

To-day, over six months later, the gudgeon is still gracing this aquarium and appears to be quite happy on a diet of chopped earthworms, other natural live foods and several makes of prepared food. In the natural habitat it is a bottom feeder; in the aquarium it travels slowly around the bottom of the tank taking in mouthfuls of compost, methodically chewing them over and ejecting them after extracting particles of nourishment. Not an active fish by any means, spending most of the time on the bottom motionless except for quick rolling movements of the eyes, the delicate pale violet of the gudgeon renders it an attractive addition to the aquarium.

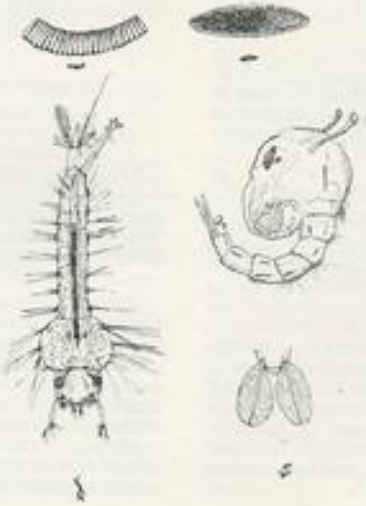
R.W.

FRIENDS & FOES No. 26

Common Gnat

CULEX PIPIENS

PHYLUM:—Arthropoda, from Greek *arthron*—joint and *podos*—foot.
CLASS:—Hexapoda, from Greek *hex*—six, and *podos*—foot.



IN spite of the well-known propensity of the female common gnat to bite and cause annoyance to human beings, it can be unquestionably classified as a friend of the aquarist, providing him during the late spring and throughout the summer with a never failing source of live food which is eagerly sought by all fishes.

The female gnat lays ingeniously constructed bunches of eggs, numbering from one hundred to two hundred. These clusters are boat-shaped and sit nicely upon the meniscus of the water, usually at the edge of the pond or pool, or drawn against the edges of floating plants. The "raft," as it is called, is dark brown, and at least three-quarters the size of the body of the gnat. Eggs hatch in about 48 hours. The newly hatched larvae are about the size of a micro worm, and while they are growing do a useful job of scavenging. Within a week to three weeks, depending upon temperature to a large extent, they pupate, changing into what appears to be a "horned comma." The pupa is active, and dodges immediately a shadow crosses its vicinity. Normally, it rests at the surface of the water, taking in atmospheric air through its "horns," which are actually breathing tubes.

The pupa bursts, and the imago—the gnat itself—emerges, often standing upon the pupa case until its wings are filled with blood, and dry enough for it to use them. Sharp eyes are needed to spot one's first egg raft, but after the first it is possible to see them everywhere.

C. E. C. Cole

TROPICAL FISH-KEEPERS' REFRESHER COURSE: *by Pisces*

Harlequin Fish

(Rasbora heteromorpha)

ORDER:—Ostariophysi, from Greek *ostarion*—a little bone, and Greek *physa*—a bladder.
FAMILY:—*Cyprinidae*, from Greek *kyprinos*—a kind of carp.
SPECIES:—*Rasbora heteromorpha*, from a native name and Greek *heteros*—different, and Greek *morphe*—form or shape.

MY introduction to this fish took place many years ago, when I was confronted in a London store by not one but a score or more in a beautifully set up aquarium, brilliantly and cunningly lit so that the light fell upon the gleaming sides of the little beauties. The effect was stunning—I could not move away. In this I was no different from other shoppers—gasps of astonishment and admiration came from all round.

The price was prohibitive—I could not afford them, but I purchased one or two just the same, and walked home in a daze. Now I see them advertised at 3s. 6d. and 5s. each, within the reach of nearly everybody, and am glad their beauty can be in everybody's home.

Their native habitat is Sumatra, Singapore, and the Malay Peninsula. They are reputed to grow to a maximum size of one and three-quarter inches, although so far I have not seen any specimen so large. The ground colour of the body is a brassy orange, brilliantly burnished and sometimes reflecting bluish tints. Overlaying this ground colour from below the dorsal fin and extending backwards to the caudal peduncle is a deep blue-black triangle surmounted by a golden line. In the male this line is more intense than in the female fish, and is regarded as the only sure indication of sex. A female swollen with roe, of course, has a more rotund appearance than a male, especially if viewed from above.

Like many other fishes, *Rasbora heteromorpha* is somewhat choosey about water, seeming to prefer slightly acid rather than alkaline, and a temperature between 75° and 80° F. If conditions suit them, however, and a liberal supply of live food is given to them, the pairs will soon show signs of spawning, which is quite an interesting procedure.

A necessity seems to be a number of strong, broad-leaved plants. *Cryptocoryne*, *Ludwigia*, *Bacopa* and *Sagittaria* (giant) have all been utilised on occasion. The female visits these plants, and inspects the undersides of the leaves carefully. She selects one, and turns upside down so that her abdomen presses closely upon it. The male sees her in this position, approaches, places his body at right angles to hers, and wraps it round her. The pressure forces two or three eggs from the female's vent. These are semi-adhesive and if the leaf is clean remain attached to it. Other embraces follow beneath different leaves until the female is spent. The eggs, if fertile, and frequently they are not, develop quite rapidly. At 80° F. they take less than 24 hours, rapidly absorb their egg sacs, and are ready for tiny Infusoria. Given enough they grow sufficiently to be able to tackle rotifers and just-hatched brine shrimp in a week or ten days, sometimes less. Micro worm, *Cyclops* nauplii, *Cyclops*, small *Daphnia* (of spineless species) and mosquito wrigglers (newly hatched) are all gratefully accepted and turned into bone and muscle. The breeding pairs will be ready to spawn again in from ten to fourteen days.

Although preferring live foods, harlequins are easily persuaded to consume dry fish foods—providing always that their environment suits them. Often when the water is not to their liking—too alkaline, perhaps, they lose all appetite, and mope in odd corners, or near the surface of the water.

Remember, though, that if your harlequins prefer acid water, and you intend to show them in a forthcoming exhibition, that at that exhibition there will be no acid water. It might be a good idea, therefore, if nothing in the rules bars you from doing so, to take sufficient water from home to fill the show tank. After all, the nearer you can reproduce at the show the conditions in which your fishes are kept at home, the more likely they are to do you credit.

Book Review

Tortoises, Terrapins and Turtles, by Ivor Nöel-Hume and Audrey Nöel-Hume, 112 pages. Photographs and line illustrations. W. & G. Foyle, Ltd. 119-125, Charing Cross Road, London, W.C.2. 2s. 6d.

I HAVE just been reading *Tortoises, Terrapins and Turtles*, by Ivor Nöel-Hume and Audrey Nöel-Hume, and I think it is the most charming, informative, and useful handbook on these delightful creatures ever written. It should fill a long-felt want for an inexpensive book which tells something about the history of tortoises, their mating and breeding habits, their care in health and sickness, and how to recognise some of the more uncommon and rare species which turn up every now and again during the summer months in dealers' importations from abroad.

A whole chapter is devoted to these hard-to-come-by species, which have been grouped under geographic headings such as "The Tortoises of Africa," "The Tortoises of Asia" and the like. Several pages are given over to the ever-popular pond tortoises and terrapins. These have been divided into three sections, namely Hardy, Half-hardy and Baby.

Perhaps what the authors have to say about the treatment terrapins need in this erratic climate may help to save many of them from an untimely death when autumn sets in. The thirteen photographs of various tortoises and terrapins which illustrate the book are remarkably clear, and a number of fine line drawings are dotted about the text.

An appendix gives the Latin names, with English equivalents, of the land tortoises, terrapins and turtles mentioned in the book.

Tortoises, Terrapins and Turtles deserves a place in every club library, in every public library, and on the shelves of every herpetologist or nature-lover interested in keeping tortoises and terrapins as garden or vivarium pets.

J. H.

In the Water Garden in JULY *by Astilbes*

Photo: H. Joel

I WONDER how many water gardeners consider the aspect of reflections in the water when planning their pond surrounds. The beauty of a pond becomes apparent at this time of the year when your lilies and other flowering water plants are at their best, but so much more colour can be obtained from the reflections of pond-side plants. Where a rockery has been planted close to a pond many colours can be seen reflected. In the spring what can look better than a mass of purple aubretia near the pond, giving an equally fine show of colour by reflection in the pond? The bright yellow of some of the saxifrages is also an added attraction.

Where no rockery has been constructed it is possible to have a few tall growing plants at the water's edge, such as the taller growing primulas or the new multi-coloured foxgloves could be used. One of the finest sights at the pond-side is that of *Wistaria sinensis* in full flower. The beautiful hanging bunches of mauve and deep mauve flowers are most suitable for such reflections as I have suggested. Many wistarias may be seen growing in a climbing fashion over a house, but with careful treatment and pruning they can be trained into a form of weeping bush or small tree. Where one actually overhangs a pond the picture made is one not easily forgotten.

Where flowering shrubs or trees do overhang a pond to a fair extent it may be that many fallen petals will find their way into the water. If they are removed each day or so with a net no harm will be done and the task takes only a few minutes. I have seen many ponds which when made had the excavated soil thrown near the pond and in many cases as this has not been too rich, few plants will grow well in it. In such cases it is advisable to plant a few of the old-fashioned ferns (which unfold in the spring so gracefully until long-feathered plumes are formed), or the hart's tongue fern, in such positions. They will get stronger and larger each year and never fail to look attractive all the late spring and summer. They may be increased by division when new heads have been formed.

If you wish to increase any of the water lilies it is a good plan to do so now. If the level of the pond water can be lowered temporarily the root-stocks will be exposed. It may then be possible to find nice sturdy pieces of the root stock which can be severed quite easily. They will probably have several roots when you detach them. Care must be taken that the actual crown is not damaged. These pieces can be planted direct into a large pond if there is a natural bottom, but in the case of all concrete based ponds it is advisable to plant in special pots so that they can be removed if necessary. An old turf in the pot will be as good as anything to give the plant a good start, and as it grows roots can be sent out of the holes near the base or bottom of the pot to get established in the mulm.

For an interesting addition to the fairly small garden pond a water soldier can be added. This plant, *Stratiotes aloides*, forms a kind of rosette similar to the top of a pineapple and can float just under the surface of the water. The leaves are rather sharp and toothed but appear to be harmless to fish. Their copious root system makes an ideal medium for holding the eggs of some of the coldwater fish. It has a white flower and will rise near the surface to flower, often sinking almost out of sight afterwards. See that the dead flowers are removed as soon as possible from all water plants when they start to decay, as too many may upset the balance of a small pond.

It may seem strange if I suggest that you make a start at planning for next year, but now is the time to attend flower shows and growers' exhibitions to see the water plants in full flower. You may easily find the very plant you were looking for and to see it in flower is such a great help. Many water lilies and irises are grown at Kew Gardens, and the fortnightly show at the Royal Horticultural Show Hall usually has at least one aquatic plant display. Choose your plants and order now after consultation with the grower as to the advisability of your trying the particular plant; this may avoid disappointment later on.

Aquatic Agonies

"Well enough in its way, but what about show points?"

OUR EXPERTS' ANSWERS TO READERS' 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.

Soon after I switch the light on over my aquarium, the temperature at the top of the water rises two or three degrees above that near the bottom of the water. Will this difference in temperature cause any harm to the fish?

A difference of two or three degrees between the top and the bottom of the water is nothing to worry about. In their natural haunts, fishes, whether they are indigenous to Britain or Borneo, are accustomed to a slight difference in temperature between the bottom and the top of the water. It is a sudden drop throughout a whole body of water which upsets fish; for instance, a drop of ten or more degrees in an hour or so.

Several months ago I bought a pair of fully grown black widow fish. Now one of them is far from well. It seems to be getting thinner every day, and spends a lot of time moping about in the plant life. Can you tell me what is the matter with it?

When fully-grown fish are bought, one can never say for certain how old they are. We think your fish is showing the signs of old age. For one of the signs of senility in fish is a sort of wasting away. We always advise aquarists to buy young or half-grown fish, if they are available. For with proper care and good conditions, most aquarium fish will live for upwards of two years. Some species, such as the little harlequin fish and the big cichlids, may attain an age of between five and ten years before going into a decline.

One of my mollies seems to experience great difficulty in keeping its balance in the water; the other fishes in my aquarium seem all right. Can you please tell me what is wrong?

Perhaps your fish have been subjected to a sudden drop in the temperature of the water. For it seems to us that your mollie is suffering from the after-effects of a chill. It is not uncommon for one fish among several to show symptoms of a chill, for some fishes, like some of us humans, are more susceptible to chill than others. We suggest you check over your heating equipment, and try to keep the temperature a few degrees above normal for a week or so. If the mollie becomes worse, the kindest thing to do is to destroy it.

I have a pair of neon tetras and should very much like to try and breed them. Can you tell me a little about their breeding requirements, please?

These fish like shallow, acid water and not too much bright light. According to reliable authorities, the eggs will soon become coated with fungus if the floor of the aquarium is at all dirty; so it is a good idea to keep the floor of the aquarium clear of all sediment and obstructions which could harbour decaying matter. Feed the fish on washed live food such as chopped *Tubifex* worms or chopped earthworms rather than packet dried food.

Please can you tell me how to treat fin-rot?

Immerse the diseased fins in a solution of one part water and one part peroxide of hydrogen (20 volumes) at least once every day until the disease is arrested and shows signs of clearing up. When the tail fin only is affected, try snipping off the diseased part with a pair of scissors; paint the severed edge with a solution of salt and water and smear with friar's balsam or Vaseline before returning the fish to the aquarium.

Please can you prescribe a treatment for the disease called costiasis?

A cure can sometimes be effected by immersing the diseased fish for about fifteen minutes in a quart of water to which has been added about a dessertspoonful of rough household salt. You may have to repeat the salt bath several times over a week to a fortnight. Another treatment consists of placing the fish in a quart of water to which some formalin has been added. Five to ten drops of a 40 per cent. solution is the correct dose. Do not leave the fish in this solution for longer than about eight minutes.

I should be pleased to learn how to extract Tubifex worms from the mud they live in when they are collected from the wild?

Place the mud containing the worms in a muslin bag or old nylon stocking, and suspend it so that the bottom of it just touches the surface of a clean bucket filled with water. After a few hours, the worms will wriggle through the fine mesh of the fabric and sink to the bottom of the water. But before feeding them to the fish, give them a thorough washing in several changes of water.

Can you tell me why female fish predominate in every brood of *Aplocheilus lineatus* I have raised this year?

This is undoubtedly nature's way of guaranteeing the continuance of a species which does not lay large numbers of eggs. For as one male can fertilise several females in a very short time, we can be almost certain of the fish surviving even in adverse conditions—in the aquarium as well as in the wild. When we used to breed *Rivulus hartii*, a related species, we always had plenty of females coming along, but very few young males. Yet we kept two aquariums well stocked with these fish over several years.

I have recently set up a 24 ins. by 12 ins. by 12 ins. tropical aquarium and have become very puzzled about a greyish scum that keeps forming on the top of the water. Can you tell me the cause of this scum, and will it harm the fishes?

Scum on the top of the water may be caused by oil working out of a putty base cement used to fix the glass sides of the aquarium to the frame; it can be caused by an impure atmosphere, say, too much cigarette smoke in a room; or it may be caused by decaying plant life, or too much uneaten food polluting the water. We advise you to check up on the hygenic state of your aquarium. In the meantime, keep removing the scum by drawing a sheet of newspaper across the surface of the water once or twice every day. If the scum is caused by oil working out of the aquarium cement, it will not be long before the condition rights itself and gives no further trouble.

I am thinking of keeping some mollies, and have been told that they appreciate some salt in their aquarium water. Is this true?

Mollies do appreciate some salt in their aquarium water. A level teaspoonful of ordinary kitchen salt added to every gallon of water in your aquarium is about right. But once salt has been added, do not add any more or else you will soon convert your aquarium into a brine bath. Mollies themselves can stand quite a lot of salt in the water, but some other fishes do not like it; and most species of water plants soon turn yellow and die in salt water.

Can you please tell me how to prevent condensation on the bottom of my aquarium, which is heated by a gas jet?

Gas always produces droplets of water on the bottom of a tank, but you will find that with the arrival of warmer weather you will not be troubled so much by condensation. Good ventilation will help to minimise it during the winter; a row of holes drilled in the sides of the base should provide plenty of air to circulate freely about the bottom and carry off excess moisture.

COLDWATER FISHKEEPING QUERIES *answered by* A. BOARDER

Do you advise having any of the bass family in a community tank?

The basses or sunfish are not suitable for the community tank. Most kinds grow fairly large and they can become bullies. Their feeding habits are somewhat different from those of most of the ordinary aquarium fish. Unless their main diet is a live one you may not be very successful with them.

I have been trying to obtain some paradise fish for my coldwater tank but am unable to get any. Would tropically-reared fish be all right?

The tropical paradise fish would be all right for your tank at this time of the year. Gradually lower the temperature of the water until it is at about room level. I find that paradise fish are quite happy in an ordinary living room temperature. As a matter of fact I left some in an unheated greenhouse during the very cold spell in early February. I found several on their sides at the bottom of the tank; the temperature of the water was then 34° F. I placed the fish in slightly warmer water and they were soon swimming about as if nothing had happened.

I am a beginner and have purchased two tank frames 36 ins. by 15 ins. by 15 ins. Will 32 ounce glass be safe to use?

I advise you to use quarter plate glass as the 32 oz. might not be strong enough. When you get a fairly large expanse of glass unsupported it is liable to crack if it receives a jar. Sometimes it is possible to obtain some coarse-spun type of plate glass cheaper than the clear. This will do for all except the front glass.

I am using an air-pump and filter in my cold tank. Is it usual to keep these going for 24 hours a day?

There is no need at all to keep the filter and pump going for so long a period. A great deal will depend on the number of fishes you are trying to keep in the tank. As water plants cease to give off oxygen during the hours of darkness it would be preferable to run the pump at night time. A well-run tank can be kept quite all right without either but as soon as you have too many fish for the size of the tank the pump becomes essential.

Can you advise me of a book on fish-house construction and maintenance?

I know of no book dealing exclusively with the construction of fish-houses. I doubt very much whether one would have a large enough appeal to cover the cost of publication. From time to time articles appear in *The Aquarist* giving details for the making and maintenance of fish-houses. So much depends on the size of the proposed house and the cash available. Many fish-houses in good use to-day are converted cellars, garages, garden sheds and greenhouses. Before you actually make up your mind on the type of house you will make, try to see one or two fish-houses and get some ideas. I don't suppose many fish-houses have been built which the owner could not improve upon if making another. Get talking with a few such aquarists and it will help a lot.

I have a fair number of fish and find that as I live in a city it is difficult to obtain a good supply of *Daphnia* for feeding purposes. I have an iron tub which will hold about ten gallons of water. Can I breed *Daphnia* in this and how shall I set about it?

It is quite possible to breed *Daphnia* in the tub you have, but (dare I say it?) I think you will find that it is as easy to breed most kinds of fish as it is to breed a continuous supply of *Daphnia*, unless you have plenty of space and spare ponds. *Daphnia* feed on small animals in the water known collectively as Infusoria. Without plenty of these the *Daphnia* would soon starve. You could fill your tub with strained pond water for a start. If you do not strain it there may be some pests in it which would live on the Infusoria. Then cultivate a good supply of Infusoria. There would probably be some in the water and these would only want feeding for them to increase. Place in the water some crushed or rotting lettuce leaves, some potato peelings, banana skin or chopped hay. When this starts to decay the Infusoria would find plenty of food. You must then test some of the water under a microscope, one with about 70 times magnifying power would do, and if plenty of small moving objects are seen the water should be ready for the introduction of a few *Daphnia*. Keep the tub screened so that no flying pests can enter, as if mosquitoes can get to the water they will lay their eggs on it and the resultant larvae will feed on the *Daphnia*. When you have a good supply of *Daphnia* you can start feeding the fish with them. If you can find another receptacle it is a good idea to have a spare tank so that if the first one becomes denuded of *Daphnia* it will be possible to have a spare source. A few points must be remembered. *Daphnia* need well oxygenated water, they must have plenty of Infusoria for food and if the water becomes too foul they will surely die.

I have had some signs of fungus on my goldfish. Is this complaint catching and how is it caused? Does the cold weather cause it?

The fungus is not caused by the cold. It is possible that the causes are present in most ponds as the germs of the common cold are present in the atmosphere. It is when the fish are in poor health that they are usually attacked. Sometimes among a dozen fish in a pond only one will be attacked. This is probably a weakling or one which has been damaged and has lost a few scales. When most of the fish in a pond are attacked by fungus it is time to look well for the causes. Cold alone will not harm goldfish. It is when foul water freezes up that the trouble is caused. If too much decaying vegetation or uneaten food lies in the bottom of a pond it gives off foul gases which soon pollute the water. At ordinary times a great deal of these gases are lost to the air and fresh oxygen can be absorbed by the water. However, once the pond freezes over the foul gases are trapped in the water and fresh oxygen cannot get in. The fish are soon in trouble and come near the surface in an attempt to get oxygen. This is why some fish get frozen in the ice. In a pond which is in a healthy state the fish go down deeper when the water freezes and are much safer. When the fish are in ill health the protective mucous covering becomes weak and cannot do its proper work, which is to ward off many diseases. Fish in healthy water should never contract fungus.

I have a veiltail which has been suffering from red streaks in the tail. I have tried the salt cure but it does not get much better. What else can I do?

The red streaks in the tail fin may be caused by some form of parasite. In this case the salt may not effect a cure. A Dettol bath may be the answer. It all depends on the cause of the congestion. It seems at times to be caused by a chill whilst at others indigestion may be to blame. The presence of tiny flukes would also cause this inflammation and, unless you know which trouble to deal with, it may be difficult to effect a cure. If you can get a strong magnifying glass and examine the affected place you may be able to recognise some parasites. If so try the Dettol, but if none are seen continue with the salt treatment.

On Monday three cats at the edge of my pond caught four of my large goldfish. My neighbour told me they were dragging the fish about her lawn. One fish was found four doors away. I recovered all of them and placed them back in the pond. They were a little torn but seemed all right otherwise. Will the damaged fish get better and the fins mend again?

Sweet creatures cats, aren't they? I am glad you were able to save the fish. They should get all right again but you must carefully watch them in case they get attacked by fungus. This is the chief fear, as their scales must have been damaged and this can allow the disease to make an entry. The fins can heal and join up again and if we have some really warm weather they may heal up in less than a month. I had a friend who found one of his goldfish speared by a heron. There was a hole right through its body, just missing the swim bladder. He treated the wound and fixed a bandage round it with some water-proof plaster. The wound healed nicely and the only marks the fish now bears are white patches where the new scales grew.

Last year in my pond I had a large number of pests which you thought might be the larvae of dragon flies or water beetles. I think I can recognise these and my pond pests were different; they had a triple tail. Can you recognise them from my sketch?

I certainly can recognise them and still say that they are the larvae of dragon flies but not the kind you may be familiar with. They are from eggs laid by the small type of dragon fly, known as damsel flies (*Zygopterids*). These larvae have three gills, or trachea, at the tail end and jerk forward in the water in hop-like movements. I do not think that they do much harm in the pond except to very small fry. I do not know the actual specific name of the species in your pond. You see there are 42 species of dragon fly and sixteen of them belong to the *Zygoptera*.

I have a large tank which has stood empty for some time. When I refilled it the water leaked out. I do not want to have the trouble of re-glazing it if I can help it, but some of the putty comes away easily. What is the best thing to do with it?

When tanks are glazed with a softish compound they hold water all right as long as it is creating pressure on the glass to keep the seal. Once the water is removed and especially if the tank is moved about, leaks start as soon as the tank is re-filled. If a good quantity of the putty has become loose it may mean that you will have to reglaze completely. This is not such a hard task if you go about it the right way. Before doing so, however, try this plan. Get some liquid Gander-bak (a Spratt's Patent product) and, when the tank is quite dry, paint the whole of the inside seams and leave to dry off a bit. Then wash out and fill. You will probably find that the compound has stopped the leak.

Can I use well-washed sea sand for my tank base?

This will be all right as long as most of the salt is washed away, otherwise it can be too powerful for some of the fishes. Some aquarium fish appear to prefer a slightly saline water, but not all.

I can get some limestone from the seashore which has been washed by the waves. Can I use it in a tank?

I do not like using limestone in a tank. It can give off alkali which will affect the water. A small stone might be all right especially if you had a little peat in the water to counteract the lime. However there is no need to go to this trouble as it is fairly easy to obtain a small piece of rockery stone—Westmorland is a good type. This is much safer.

Is it safe to feed the fry of shubunkins on baby *Daphnia*?

It all depends on whether the fry are large enough to eat the *Daphnia* when first put in the tank. Many aquarists go wrong by feeding with *Daphnia* too soon. If the fry are small and still on Infusoria they will not be able to eat the *Daphnia*. These will then eat the Infusoria which should have gone to the fry. Also one or two advanced fry may be able to eat small *Daphnia*. They do so and then grow faster than the other fry with the result that they soon outstrip their brothers and sisters and can in turn eat them. *Daphnia* should never be given until most of the fry are large enough to eat them with ease.

I am having trouble with my fantails. Some of them show bubbles on the fins, more like blisters, and the edges of the fins are frayed. What is the trouble and cure?

It appears to me to be a form of fin-rot, and may be what is known as cyclochaetiasis. The salt treatment will sometimes bring relief but if not try immersing the affected parts in a mixture of one part water to one part peroxide of hydrogen. Then feed only on live foods such as *Daphnia* and earthworms and the fish should improve, especially as the days get warmer.

I have recently set up a new tank and am having trouble with the plants. The water went green and so I shaded the tank but then the plants did not grow. What shall I do now?

It is the usual story of trying to set up a tank with plants which are not growing at the time, generally having no roots. If you had healthy plants they would soon outgrow the algae. You may have to make some experiments with lighting until you get the right amount, that is, enough for the plants but not so much that it encourages the algae to flourish. This is a bit tricky as you are dealing with two types of plant life, the algae being the one you do not want. Unfortunately it thrives under the same conditions as do the plants we require.

Will it be all right for me to make rocks for my tank from concrete?

It will be all right as long as the rocks are well soaked and scrubbed before use. Make sure that most of the free lime is removed. Surely it would be far less trouble to get a small bit of rockery stone from a nurseryman!

I have heard that fish have no proper ears. How is it that they dash away when I walk near the pond?

Fish have what is called a lateral line which is capable of conveying vibrations to the brain of the fish. In the accompanying photograph of a fantail this line can be seen as a number of black dots starting from just behind the top of the gill plate and running along towards the tail. Remember, too, that the vision of a fish near the surface of the water is such that you may be seen before you think yourself within range.

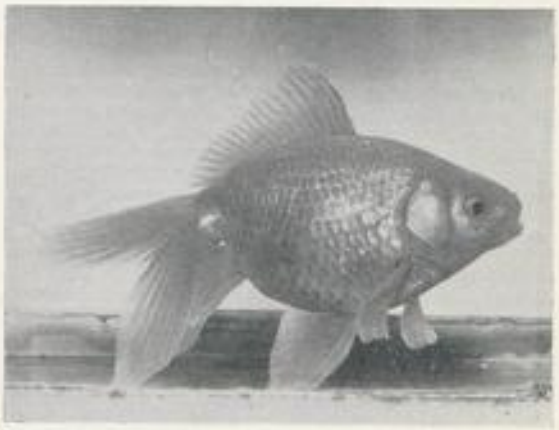


Photo: Laurence E. Perkins

The vibration-sensitive lateral line organ of this fantail goldfish can be seen as a curved line on its side arising near the top of the gill cover

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

Hydrogen Peroxide

MAY I make two comments on your June issue? First, to Mr. Raymond Yates (whose articles I always read with great interest) who refers to the use of hydrogen peroxide—it *is* safe to use in larger quantities than you have used, but only to the fish.

I added about two ounces (4 tablespoons) to a 30 gallons tank when my angel fish appeared to be "off colour," and as a result all my *Vallisneria* went soft and rotted, except the roots. So peroxide appears to be affect plant life adversely, which is also borne out by Mr. Yates' experience with it affecting algae. On the other hand if you do add excess peroxide you can neutralise it very quickly by adding potassium permanganate solution.

The beauty of this method is that the permanganate is decolorised as it goes in if added in small quantities, so you can judge when you have added enough. The water in the tank should be thoroughly mixed all the time you are adding this substance, and an aerator going at full speed is the best method, until some pinkness persists. Nearly all the "antiseptics" and "bactericides" that we use are oxidising agents. Some (like peroxide and permanganate) are antagonistic to each other, and oxidise "mutually" to form harmless compounds. The action takes place more readily in slightly acid water.

Of all the available chemicals at our disposal for curing fish diseases I prefer methylene blue, because it is so very harmless to plants and fish if used properly and the range of its curative properties is very wide. I have known quinine to sterilise black mollies, lace gouramies and one or two other species. It is significant that quinine type compounds have been used as chemical contraceptives (to kill sperms) and it also looks as if it is the male fish which is more affected by the use of quinine.

The other point I would like to mention concerns the use of zinc, etc. for aquarium hoods, referred to on page 66. Though thoroughly agreeing with you that zinc and copper form poisonous salts which dissolve in the water, I would like to state that I have successfully reared three broods of angel fish in an 18 gallons tank having a large, heavy galvanised iron lid. I painted it thoroughly with a good enamel on the inside and have never had any trouble although it has been set up for two years. Still, it is always better to stick to correct principles, and I suppose I have been lucky in choosing a particularly good waterproof enamel paint!

JOHN A. DALLEY,
Whitby, Yorks.

Heating Failures

REGARDING Mr. Peter Watts' article in the March issue of *The Aquarist*, by his method failure of heating is provided against by the use of two heaters, each capable of maintaining the temperature above 70°F. But another danger is thereby increased—that of overheating if one of the thermostats sticks in the closed position.

I would submit, therefore, that alarm systems should be employed for both dangerously high and low temperatures, and that these must be operated, as Mr. Watts indicates, by an independent source of electric power.

D. A. BELL,
Birkenhead.

The Bennett Cure

WE all have a long way to go before our knowledge of the swim bladder is sufficient to make claims for a definite cure for all cases of trouble. After long observations on this matter I feel certain we shall never hear of one, but each case diagnosed must be treated separately. The treatment I have used which was published in *The Aquarist* (March) was given without full details. The remedy, although drastic, is only applicable to certain swim bladder deflations and the shallow water and gradual rise in temperature methods often only give relief. The treatment described is only in the experimental stage but with selected fish has proved successful and without any after-effects. To me a drastic treatment with success and no p.m. for Mr. Cotton is better than killing affected fish which have for so long adorned my aquaria.

J. BENNETT,
Stourbridge.

Post-Mortem Examination of Fishes:

W. Harold Cotton, F.R.M.S., F.Z.S., 39, Brook Lane, King's Heath, Birmingham, 14. ('Phone: Highbury 1693)

Specimens should be sent direct to Mr. Cotton with full particulars of circumstances, and a fee of 3s.

It is important that the following method of packing fish be adopted:—Wrap fish, very wet, and loosely in grease proof paper and then in wet cloth. Re-wrap in grease proof or wax paper and pack around with cotton wool in tin box. Despatch as soon as possible after death, with brief history of aquarium or pond conditions.

Breeding *Tilapia mossambica*

by R. EDMEAD
(R.A.F., Singapore)

IN *Exotic Aquarium Fishes*, by W. T. Innes, it is stated in the paragraph concerning the cichlid *Tilapia mossambica* that this fish has seldom been bred and that there was no certainty about which parent carries the eggs during incubation. Last Christmas I caught five of these cichlids on Singapore Island, small ones about two inches in length, and have since been able to make some observations of their breeding habits.

Within three months the fish were four inches long and proved to be three males and two females. The males especially were easily recognisable by shape, markings and coloration. They differ slightly from the description provided in the book mentioned above in having a red line running the full length of the top of the dorsal fin; the pectoral fins are also red at the top, shading gradually to complete transparency at the bottom. Both of these features are quite distinct.

The fish partnered themselves off and bred before Mr. G. Yallup (who helps me with my Malayan fish collection), or myself really knew what had happened. Whilst moving the fish to a new tank three eggs fell from the mouth of a female into the net. The two pairs were immediately placed in a separate aquarium. The females' jaws and gills were seen to move very slowly, but when one came close to the glass it was possible to see the eggs being moved as water passed through the mouth.

A pouch under the jaw of the female is distended by the presence of eggs during incubation and later the young, until they decide to fend for themselves. After two days both females were blowing out clouds of fry and then chasing their mates away. Seeing this, both males were removed. Each female had between 40 and 50 young, and these were "blown" out for a swim at irregular intervals, being taken back into the mouth at the slightest disturbance. The aquarium was 24 ins. by 12 ins. by 12 ins. with two sides, and the floor covered in algae. It was seen that whilst carrying eggs the females do not eat and become quite thin before the young are free-swimming.

After about five days the young appeared to be free-swimming so the adults were all placed together in a tank layered with four inches of sand. After a week the females were again carrying eggs in their mouths. In the new aquarium the two males dug holes roughly eight inches square at opposite ends of the tank, the holes being used as nests by each pair, and were so deep that the bottom of the tank was exposed. This bare patch was kept clear by the male, who carries sand in his mouth and adds it to the "breastwork" formed by the sand already removed from the hole.

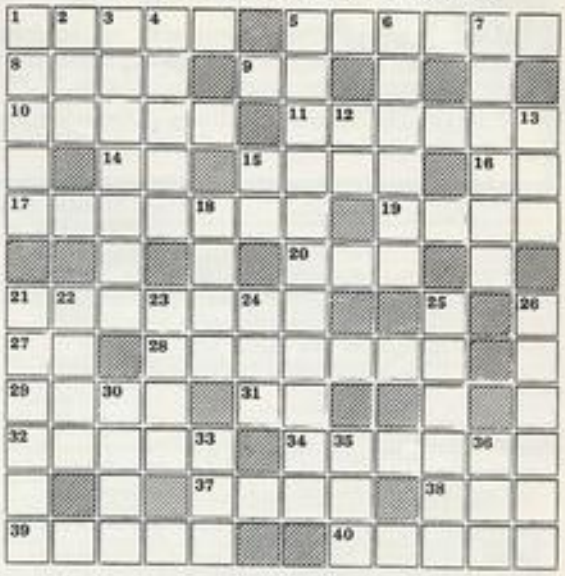
The exposed patch at the bottom of the hole is apparently used by the females to lay their eggs upon, but I am not sure whether the male fertilises them whilst they are on the tank bottom or whilst in the female's mouth, for he appears to do both. The male also possesses the pouch beneath the jaw but only distends this structure to add to his fearsome appearance when fighting. The fighting in this species, however, appears to be mainly bluff, for there is very little physical contact.

CORRECTION

In a review published in our May issue the name of A. F. Bird was incorrectly given as British Agent for *Keeping and Breeding Aquarium Fishes*. Academic Books, Ltd., 129, Queensway, London W.2, are the London offices of the New York publishers of this book and handle their publications in the United Kingdom and British Commonwealth.

The AQUARIST Crossword

Compiled by J. LAUGHLAND



CLUES ACROSS

1 Do singers so fish? (5)
5 Crossbreed (6)
8 To free from trouble (4)
9 A half of beer is (2)
10 Pupa (5)
11 Small British fish; often a disparaging term (6)
14 Exclamation from the reeds (2)
15 Take care in them Indian ferns shows one above grammar (4)
16 Head of the parasites (2)
17 These fish should be caller (7)
19 Pike (4)
20 Perch or the means of taking it (3)
21 Harlequin fish (7)
27 Supposing that is the clue (2)
28 Fish are these; so are we; plants are not (7)
29 Goldfish belong to this family (4)
31 Private soldiers' medal (1, 1)
32 Obvious feature of the crested newt (5)
34 One-footed creature (6)
37 In addition (4)
38 Addled roe for metallic earth (3)
39 Viper (5)
40 Great surges of waters (5)

CLUES DOWN

1 The doctor fish (5)
2 Fish or beam (3)
3 Smelt (7)
4 Repel back the unclean (5)
5 Beacon fish is this *scalifer* (1, 1)
6 In ichthyology, marked by lines around the body (6)
7 Any higher crustacean with unstalked eyes (6)
12 Not out of minnow (2)
13 A produce of the bees (3)
15 Briefly the Merchant Navy (1, 1)
18 Whalers' harpoon (4)
21 Crystalwort (6)
22 Distant (4)
23 Rolls in Scotland (4)
24 Brim, even beheaded (3)
25 I do sop (anagram)
26 Shads make most of these colour variations (6)
30 A tall marshgrass, or a musical instrument (4)
33 Rat returns (3)
35 Not quite the clue (3)
36 Before it is in the mere (3)

PICK YOUR ANSWER

1. The scientific name of the one-spot barb is: (a) *Barbus binotatus*. (b) *Barbus stoliczanus*. (c) *Barbus terio*. (d) *Barbus ticto*.
2. The family Mastacembelidae is popularly known as: (a) knife fishes. (b) pike heads. (c) silversides. (d) spiny eels.
3. *Ambassis baroensis* was named by: (a) Bleeker. (b) Day. (c) Hamilton-Buchanan. (d) Regan.
4. *Barbus soambarae* is named after a: (a) District in Tanganyika. (b) Lake in Assam. (c) River in Basutoland. (d) Town in Bengal.
5. Which of these plants flowers under water? (a) *Aponogeton fenestrale*. (b) *Ceratophyllum demersum*. (c) *Najas flexilis*. (d) *Sagittaria subulata*.
6. "Cry to it, nuncle, as the cockney did to the . . ., when she put 'em i' the paste alive." The missing word in the quotation from Shakespeare's *King Lear* is: (a) anchovies. (b) eels. (c) smelts. (d) sprats.

(Solution on page 94)

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.

New Societies

Bourne and District Aquarist Society *Secretary:* Mr. R. L. Pattison, Avondale, 16, West Road, Bourne, Lincs. *Meetings:* Alternate Wednesday evenings.

Preston and District Aquatic Society *Secretary:* Mr. A. McCann, 105, Todd Lane North, Lostock Hall, Nr. Preston, Lancs. *Meetings:* First Thursday each month, 7.30 p.m., at Grimshaw Street Hall, Preston. This is the only aquarium society now active in the Preston area.

AQUARISTS in the **Renistone (Near Sheffield)** district are forming a new society and interested readers should contact Mr. V. Robinson, 61 Victoria Street, Renistone, Nr. Sheffield, Yorks.

Secretary Changes

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

Bolton and District Aquarist Pond and Marine Society (Mr. A. Sewell, 36, Eskrick Street, Bolton); **Hawick and District Aquarist Society** (Mr. J. M. Bonsor, 116, Silverbuthall, Hawick); **High Wycombe and District Aquarist Society** (Mr. D. L. Barrett, Craignairn, Bolter End, High Wycombe, Bucks.); **Nottingham and District Aquarists' Society** (Mrs. Joy D. Pullon, 50, Luttrell Way, West Bridgford, Nottingham); **Lambeth Aquarist Society** (Mr. D. G. W. Page, 18, Clive Road, West Dulwich, London S.E.21); **Nuneaton and District Aquarists' Society** (Mr. D. Tunnicliff, 283, Edward Street, Nuneaton); **Peterborough and District Aquarists' Society** (Mrs. Y. Stockdale, 2, Home Place, Eastgate, Peterborough); **Pisces Aquarist Club (Dulwich)** (Mr. F.S. Sayers, 3, Rokell House, Beckenham Hill Road, Beckenham, Kent).

Aquarist's Calendar

1st-3rd July: **Southampton and District Aquarists' Society** fifth annual open show at the Avenue Hall, Southampton.

2nd-4th July: **City of Salford Aquarist Society** open show at the Drill Hall, Cross Lane, Salford, Lancs. Details from secretary Mr. W. Wainman, 249, Eccles New Road, Salford 5, Lancs.

9th-10th July: **Bolton and District Aquarist Pond and Marine Society** show at Spinners' Hall, St. George's Road, Bolton.

16th-17th July: **Macclesfield Aquarium Society** annual show at the Brocklehurst Memorial Hall, Macclesfield.

21st-24th July: **Kingston and District Aquarist Society** Fifth annual exhibition at the Y.M.C.A. Hall, Elden Street, Kingston-on-Thames, Surrey.

22nd-24th July: **Bath Aquarists' Society** open show of tropical and coldwater fishes and aquaria at the Pump Room, Bath. Show schedules from show secretary Miss A. Gurney, 41, Sydney Buildings, Bath.

Members of the Hendon and District A.S. erecting a new store for the greatly increased amount of equipment now possessed by the society. An invitation from the society is made is made to all aquarists to attend all meetings any Thursday evening, at 8 p.m. at the Brotherhood Hall, Edgware Road, Hendon, London, N.W.9

31st July-7th August: **Blackpool and Fylde Aquatic Society** fourth annual open show at the Victoria Street Congregational School Rooms, Blackpool. Schedules available from show secretary Mr. J. Peck, 82, Bathurst Avenue, Blackpool.

3rd-4th August: **Leicester Aquarist Society** display in the Horticultural Marquee at the Abbey Park Show, Leicester.

6th-7th August: **Hendon and District Aquatic Society** annual open single entry show at the Brotherhood Hall, Hendon, London N.W.9.

8th-15th August: **North of Scotland Aquarist Society** annual show at the Y.M.C.A. Union Street, Aberdeen. Competition entries to Mr. T. McRobb, 20, Seamount Place, Aberdeen, Scotland.

19th-21st August: **Portsmouth Aquarists' Club** open show at the Royal Engineers Drill Hall, Portsmouth. Entry forms from show secretary Mr. G. Elverson, 24, Bertie Road, Southsea.

21st August: **Romford Aquarists' Society** annual open show of tropical fishes at the Lambourne Hall, Western Road, Romford. Schedules obtainable from show secretary Mr. A. C. Speller, 21, Cedar Road, Romford.

25th-28th August: **Leicester Aquarist Society** annual show at St. Mark's School Room, Belgrave Road, Leicester.

26th-28th August: **Stockport and District Aquarist Society** annual show. Details from secretary Mrs. J. Pay, 23, Oakfield Avenue, Frieswood, Manchester 16.

26th-28th August: **Midland Aquarium and Pool Society** open show at the Minor Hall, Bingley Hall, Birmingham. Schedules and entry forms from show secretary Mr. C. D. Roe, Shirley Aquatics Ltd., Monkspath, Shirley, Nr. Birmingham. Closing date 9th August.

2nd-4th September: **Stoke Newington and District Aquaria Society** annual show at the Library Hall, Church Street, Stoke Newington. For entries write to Mr. F. G. Gatehouse, 115, Bouverie Road, London, N.16.

3rd-4th September: **Walthamstow and District Aquarists' Society** annual show. Details from show secretary Mr. J. Browning, 28, Sperling Road, Tottenham, London, N.17.

4th September: **High Wycombe and District Aquarist Society** show in conjunction with the High Wycombe and District Show. Details and schedules from show secretary Mr. R. Adkin, 7, East Drive, Totteridge, High Wycombe, Bucks.

10th-11th September: **Bethnal Green Aquatic Society** fifth annual show, with six open classes for club furnished aquaria. Venue: Men's Institute, Bethnal Green. Show schedules from Mr. W. A. Richardson, 16, Whitman House, Roman Road, London, E.2 (closing date 13th August).

11th-12th September: **Willesden and District Aquarists' Club** show as part of Willesden Borough Show.

Crossword Solution

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

PICK YOUR ANSWER (Solution)

1 (c). 2 (d). 3 (a). 4 (a). 5 (b). 6 (b).