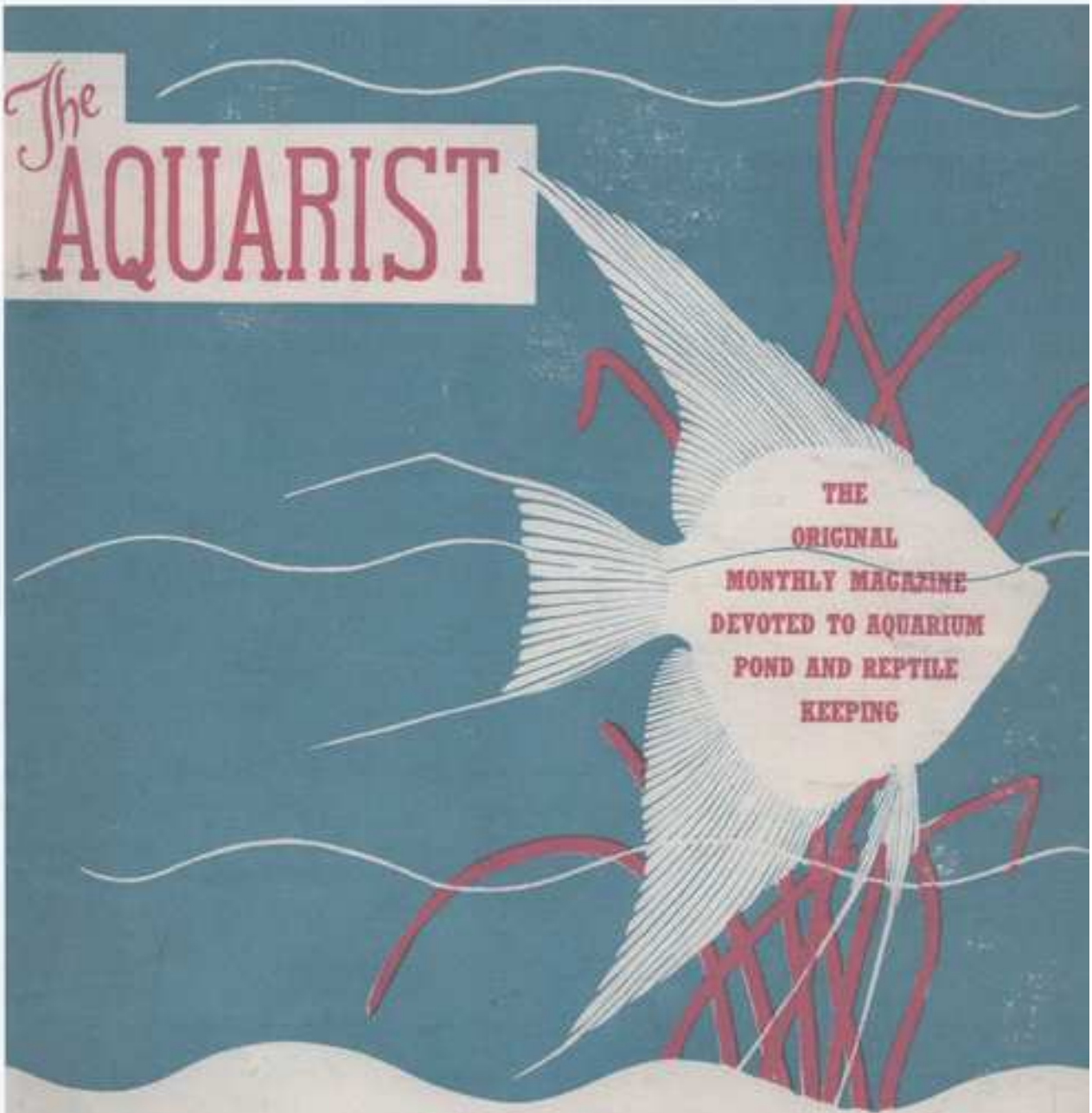
The AQUARIST



THE
ORIGINAL
MONTHLY MAGAZINE
DEVOTED TO AQUARIUM
POND AND REPTILE
KEEPING

Vol. XIV. No. 2 MAY, 1949

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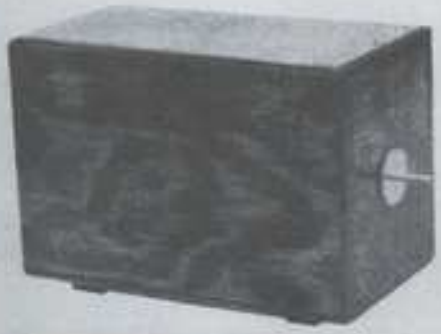

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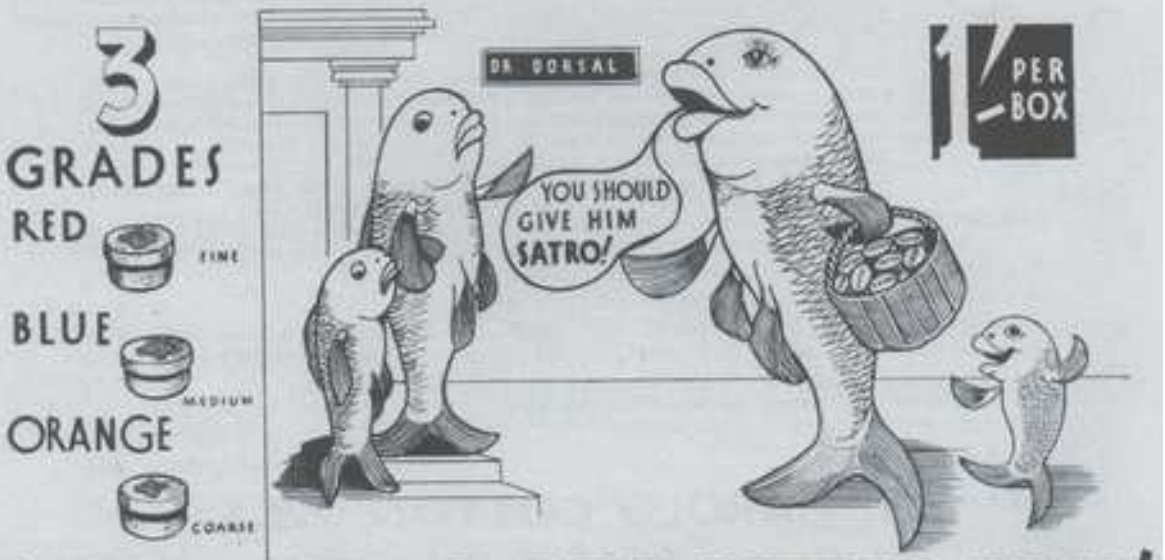

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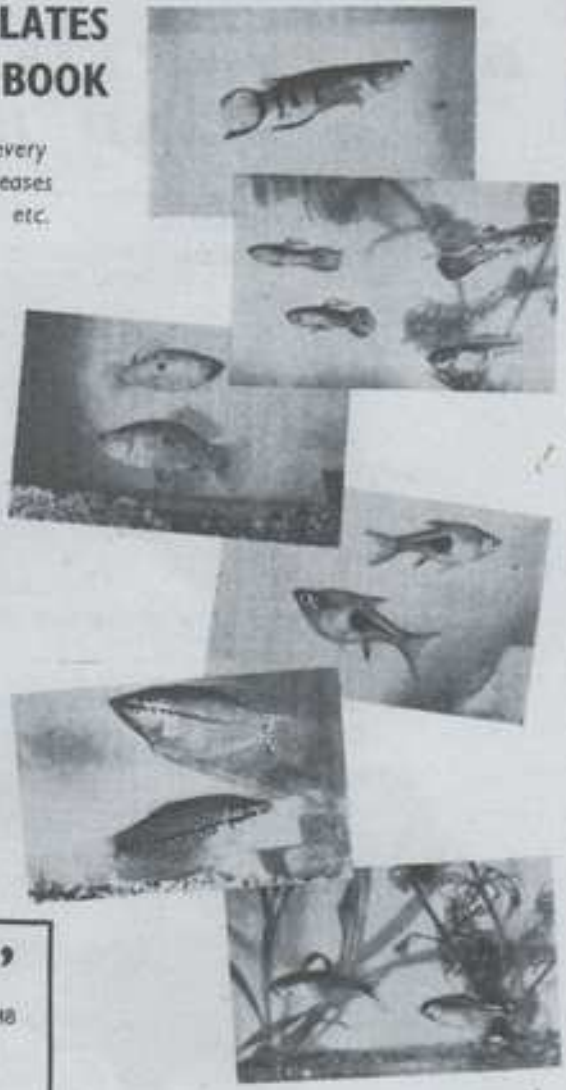

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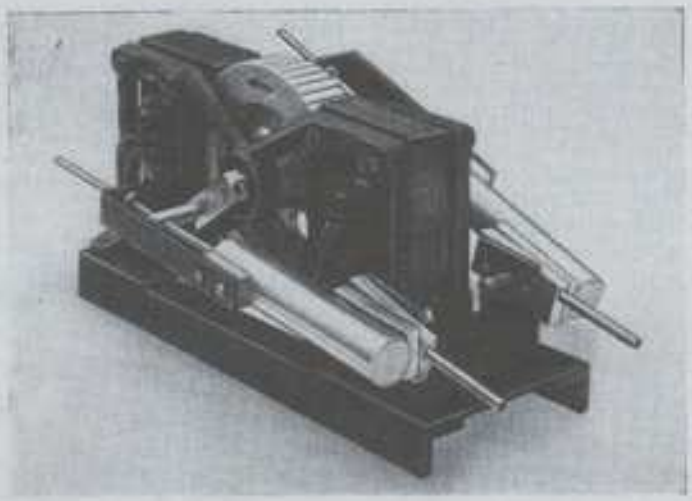

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AND PONDKEEPER

Founded in 1924 as "The Amateur Aquarist"

PUBLISHED MONTHLY | VOL. XIV No. 2 | MAY, 1949

All communications to :
The Editor, *The Aquarist*,
The Butts, Half Acre,
Brentford, Middlesex.

In every case the name and address of the writer must be given.

Our COLOUR SUPPLEMENT

Photo : W. S. Pitt

A striking photograph showing the impressive appearance and massed beauty of a shoal of young angel fish

Editorial

IT is interesting, and not out of place in this issue, in which recapitulation of twenty-five eventful years has emphasis, to reflect on changes which attend the advance of years. Such reflection is probably the only mental occupation in any but the very young that the advent of a birthday brings.

Jubilation at accomplishments and achievements, regret over lost opportunities, these will occur, and according to the degree that one exceeds the other, so will the outlook adopted for the future be affected. The period in which this journal has been in existence has seen the greatest development of the science and hobby of aquarium keeping, and changes have been ones that give no cause for regrets. What of the future ?

Tropical enthusiasts will welcome the day in which as wide a range of fish species as existed here before the war is again available. With the increasing interest of airlines in problems of live fish transport, although so far shown chiefly by airlines in other countries, many exciting possibilities come to mind. Attention to details of airlifting fish could bring countless new species to our shores, and at prices that would not place them out of reach.

An increased interest in marine aquaria, with the development of technique to make this possible for the amateur, is long overdue. Too seldom does one meet followers of the sea-water cult. Once again, with air transport established, tropical marine aquaria in the home may become a possibility—and this time study of this branch may reach the prominence it promised shortly before the war displaced it altogether. For sheer variety of form and colour, the coral fishes know no equal.

One other development that must come is the provision of more public aquariums ; these should be fully equipped for both display of aquatic life to the public and for the furthering of scientific research in all its spheres by trained research workers. Such a development would considerably increase the scope for the aquarist in his home, and ensure that the problems his activities raise are not passed by.

Our Founder and First Editor

A. E. HODGE, F.Z.S.

JUST twenty-five years ago this month there appeared, for the first time in the history of the hobby, a journal devoted entirely to the interests of students of aquatic life.

It was called *The Amateur Aquarist*, and the man who foresaw the necessity for this periodical was A. E. Hodge, F.Z.S., who became its first editor. His reasons for undertaking the venture were sincere and precise; in his first editorial he wrote, "During the many years I have indulged in the pleasures of aquarium-keeping, I have always felt the need for a publication in which aquarists could voice their views and get in closer touch with one another. It is because I fancy that other aquarists have a similar desire that the magazine has been launched . . . . With cordial support and co-operation, *The Amateur Aquarist* should soon prove an organ of importance in its own sphere."

Cordial support and co-operation were soon forthcoming and not only in this country, but in English-speaking countries all over the world aquarists acclaimed the birth of their own magazine with delight. A. E. Hodge was an acknowledged authority on water biology and aquarium keeping. His interest in these subjects had dated from boyhood, and his genuine wish to introduce the pleasures he derived from his studies to as many others as possible was responsible for the foundation of the hobby we follow to-day. The twelve years in which he advanced and improved his beloved magazine were not easy ones. Many obstacles had to be overcome, and finances for the expensive production of such a specialist journal were not the least of the problems. He devoted himself untiringly and unceasingly to the interests of the "hobby," and his untimely death in 1936 robbed him of the chance of seeing

The Aquarist—

the full fruition of his efforts. But he had done pioneer work, and it had cost him his health.

Fortunately, his enthusiasm had infected others, and because his magazine was so obviously filling a long-felt need, it was not allowed to perish with its founder. Two friends, lifelong devotees to natural history and to its aquatic spheres in particular, both regular contributors who had shared in the labours of A.E.H. when his health began to fail, were in a position to take over where he had left off.

Frank Austin Watson, F.Z.S., became editor, and A. Fraser-Brunner, F.Z.S., in his unique position as a professional ichthyologist at the British Museum (Natural History), was well fitted to act in an advisory capacity on the scientific aspects of aquarium studies. In addition, his interest and skill in illustrating and painting water life made him a most valuable member of the staff.

The title of the magazine had been changed in its second volume to its present one, and although conditions had not permitted it to continue as a monthly, as had first been hoped and attempted, it was restored to monthly status with number one of volume eight.

Many changes had occurred meanwhile in the hobby itself, and many of the innovations to fish-keeping and advances in technique first saw the light in the pages of *The Aquarist*. The emphasis was always on the presentation of sound, authoritative and practical articles, and in 1938 the editor could truly write, "Those who have been careful enough to bind each volume as it was completed have, on their shelves, as complete a history of the hobby in this country as is ever likely to be written in the future, a veritable encyclopædia of knowledge and history in one."

F. Austin Watson had great ability for leadership, and this was shown in his relations with the various aquatic societies that had by then appeared and developed to a thriving condition. He wrote several books on aquatic subjects, and his personality, intruding in the pages of the

magazine, greatly increased its value. A good friend and cheerful companion, stern critic, and a man of unbounded energy, he continued his editorship right into the early and most trying war years.

In 1941 the editorial offices and publishing works of

Twenty-five Years

The Aquarist were destroyed by enemy action. War conditions, with the absence of many of our readers and staff in the Armed Forces, and the short supply of paper and printing materials, forced a decision to suspend the journal for the duration of hostilities. The following year, 1942, brought another tragic setback, when, after injuries he received during Civil Defence duties, the death of Watson occurred.

F. AUSTIN WATSON, F.Z.S.
Editor 1936-1942

Our Advisory Editor

A. FRASER-BRUNNER, F.Z.S.
Editor 1946-1948

The journal was recommenced in 1946, with Mr. Fraser-Brunner at the editorial helm, and despite difficulties fully equalling those attending the first launching of the journal, in spite of the war loss of a unique collection of printing blocks, photographs and valuable equipment, it, and the aquarium hobby, revived. Thanks to the hard work of its third editor, *The Aquarist* caught up its pre-war position and resumed its close contact with the hobby, with the post-war recovery of which it is inseparably linked.

Since his knowledge and experience have called him to work on urgent fishery problems overseas, Mr. Fraser-Brunner has become advisory editor to our journal, and we are thus able to continue to profit from his long experience and interest.

Tribute must be paid in this brief record to the many who from the earliest days have given their full support—to contributors, advertisers and, of course, to readers. Last, but not least, to our publishers, whose interest and foresight has maintained the journal through some very difficult periods, and to all members of our staff we say, happy Silver Jubilee—may our service to the hobby be as great in the future as it has been in the past.

Photo: S. C. Porter

Irises growing at the corner of a pool

H. A. DAY, F.R.H.S., *writes*

Concerning the Pond *and* Water-Garden *in* MAY—JUNE

THE pondkeeper, with his or her more or less wet garden, can produce a more artistic and colourful effect than is possible in a dry garden. There is a far greater variety of flowering subjects for choice, a more substantial and lasting growth, a greater range of form and colour—all due to the perennial presence of moisture. Where there is a pond or stream, with movement of water in the inflow and outflow, and the action of sun and wind upon the water—there will always be moisture in the air and in the soil; this moisture makes for luxuriance of growth which can hardly be expected in the dry garden. The aquarist should take advantage of these facts, and organise a garden of colour to match the colours of fish in the pond or stream, and thus enhance the beauty of both.

AT this time there are many water-loving plants at the disposal of the aquarist. I could name a score of primulas and their hybrids that provide every shade of colour imaginable, most of them in full flower just now. The earlier primulas that have finished blooming will be sending up their large, handsome leaves—do not cut or remove these on any account, for they are essential to the well-being of the plants; you can remove the leaves later on when they become unsightly.

Then the irises—what a show they give! June is their special month, but some bloom earlier and others later. Probably the flower attracting most attention just now is the water-lily, which also claims June as its own special month. See that the blooms do not become overcrowded by the leaves—the latter should lie flat upon the water, each having plenty of room. Should the leaves be bunched together it is a sign of the plant needing division and replanting. It may be useful to remove some of the overcrowded leaves by cutting them out near the root-stock; but you may be able to remedy matters in the case of slight overcrowding by keeping the water to a high level.

IF you want to create a foliage effect but have insufficient room for bulrushes and other water grasses, you should try a clump of the old-time "lady's garter" grass, with its white and green stripes. This is very ornamental, but the roots unfortunately are great trespassers. Still, you can divide up the plants each autumn, and also thin out some of the stems now if needed.

In the very damp spots—such as near the overflow, or damp bricks or rocks—you should grow the tiny *Arenaria balearica*, which clothes the spot with small leaves and tiny star-like flowers. The whole forms a striking object, despite its diminutive size, when it is grown in masses. The smallest piece of this plant will root itself and will quickly spread quite a long distance wherever it finds moisture. On the other hand, it quickly dies and dries up if moisture leaves the place—the sun soon scorches this little plant; so be careful to give it a moist position.

ANOTHER tiny plant suited to a shady site is the Houstonia. This little Alpine plant quickly forms a dense mat of tiny leaves and small pale blue flowers. Both these diminutive plants are very useful for planting near the edge of a small pool, but they should not be given an exposed position, as they do not like cold weather.

Aquarists who grow lily-of-the-valley (a good idea if carried out on a shady site or a slope that is not too moist) should take care not to injure the leaves now that flowering is all but over, as leaves store up food in the plants for use next season. Try the effect of dropping some seeds of "love-in-the-mist" (*Nigella*), mixed with sand or fine soil, between the lily leaves—this will hide the leaves and make the spot bright until late autumn.

Overcrowded lily leaves—the signal to divide and re-plant

In this article the development of the aquarists' hobby and the recent history of the

Cult of the Aquarium

is reviewed by L. R. BRIGHTWELL

Above the tanks—a photograph taken in 1914: the late Joseph Wells is standing on the servicing planks of the old Brighton Aquarium

Photo: L. R. Brightwell

LOOKING back over the "aquarium movement," fairly crystallised in the journal which has honoured me with a request for this hurried review, one is struck by its extraordinary rapidity, the impetus of its take-off against seemingly overwhelming odds.

Just over a century ago, when Philip Henry Gosse and his great champion, Charles Kingsley, were thundering against the general blindness to nature, the naturalist was a mere figure of fun. Despite the growing strength of the Zoological Society and Natural History Museum, animals, unless associated with so-called sport, and over-eating, were of little account. But, thanks to Gosse, the first-aquarium-ever was opened at the London Zoo, in 1832, and it took the more educated public by storm. Thanks to the lack of those mechanical aids which have made our hobby what it is to-day, the sea-water section came to a sad end, but a lamp had been lit, and soon it blazed into a bonfire. It set the pace for those flamboyant drawing-room aquariums which so aroused the mirth of Mr. Punch, and they had their day. But this was but a bursting bubble on the steady stream of progress. Nature study was no longer a butt for wits.

Two years ago the writer conducted some forty West Surrey aquarists on a collecting expedition to Black Rock, Brighton. It was in the height of the holiday season, but though loaded with the impediments of our pursuit, not a head was turned to regard us as persons of unusual appearance or behaviour. Mr. Punch, it may be mentioned, has, as a persevering commentator on our changing world, twice given *The Aquarist* honourable mention, and one of his most famous contributors, Sir Alan Herbert, has written a charming article extolling the aquarium cult.

Immediate results of the Zoo effort were the establishment of the Westminster and Crystal Palace aquariums, and here it may be said that any aquarium founded merely as a moneymaking "stunt," and not primarily as a scientifically run establishment, is doomed to failure. Westminster's last and largest exhibit was a meeting of shareholders. Brighton opened in 1872 and, for long the finest aquarium in the world (it even housed a white whale, and saw the birth of a porpoise), it is now a place of melancholy memories. But the same year, which marked Brighton's high hopes, saw the birth of the world's first laboratory for the study of aquatic life, the magnificent Anton Dohrn Aquarium, still standing at Naples.

It was largely got upon its feet by the efforts of an Englishman, the late Sir E. Ray Lankester, and just twelve years later the first of the many British marine stations was set up at Plymouth. Others followed at Lowestoft, Cullercoats, Millport, Aberdeen, Port Erin and Conway. In fact biological stations fairly ring the world, and no great coastal city is without a public aquarium. The research movement culminated in 1890 with the vast Wood's Hole laboratory, Massachusetts. Its illustrated list of "material for sale" is a veritable tome.

From this date onwards, perhaps the writer's personal

By permission of the Proprietors of Punch. 1857.

Terrific accident—to a home "aqua-vivarium" in 1857

By permission of the Proprietors of Punch. 1858.

Common objects of the sea-side in 1858

[illegible] may be permitted to creep in. London seemed [illegible] dozen dealers, though they advertised little. One of the earliest was Messrs. Newmarsh, and there was also Lloyd's in Great Portland Street, Childs in Pentonville Road, and, of course, Cura, happily still with us. Castang's too, at Haverstock Hill, was a place to visit, but the fish fans' Mecca, perhaps, was Green's Conservatories, on the roof of Covent Garden. Would that I had preserved more of those early price lists. To-day, one would read them between laughter and tears. Green was handy for picking up animal stowaways amongst the fruit crates, and what a collection! Young boas for a few shillings, fresh-water crabs at eighteenpence each, and small goldfish a penny a time, and a substantial reduction on a quantity. I remember too, a shop in Oxford Street that actually displayed an inverted bell-jar full of living sea horses.

Well into the nineties the home aquarium was disfigured with models of Rhenish castles (for the fishes to play hide-and-seek in), china mermaids, tropical shells, coral branches and other outrages. But gradually the more scientific approach prevailed. In 1896, New York opened, at Battery Park, the then largest aquarium in the world. More and more people, particularly Americans and Germans, began to realise there was "money in pollywogs," and many, previously not interested in ponds and ditches, regarded them with new eyes. They saw gold at the bottom!

Gosse set the fashion not only for aquariums, but for a new literature. The Reverend Bateman's twin volumes on Fresh-water and Marine Aquaria, issued in 1897, was the most ambitious and comprehensive work of its kind, though history has shown him to have been far too optimistic regarding salt water aquaria, despite the fact that the Great Eastern Railway would send a barrel of it to anywhere in the kingdom for fourpence until as late as 1910. 1905 witnessed a small but severely scientific marine aquarium at Horniman's Museum, and the year following saw the Prince of Monaco's still unique oceanographical museum. A little later Madras opened an aquarium, still extant, but as yet, publicity, apart from scientific papers, was confined to spasmodic and generally inaccurate press notices.

The dawn came indeed on a May morning in 1924, with the birth of *The Aquarist*. It consisted of eight pages, "ads." were confined to its pale blue paper covers, and the only club announcement was that of the British Aquarium Society (founded 1920) with, as its President, the late E. G. Boulenger, who also wrote the first page fanfare—a brief review of the aquatic movement. As to the ads., the cheapest aerator was fifty shillings, but a collection of plants, fish and snails, was offered for seven and sixpence, and globes—globes(!)—were advertised by firms that doubtless now know better.

Space will not permit a complete chronological review, but enough to say that the nineteen twenties saw the Zoo's present aquarium create a great sensation, and the thirties the building of the world's largest marine aquaria to date, the John Shedd at Chicago and Marine Studios in Florida. The latest *Aquarist* will keep all posted in developments both at home and abroad.

What of the future?—it may be asked. The cult of "trops," indeed, would seem to have reached something like a peak, and the establishment of the Fresh-water Biological Association opens up illimitable vistas for the cold fresh-water enthusiast. But despite *The Aquarist's* courageous pioneer articles the home marine aquarium is still, one fears, scarcely in its infancy. Last year this journal made several good attempts to encourage the beginner, but he is still deterred, one feels, by two main factors. First, a quite unjustified timidity regarding technicalities, and (I write this with no desire to give offence), a complete lack of "show standards." To some folks a competitive spirit is essential to arouse enthusiasm. Now if only somebody would draw up a set of show standards for the common blenny, or offer a challenge cup for fine upstanding starfishes—better still, if clubs would offer a small prize for the best marine tank of any kind, at their very next exhibition, then, one feels assured, the subject would meet with the enthusiasm it demands. Think of the illimitable reserves of exhibits, to say nothing of the sand, rock and water, just to be had for the gathering—free.

Not that anyone need despair. Only a quarter of a century ago we were all waiting for one man to found a journal which aquarists the world over now accept as naturally as they take their breakfasts—or the income tax!

PIKE AGAIN!

The newspapers report that goldfish worth £600 were eaten by a pike which some person or persons unknown introduced into the lily pond at King George VI Park at East Retford, Notts. In order to save the remaining goldfish, the pond was drained of something like 40,000 gallons of water. Men who waded into the almost emptied pond captured the pike; it measured 15 inches in length and turned the scales at 1¼ lb.

J. H.

SUBSCRIPTION RATES

The Aquarist will be sent post free for one year to any address for 16/6. Half yearly 8/3.

QUERIES

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

CONTRIBUTIONS

The Editor welcomes the opportunity of considering original contributions on all branches of the hobby and its allied interests, authentic breeding records, personal experiences, and photographs.

Articles: should be clearly written or typed on one side of the paper only.

Illustrations: should be on plain white paper or card and finished in Indian ink.

M.S.S. or prints unaccompanied by a stamped addressed envelope cannot be returned, and no responsibility is accepted for contributions submitted.

Correspondence with intending contributors is welcomed.

Post-Mortem Examination of Fishes

W. Harold Cotton, F.Z.S., 30, Brook Lane, King's Heath, Birmingham, 14.

Specimens should be sent direct to Mr. Cotton, with full particulars of circumstances, and a fee of 2/6.

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 greaseproof or wax paper and pack around with cotton wool in the box. Despatch as soon as possible after death, with brief history of aquarium or pond conditions.

Water samples should be sent in a large clean medicine bottle, and contain a little bottom sediment, and a stem or two of typical plant growth.

The writer of this article treated the same subject in the first issue of The Aquarist. Despite the lapse of years there is still much that is unknown about the habits of this fish

Breeding Habits of the BITTERLING

(*Rhodeus amarus*)

by W. S. PITT

IT is just twenty-five years ago that I wrote an article for the first issue of this magazine on the breeding habits of bitterling. Now that I have been asked for a contribution to the Jubilee number, I am returning to the same subject, as these habits are of considerable interest and, I suggest, not fully established in all details.

I should explain shortly that bitterling are found wild in most rivers of Central Europe, and reach a length of about three inches when full grown. To rear any young fish it is essential that one or more freshwater mussels be provided, as the eggs are deposited by the female in the siphon of the mussel, being fertilised by the male ejecting milt into the water. If all goes well, the young develop inside the mussel and appear about one month after the spawning.

What particularly intrigued my brother and me when we watched our bitterling spawning was the method by which the eggs appeared to be placed in the mussel. Our observations were set out very shortly in my original article, and as they have not been fully confirmed (so far as I am aware) I propose to repeat them with further details and also to review the comments of other writers on the same subject.

It is agreed by everyone that the female bitterling in the early spring develops a small tube, which at first only protrudes from her vent to the extent of half an inch or less. A few hours before spawning, this tube (which for the sake of convenience I will refer to as the ovipositor), lengthens until in the case of a full grown fish it is about two inches long and reaches the tip of her tail while she is in motion, for it is very flaccid and trails behind.

In 1923, my brother and I placed four male and two female bitterling in a three foot tank with two mussels. On 12th May the ovipositor of one of the females had lengthened, and on 13th May we watched the fish for several hours. The mussels were near the front glass with no weeds intervening so that we had a perfect view of the proceedings. The males were very excited and we expected to see the female insert her ovipositor into the siphon of the mussel (as we had read was usual), but, unless our eyes deceived us, she did nothing of the sort. The procedure of the actual egg-laying, as we witnessed it, was as follows :—

The female would hang head down at an angle of about 75 degrees and then suddenly dive down on to the mussel, striking it on the mouth of the siphon with the part of her body which is immediately in front of the ovipositor. At that particular point in her anatomy there seemed to be a small whitish flap. The mussel closed at once on being hit. We particularly looked for the position of the tip of the ovipositor at the time and it always seemed to be trailing away behind the fish and not to be either deliberately inserted or to be sucked in by the mussel closing. It appeared to us that the fish had no control over the ovipositor.

The long ovipositor of the female Bitterling is shown in this illustration of a pair of the fish in the breeding attitude

We saw the same thing happen about twenty times that day between 11.30 a.m. and 4.30 p.m. We removed the mussel the next day to another tank, and in a little under four weeks young fish appeared, so that I am satisfied that the fish were spawning while we watched them.

I was so amazed at what we had observed that I wrote to the late J. R. NORMAN, at the British Museum (Natural History), giving him details, and subsequently, at his request I sent him two female bitterling. The two letters I received in reply are so interesting that I quote the relevant parts in full and reproduce his rough sketch.

" British Museum (Natural History),
Cromwell Road, London, S.W.7.
25th May, 1923.

" . . . . With reference to the breeding habits of the 'bitterling' (*Rhodeus amarus*), I am interested to read your account of the process. It is quite different from that which we have always believed to take place, as it has always been said that the elongate tube, which is merely the genital papilla greatly lengthened in the breeding season, was the actual instrument which deposited the eggs in the mussel. According to other workers, a dissection of the female shows that the actual oviduct is connected with this elongate tube. If you could spare a fresh specimen of a female *Rhodeus*, I could make a dissection to check this point, but I think that you will find that the egg does pass down this tube.

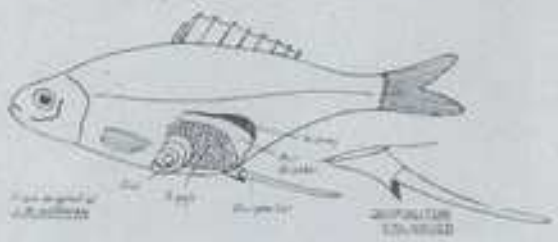
" As far as I am aware the spawning takes place in the following manner. The female is closely followed about by the brightly coloured male, who drives her towards any open mussels lying at the bottom. She apparently selects one, and then suddenly assumes a vertical position

with the head downward; she then darts down and inserts the long ovipositor into the siphon of the mollusc. The large egg (about 3 mm. in diameter), is already lying in the proximal part of the tube. As soon as the egg commences to glide down the ovipositor the latter stiffens, and after the egg has been deposited it is withdrawn, being now twice as thick and shorter than before. It soon resumes its previous shape, however. The male, who has been following all the activities of the female, then pours his milt over the respiratory siphon of the mollusc. The above process is repeated at intervals for several days."

" June 6th, 1923

" . . . . I have now made a dissection of *Rhodeus*, but although it shows one or two points of interest, I have been unable to clear the matter up completely. The ovipositor appears to have a sort of double structure at the base, which is hard to describe. However, the accompanying diagram may make it clear. There is a wide and loose membrane connected with the base of the narrow tube, forming a wide-lipped tube itself, and this is undoubtedly the small organ which you observed. Both this wide-lipped tube and the long narrow ovipositor appears to be connected with the oviduct by a single opening, so that the egg could be shed through either. Gentle pressure will not make an egg enter either tube, and if more is exerted a mess of crushed eggs is extruded through the long and narrow tube.

" As you have observed the process of oviposition several times however, I should think that it is quite probable that the egg is laid through the wide-lipped tube, and it would be of great interest if you could write a short note about the matter, giving your observations and own views on the subject."



Now, if Norman had reported that it was physically impossible for the eggs to be deposited, except through the ovipositor, it would be obvious that somehow we had failed to observe the real procedure, and I should have had to assume, either (1) that the egg was dropped from the ovipositor while the fish was hanging head down, and was unconsciously sucked in by the mussel as it took in water, or (2) that the mussel on being hit and closing suddenly, sucked in the ovipositor, or (3) that the ovipositor does in fact stiffen and the fish thrusts it into the mussel. It is interesting to me, therefore, to find that all these theories receive support from other observers.

Since my original article was published, there have been many accounts by other aquarists of how bitterling breed. As every one has stated that the eggs are deposited through the ovipositor, my confidence in my own theory that the eggs are deposited by the small organ in front of the ovipositor has diminished, and would, in fact, have vanished long ago were it not for the fact that hardly any two of these writers agree in detail, and some of them definitely confirm the unusual features which first caused me to write to Norman.

I give at the end a list of references, confining myself to authors who claim to speak from actual observation, but as some of these volumes may not be available to all readers, I give short extracts.

BADOCKS writes that the egg is " deposited by the aid of her long ovipositor."

STOKES writes—" The female seems to stand almost on her head looking into the breathing siphon of the mussel and judging her distance. She then, quite suddenly, dives down on to it, *coming in contact with it at the spot where the ovipositor joins the fish.* If her aim is good, and it quite frequently is not, *the whole ovipositor is sucked into the mussel's siphon* which immediately closes, and she then swims away lengthening the ovipositor as she pulls it out and leaving the eggs behind."

STEUER writes—" Arrived at her destination, she assumed a slanting position above the siphon of the mussel, her tail pointing upwards, and *inserted the ovipositor into the mussel . . . . A gonopodium-like spiny formation extends along the base of the ovipositor for half an inch, else this long flabby organ could not be introduced into the siphon of the mussel.*"

CALDER writes—" Now the story has been related of how the female lowers the ovipositor into the opening of the mussel, which receives the ova. *This is positively not so . . . .* I think the bitterling may have control to a slight degree at the body end of this appendage, and *it is out of the question to imagine that she can direct the other end to any definite spot . . . .* The whole process of the disposition of the eggs is very haphazard. I saw several eggs leave the female singly and sink slowly to the bottom of the tank, whilst the male devoured, if not all, some of them. It must be a matter of luck if the egg is near to the mussel's aperture at the precise moment that it is working its siphon on the intake valve."

EDWARDS writes—" Then, with much quivering on the part of both, *the egg duct was lowered*, and an egg laid. The actual laying took only a second or two, and then the female, with still another egg visible in the ovipositor, darted away."

HILL writes that the female " jerks herself forward several times, eventually depositing an egg *by sliding the ovipositor into the siphon.*"

SCOTT writes—" The female now performs a dipping motion with her body, levelling out and dragging the ovipositor across the siphon of the mussel. If her aim is true (quite frequently it is not), *the ovipositor appears to be sucked into the siphon* and held for a second or two, after which it is drawn out by the female, the eggs having been dropped into the siphon."

Up to a point I think I may fairly claim that both Stokes and Scott confirm part of my observations. I agree that once the female pulls out of her dive, having hit the mussel, the ovipositor must of necessity be dragged over the siphon, but I certainly never saw it disappear into or be held by the mussel.

BRETSCHNEIDER and DE WIT, with other Dutch scientists, have, in recent years, made an intensive study of bitterling from various aspects, and published their findings in a book of which there is an English edition. I think it is clear that in connection with these researches, they must have watched the spawning act many times and under control conditions, so that I should expect their observations to be absolutely accurate.

They write—" *We should here insert a description of the mechanism of erection of the ovipositor. The ovipositor is placed in a rigid state into the exhalant siphon of the freshwater mussel.* The ovipositor itself is completely flaccid, and cannot be pushed into the mussel in that state. When a mature ovum arrives at the base of the ovipositor it is pushed into the ovipositor by contraction of the muscles of the urinary bladder. The urine cannot run away through the ovipositor, because the ovum acts as a plug. When the ovum is pushed towards the tip of the ovipositor, that part of the ovipositor behind it is filled with urine, which causes a certain rigidity. In this rigid state the ovipositor is introduced into the mussel, and is able to penetrate deeply enough into the mollusc for the safe deposit of the ovum. As soon as the ovum has been forced out of the ovipositor the liquid under pressure flows away and the ovipositor relaxes completely. This course of events was observed in ovulations that had failed, and in which the ova had missed the mussel. In normal cases the ovum glides through the ovipositor so quickly that the tube is rigid for only a very short time and it is difficult to follow the process closely, especially as the ovipositor is for the greater part inside the shells of the mussel.

" An interesting detail is the behaviour of the male in display and during oviposition . . . . When the male displays in spawning time, it is inclined to place itself near a mussel. The latter is regarded as the centre of the male's territory, and from here fishes venturing inside this domain are continually chased away. Not only are males of the same species driven off, but all sorts of other fishes as well, even females with long ovipositors. These female bitterlings, however, which, apart from possessing a long ovipositor, also adopt a certain posture, namely with the head inclining slightly downwards (inclination-position), appear to attract the special attention of the male. These females do not take flight as the male rushes at them impetuously, but rather convey the impression of being apathetic. When a male comes in the neighbourhood of such a female its behaviour suddenly changes. Displaying himself, and trembling all over, he slowly swims before the female in the direction of the mussel. The female seems fascinated by these tremblings, and follows slowly until it comes near to the mussel. There it inspects the filaments of the exhalant siphon, and in the most favourable case places itself with its tail above the siphon of the mussel, its head slightly downwards, and *with a sudden forward movement shoots its ovipositor into the opening.* During this manoeuvre, which lasts only a fraction of a second, the displaying male performs extremely rapid trembling movements which probably constitute the actual ovulation stimulus to the female. As soon as the female has deposited her eggs and swims away, the male, shining in brilliant colouring, discharges his sperm from above into the same opening."

This book contains two photographs. The first shows the female hanging head down over the mussel and the second apparently shows the female withdrawing her

ovipositor. I say "apparently," as the detail is not too clear, and there is such a striking difference in the appearance in colour and shape of the ovipositor in the two photographs that it may be that the second photograph has been touched up.

Now, until my attention was drawn to this book, I thought it just possible that I might have missed seeing the ovipositor sucked into the mussel after the latter had been hit by the fish, and if so, I could agree with the descriptions given by Stokes and Scott. Now, however, that we have the word of the Dutch scientists (who confirm the description in Norman's first letter—which was taken from some German publication), that the ovipositor does in fact stiffen, how are we to explain that not one of the other observers I quote mentions this fact ? If this is the true method, then the idea that the ovipositor is sucked into the mussel must also be abandoned.

Personally, I am satisfied that it is part of the spawning act for the fish to hit the mussel, as both Stokes and I have described, and also that at the exact point where the fish and mussel come into contact there is a small organ in addition to the ovipositor, as has been confirmed by Norman, and Stenger. If the fish does not deposit an egg at that precise moment by means of this additional organ, or alternatively, if such action does not cause the mussel to close and suck in the ovipositor, what is the explanation of this apparently extraordinary behaviour ?

It would be interesting if several aquarists were to breed this little fish and publish in this magazine their views on these points which are not clear.

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A Pioneer Looks Back

THIS Silver Jubilee number, a landmark in our hobby, raises memories of the early difficult days of the "fancy," and in the shadows of those memories I see faces which had been long forgotten, and names spring to the mind, names unknown to most of our readers to-day.

May I mention some ? I cannot say, "first," because it would be difficult to say who heads the list. I think of Miss Glover, the hard-working secretary of the first aquarium society in Great Britain, and the intimate, but lively meetings, we used to have in Fetter Lane ; the first aquarium show that was held there, and my pride in "mopping the board" with my plant show. A. E. Hodge, then writing under his initials a half column each week for the *Daily Chronicle*, and his little office at his home in Southfields, with the walls lined with cold water tanks. The arguments—over two bottles of stout—about whether or no *Daphnia* eat algæ. I see it all again.

The mighty six-inch Green Swords, from the Mexican wilds, in a tank in the reptile house—no aquarium then—which were presented by Mr. Shattock. Ever heard of him ? The sunfishes and bass, bred in the open at Chorleywood, by Col. Gilliatt. The mighty orfe in Major Pryor's lake at Preston Park, orfe bought as babies at Green's in Covent Garden, 82 years ago ! Sid Whittle, the wizard who bred great cichlids in little home-made 18×10 tanks, and who then was probably the greatest expert on tropicals in England. The early pioneer dealers, Cura and Ben Child, with whom a visit to see some new tropical was an adventure.

No textbooks to help us, and the meanings of the Latin names—when we got them—had to be worked out with what little knowledge of Latin and Greek that we had conserved from our schooldays ; this was where I had a little advantage, as I had always been a keen, although fifth-rate amateur philologist. Excitement when Les Katterns imported the first shubunkins, and sent most down to me, as he had such little room. His disgust when Sunday morning visitors dropped several cigarette ends into his big tanks, and killed all he had kept. My disappointment when I found that the shus were the same fishes as I had produced (as runts), in crossing calico veils with Japanese fringetails ! Sh ! tell it not in Gath. Well, the unbounded enthusiasm, and evangelical work done by all these, and many that my memory has left behind, laid the foundation of the hobby as it is to-day.

Perhaps one of the most important things of those days was the founding, by A. E. Hodge, of our *Aquarist*. What a struggle he had ! I wrote regularly for him, in those days, on a barter basis. One article in return for one advertisement ! He could barely afford to pay for articles, and I couldn't afford to pay for advertisements ! Those were the days !

Anyhow, to the pioneers passed over—R.I.P.—to those still living, but unknown, my affectionate memories. May our hobby never go back, but go on until it becomes the premier fancy of Great Britain, especially of the young folk. This brings to mind the motto on my old trade card, in happier days, "Better a hobby than a vice." Who would dispute the truth of that ?

ARTHUR DERHAM

* * * *

ARTHUR DERHAM made his first pond when eight years of age. His boyhood activities were all by, on or in water. His first job was as a journalist on the *Pall Mall Gazette* but love of the strenuous and outdoor life sent him wandering, with periods of hard work and thrift to allow him to wander again. Apart from his interest in "finny creatures" he became boxing instructor at a Polytechnic (and later won—and retired unbeaten—the heavy-weight boxing championship of his county), spent three of the still hours each night at his language books and generally filled every minute. In World War I he was sergeant interpreter in France. Home again, he was the first in this country to breed tropicals in the open air—in ponds heated by waste steam from his brother's Turkish Delight factory! The Derham Fish Farm was started and soon became a show place which aquarists from all over the country came to see. The last war finished this, and now, although he is more interested in the experimental side of the hobby, he grows and sells water plants, and as he says, "gets as much joy in his old age out of the hobby as he did as a child"; he regrets that shattered health from his war service, and shortage of time, give him no chance to mix with fish-keepers, although he admits a soft spot for our Scottish friends, whom he visits as often as he can.

NATIVE AQUATIC PLANTS

by STEPHEN HOOK

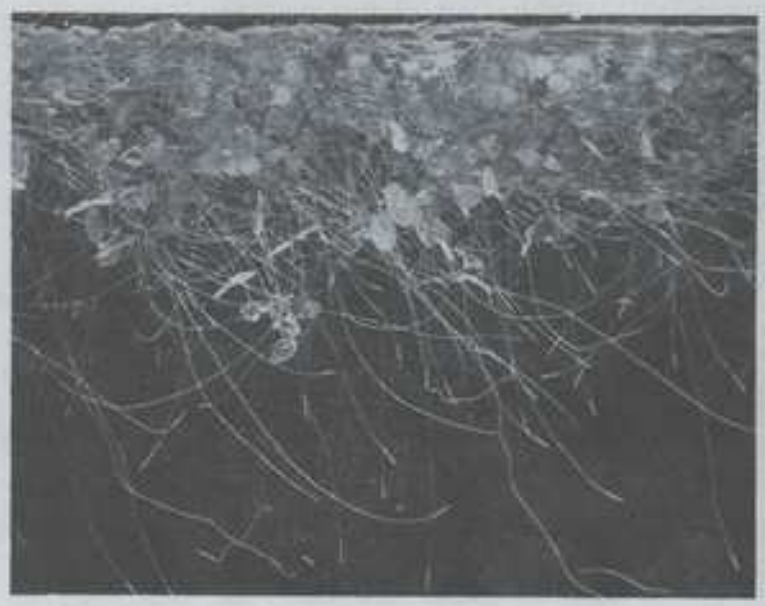
with photographs taken by LIONEL E. DAY

IT is thought that millions of years ago, plant life originated in water, and that later, the various types adapted themselves to the land; this all happened before the appearance of flowering plants, but since then flowering species that are aquatic have developed.

Although most of the British ponds, rivers and streams have varying types of aquatic plant life, the amount is regulated by definite geographical conditions. In fast-flowing rivers there is comparatively little vegetation except algæ, mosses and lichens, owing to the fact that the speed of the water will not allow larger plants to gain sufficient hold and propagate. In slower streams and rivers with moderate currents, the vegetation is dense, and a number of flowering plants are to be found, these being arranged in zones. In stagnant pools and dykes the vegetation is usually prolific, and if care is not taken to have such waters cleared regularly, they become choked with the new growth; decayed plants fall to the bottom, very quickly raising the level of this and diminishing the depth of the water. Eventually what was once quite a useful pond will become marshland, and then may dry out completely, merging with the surrounding country.

Although water currents play a very large part in the distribution of aquatic plants there are several other controlling factors. For instance, aquatics obtain their nourishment from the mineral salts dissolved in the water, and in some cases from the mud or silt brought down by the rivers. Therefore if the food value of the water is low, or the soil is poor, little or poor quality vegetation will be found. A number of plants float, and these obtain their nourishment from the water, while others are submerged but have an emergent inflorescence. In order to manufacture food, the leaves extract the carbon dioxide from the water and give off oxygen; thus we arrive at one of the main reasons for introducing plants into aquaria. Given the required amount of light they will thrive and oxygenate the water. If too much light is allowed algæ will grow, and ruin both the plants and the transparency of the glass!

Where there are many aquatic plants there is usually an abundance of animal life. The fish spawn among the plants, and the fry find shelter among them. Many aquatic insects are to be found, and the plants provide food for numbers of herbivorous insects, fish, and other animals.



Lesser duckweed (Lemna minor)

Hornwort

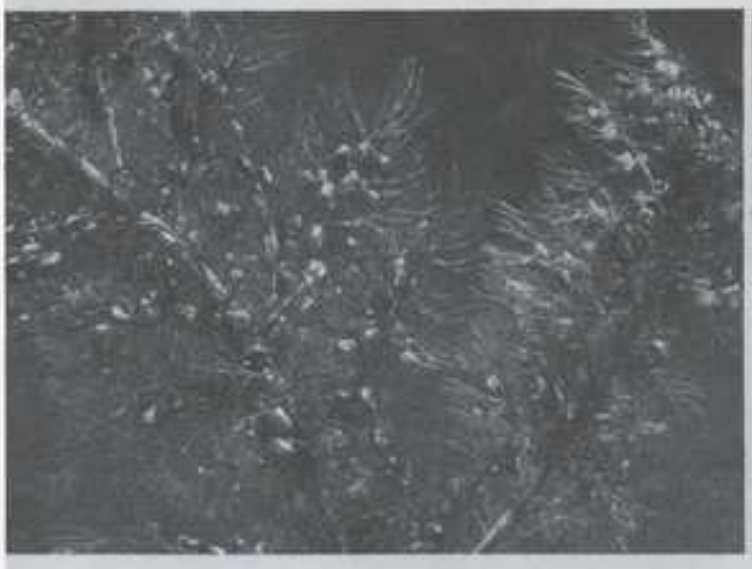
Swans, ducks, and even horses, eat some water plants, and in the case of *Elodea*, its growth is definitely curtailed by being eaten by birds.

Duckweed

The duckweeds (Lemnaceae) are probably one of the most common and widely distributed botanical families. Four species are found in Great Britain, and they are our smallest flowering plants.

The most common species is the lesser duckweed (*Lemna minor*), and it is to be found growing on the surface of many ponds and ditches of stagnant water. It is easily transferred and kept in aquaria, and affords excellent shelter for fish and small aquatic insects. No soil is necessary for its growth, as the threadlike root given off by each plant obtains nourishment from the water.

Each plant consists of a frond and a root, and the root caps



Greater bladderwort (*Utricularia vulgaris*)

Canadian pond weed

are clearly visible. The frond in *Lemna minor* is tiny and ovate; it is fairly thick for its size, the margin is entire, and it is darker in colour on the upper surface than on the underside. Propagation is carried out by budding and from seeds, but budding from the margin of the frond is the main method. The tiny flowers, which occur in early summer, and give the surface of the water a yellowish tint, grow on the surface of the leaf, and although they have no perianth there is a one-celled ovary containing one or more ovules, and one or two minute stamens enclosed in a membranous sheath. During the winter the plants sink to the bottom.

When introducing this species into a pond or aquarium, care should be taken not to overstock with it as this is a most prolific plant which spreads rapidly.

Canadian Pond Weed

Elodea canadensis is known by many popular names, the most common include Canadian or American water weed, ditchmoss, water pest, water thyme and Babington's curse, and their uncomplimentary nature is due to the fact that the plant grows so rapidly that it is apt to become a nuisance.

It made its first appearance on this side of the Atlantic in County Down in 1836; in 1842, it was found in a lake in Berwickshire, and by 1850 it had spread to most localities in Great Britain. In 1852 the dykes in the Fens had become choked by the plant, and the Government sent a representative to the district to advise on its clearance. However, dredging failed to clear it, and left to its own devices for some years, the plant slightly diminished. The menace was at its peak between 1850 and 1880, and although *Elodea* has spread rapidly throughout Central Europe to the South-east, it is hoped that its growth will at least be checked, if not entirely stopped. In choking rivers and streams, *Elodea* is a great nuisance to swimmers and fishermen, but its dense growth provides good cover for aquatic insects and fish fry.

This aquatic will grow either with roots embedded in soil or floating free in the water; in this condition, providing the stem has a whorl of leaves on it, adventitious roots will be given off at the nodes.

The plant is dioecious, and it is mainly the female plant which is found in Great Britain; propagation is from the buds. The leaves vary from light to dark green in colour, are minutely serrated, and three or four leaves are arranged in a whorl. The streaming of the contents of their cells can be clearly seen under a microscope. In shape, the leaves are oval to ovate. The stem is long, brittle, round and transparent. It branches and forms great masses near the bottom of the pond. The underwater flowers grow from a spathe, while the pistillate flowers have a long threadlike tube reaching to the surface, and having masses of leaves crowded at the top.

Elodea grows well in tanks, providing it has plenty of light. It is a good oxygenator, and seldom dies if decayed leaves are regularly clipped off; to gain the best effect in a tank the plants should be leaded and sunk in bunches so that they can root in the soil.

Hornwort

This species (*Ceratophyllum submersum*) is a rather rare plant, but is to be found prolifically in some ditches and dykes in Southern England, and derives its generic name from the Greek word meaning horn-leaved.

It differs from the more common *Ceratophyllum demersum*, inasmuch as the fruit does not have two horns at the base, while the leaves are a pale green and further apart. They are narrow and rigid, being subdivided three or four times, setaceous, and growing in whorls. The plant is extremely brittle and it resembles a sparsely-leaved *Myriophyllum*. Roots are absent, and food is obtained by absorption through the leaves. This plant is also known as the coontail in America. The flowers are inconspicuous and grow in the axils of the leaves.

Although this is a hardy plant, and a good oxygenator, it is not particularly good for tanks as it tends to decompose very quickly. It has the advantage, however, of providing good refuge for young fish.

Greater Bladderwort

The bladderwort (*Utricularia vulgaris*) belongs to the Utricularia family (from the Latin *utriculus*, meaning little bladder). It is found in ditches, ponds, and slow-running

(*Continued at foot of page 39*)

BREEDING FANCY GOLDFISH 2.

Rearing the Fry

by A. BOARDER

Photo: G. T. C. Morris

The male goldfish is distinguished by the tubercles seen on the gill-plates

BY the time that this article appears I expect that many fancy goldfishes will have spawned in the open pond, and that fry may have already hatched. I will deal with the feeding of the fry a little later on in this article, but first I will write a few notes on the sexing of your parent fish, as several inquirers seem to be in doubt about how this can be done. Some fancy goldfish are so chubby in body that it is rather difficult for beginners to sex them. Usually the female is much thicker in the body, especially on the left side. However, in fantails and veiltails the male is sometimes as thick as the female in the body, which makes sexing more difficult.

The surer method of sexing is to look for the small white raised spots or tubercles on the gill plates and pectoral fins of the male. These are only apparent when the fish are coming into breeding condition, and so in the winter these spots are not in evidence. Some aquarists are of the opinion that the tubercles on the gill plates are not too sure a sign, since they may appear on females. I have never seen them on females among my own fish, but it may be true nevertheless. The spots on the pectoral fins seem to be a more certain sign of the male as I have not heard of females carrying the tubercles on their fins. When a male fish is in full breeding condition the tubercles can be felt as well as seen. I have noticed the tubercles on young males at the age of nine months but these fish had been very well fed and had grown and matured quickly; in the usual course of events fish of this age would not show the signs so early. Again it must be realised that although the signs on a young fish will signify that it is a male it must not be assumed from this that all the other fish of the same spawning are females; after a week or so some other fish may develop the spots, because all fish do not mature at the same time. Once the fish are actually spawning it is a simple matter to pick out the males as they chase and nuzzle the females very energetically and so cannot be mistaken.

I will now deal with the treatment of the eggs, which I hope by now have been laid, and which you have removed from the pond into the shallow hatching tanks or bowls. It is much better to refrain from forcing a very quick hatching by raising the temperature above 75° F., so do not expose the eggs to very strong sunshine whilst they are in a shallow bowl or in an all-glass tank. The embryos in the eggs may be killed by this treatment. There is no need to keep the temperature at one steady level, as a rise and fall over about ten degrees will do no harm. I have had fry hatch out after the water temperature has varied from 50 to 80° F., which proves how much the eggs can stand in the way of variation. When the water becomes very cold the development is retarded, and so when the water has cooled down occasionally you must not look for a quick hatching. I think that a temperature of about 70° F. is ideal, as this will give a hatching in four days.

During the incubation you may change some of the water in the hatching tank now and again, say on the second, third and fourth days, but do not disturb the eggs too much as they are easily detached from the weed and may sink to the bottom and not hatch.

I think that the best food for young fry after they have consumed the egg yolk, say after two days, is pond-water which contains plenty of Infusoria and algae. Most ponds that have been in existence for a year or two will have plenty of minute life therein, which you should be able to see with a strong magnifying glass even if you have no microscope. Remove some of the water from the fry tank through a sieve so that you do not catch up any of the fry and then pour in some pond water through the sieve again to make sure that no harmful creatures are introduced into the tank. There is no need to worry unduly about any slight change in the temperature of the fresh water from that of your hatching tank, as the small amount, say up to about a tenth of the quantity, will make very little difference.

As there may be anything up to two thousand fry in one hatching it is absolutely essential that they have plenty of room in which to develop. Make no mistake about this point, no matter how well you feed the fry they will not grow into strong healthy fish unless they have plenty of water in which to develop. I have had over a thousand fry hatch in a sixty-gallon tank, and it has soon become apparent that very few would grow into adult fish unless many were removed to other tanks.

It is therefore essential that when you are breeding fancy goldfish you must weed out the poor quality fish as soon as possible so that the better ones can have more room, and so have a better chance of making good fish. Although it is almost impossible for anyone to pick out show standard fish from fry at fourteen days of age, yet it is possible with the double-tailed fish, such as fantails, moors and veiltails, to sort out the throwouts such as the single-tailed ones. The double-tail at this early stage appears as a small spear and can be seen from above quite easily if the fish are placed in a white bowl. With the single-tailed fish, such as the shubunkin, it is not possible to sort out the fish so early, but they have one very big advantage over the fantail in that they do colour much more quickly, being calico or almost transparently scaled fish. It is possible to sort out the shubunkin fry from about a month old if only by taking out those with a bad shape, such as a pronounced snout or flat back, a bad fault found in many shubunkins to-day.

You will be well advised to concentrate on raising good

healthy fry to the age of about three months, when it is fairly easy to pick out all those fish which are not likely to make show specimens, even if you cannot with surety pick out the winners.

Fish hatched in May and June stand a much better chance of survival through the winter than those which are hatched later on in the season, as they have the best of the long days in which to feed and grow; fish hatched as late as August have a very poor chance of living through the winter in an outdoor pond, and can only be raised with any degree of safety by giving them treatment suitable for tropical fish.

Once you have completed the first sort-out you can feed up the selected fish and grow them on more quickly by allowing them more space. From a fortnight old it is possible to feed the fry on fine dried foods such as ground and sifted Bemax. Various foods which are fine enough may be tried, such as packet tropical foods, dried egg and oatmeal flour. These should be used with caution however, and rarely if you are able to obtain a good supply of small live food. Live foods suitable in the very early stages are, first, algae and Infusoria, then micro worms, after those, small water mites and very small *Daphnia* can be used. The exact ages for the different kinds of food cannot be given as so much depends on the rate of growth of the fry, but common sense will tell you how large a size of food can be used. As the fish grow you should gradually increase the size of the food, as they are very greedy feeders and will always go for the largest pieces; the very fine is often left to decay and pollute the water. At three weeks of age the fish should be able to eat chopped white worms and *Tubifex*. Be careful with the *Tubifex* though, and never feed freshly caught *Tubifex* to fish. These worms take in decomposing materials, and if fed to fish shortly after they have been collected, may poison them; I know of cases where this has happened. Leave the worms in running water for a few hours until they have had a chance to clear their systems.

From one month onward you may add finely chopped earthworms to the diet, and from then on your feeding troubles should be at an end. Once the fry can eat chopped worms there is no difficulty in finding a good change of food. Ordinary sized *Daphnia*, white worms, *Tubifex*, larvae of mosquitos and in fact, almost anything that moves in or around the water will be acceptable to them. The choice of dried foods is now much larger, but with these foods much more care must be taken than when you are feeding with live foods. The advantage of feeding live foods is that the food which is not immediately eaten can live on to be taken later without the fear that it will pollute the water; an over-feed of dried food can upset the balance in the tank in a very short time, so take every care not to give more than can be cleared up in a few minutes. When you are feeding with starchy foods you must watch the water very carefully; I find that if uneaten food remains in the tank for even a short time the fish will develop fungus on their fins. This is the first sign of trouble, and in my opinion, is due to polluted or overcrowded water. The fungus will often then spread to the rest of the body and the gills, when it will prove fatal.

From a very early stage I am sure that it is beneficial to change part of the water in the rearing tanks every day. By this method you are not only removing some of the polluted water but by introducing fresh water you are re-oxygenating it as well as probably putting in new food in the form of Infusoria.

Try to grow the fish on as quickly as possible before the days shorten and become cooler. You have very little chance of bringing your fish through a winter out of doors in a pond unless they are about three inches in length overall before the end of the autumn. A lot depends on the size of the pond, I know, and the larger it is the easier it is to winter the fish, but also a great deal depends on the weather. Last winter was an example of changes which do more harm to fish in outdoor ponds than the density of cold. We had a fairly open winter last season and the fish appeared to be going through very well. By February they were moving around well in fairly mild weather, and with frogs paired in the pond it looked as if all our troubles were over. Suddenly, however, on the first of March, we had very severe frosts with thick ice on the ponds, followed by snow and cold winds. It remained very cold, with ice on the pond for about ten days. The result of this sudden and severe spell had done more harm than all the previous winter weather, and hundreds of fish all over the country developed fungus after this spell. Fish seemed very well until this time and then I heard tales of fish developing fungus on the tails, and of tails rotting away. I am of the opinion that this was caused by the fish becoming active early in the year and then being exposed to the sudden cold after they had used up their reserves in the mild February.

There is nothing better as fungus treatment than a bath in sea-salt, one tablespoonful to each gallon of water; leave fish in for about a quarter of an hour and repeat in fresh mixture each day until better. If the fish are badly attacked before they are noticed, and have the fungus on their eyes I am afraid that you have very little chance of saving the fish. Sometimes a fish appears cured, and after being replaced in the pond it has another attack which may prove fatal. This fungus can appear in the best-kept ponds even when the pond has been well cleaned out, and in my opinion, it is caused more by sudden cold spells than by a steady and continual cold period throughout the winter. The trouble generally appears in April, but if you are fortunate enough to spot the fungus on the fish before it gets a hold you may effect a cure. The first sign of trouble with most fish is that they sulk and keep by themselves.

(*To be continued*)

Native Aquatic Plants

(*Continued from page* 37)

rivers in South and East England, but there are about 290 species in the genus widely distributed in the tropical and temperate zones.

One of the most interesting features of this plant is that it is insectivorous.

All kinds of small aquatic organisms are attracted to the plants. As the victim touches the front of the bladder it is sucked inside, and remains there to die. The plant does not kill its victim quickly, neither does it exude any fluid to hasten the end, but star-shaped cells absorb the nitrogenous matter formed by the decaying animals. The bladders or utricles are a pinkish purple, and although they are interesting for their insectivorous properties, their main purpose is to buoy up the plant. As summer approaches the bladders fill with air and the bladderwort rises in the water. This enables the plant to obtain more air and light, and the bright yellow flowers rise several inches above the surface. After the plant has flowered, the bladders fill with water, and the whole thing sinks to the bottom. Decay sets in except in the oblong terminal buds, which are about the size of a pea. These lay dormant until the following spring, when they form new plants.

The submerged leaves are subdivided into threadlike segments, and the leaves of one species are very alike those of *Myriophyllum*. The flowers are large and a bright yellow, and grow in clusters of six or eight, each flower being two-lipped. In the early spring the terminal buds can be taken by the aid of a net and placed in a tank. Their growth is interesting, but for successful development they need plenty of light.

INTRO

CONTRIBUTORS

ELIZABETH CROSS, teacher and journalist, has written for *The Aquarist* for many years. She spent the war years in the Land Army, and has since returned to teaching after a period on the editorial staff of *The Countryman*, owing to the shortage of infant teachers. She has a fine garden by the sea, and regards a ditch in which tadpoles and newts abound as one of its assets. Her chief interests are "messing about out of doors—chiefly with mud and water!"

A. BOARDER, a retired member of the Metropolitan Police Force, has kept fish for many years and has been breeding the scaled fantail since 1937. His fish have won prizes, cups and medals in all the outstanding shows. Other interests have included breeding and exhibiting canaries, collecting and raising cacti from seed, in which field he is also an acknowledged authority, gardening and bird-watching. He is also a keen woodworker and water-colour painter, and his own house is decorated with his work.

L. R. BRIGHTWELL began to draw animals at the age of six, and has since illustrated over a hundred books, written a dozen and produced many hundreds of articles and thousands of drawings. These latter range from pages in *Comic Cuts* and *Punch* to those in the *Proceedings of the London Zoological Society* and, of course, *The Aquarist*. He finds his wife a particularly helpful critic. He is an active member of the West Surrey Aquarists, a Fellow of the Zoological Society and member of the Marine Biological Society among others. Travel includes deep sea trawler trips. His hobbies are theatre going . . . and work.

BARRY FUNNELL admits that he served his apprenticeship to fishy things as a follower of Izaak Walton, but he soon became more interested in studying fish than catching them. Before the last war he had accumulated one of the most extensive collections of tropicals in England and bred many difficult species. He has contributed extensively to aquarium literature and has had one fish named after him (*Corydoras funnelli*). Since the loss of his first collection by a bomb in 1940 he has turned to the study of marine biology and marine aquarium keeping, fields in which he is now experimencing.

IAN HARMAN is a well-known naturalist and nature writer. As a schoolboy he lived in Tasmania with relatives for four years, and had his first article, on Tasmanian birds, in print at the age of thirteen. He is now a free-lance writer, and has written several books, including recent ones on cats and Pekingese dogs. A book on tropical fishes written by him is expected to be published this year, and he is already planning a companion volume on coldwater fishes.

H. A. DAY, F.R.H.S., ce his 77th birthday in Ma year. He is a recognised on garden matters, and specialised in the pond a garden spheres. He lived riverside as a boy and sp his observations of nat writing about these his fa as a young man to become musician and conductor, take up photography as He is still working as a consultant and lecturer o subjects, and the list of b and papers, journals and m to which he has contribute fill a column of this page.

IRIS MURRAY, whose artic been illustrated in these page photographs of Mr. L. E. Day devoutly interested in aquatic training to be a school teach later entered the Civil Serv following a domestic period marriage in 1937, she worke European Service of the B.B has two children, both ardent Her main aim in life is to tr meanwhile she is keeping writing the script for much of work, and preparing lantern for a series of subjects to this year.

JACK HEMS has been an a keeper for as long as he can r and a writer on aquarium s two decades. He is a native but has been living in the Mi a few years. He is not very e of *Homo sapiens* but is fond o so-called lower creatures." D war he divided any leisure ho fishkeeping between haun London bookshops and freque galleries of the British Museum enjoying the pleasures ab watching fishes, collecting listening to symphony concert records of Dixieland jazz and an occasional Guinness, he thing of a gastronome and a for the culinary delights o Soho.

JCING

OVISORY BOARD

H. LEON GAUNTLETT, M.D., a keen marine zoologist and naturalist, has been unable to follow his profession since receiving severe disabling wounds as Captain, R.A.M.C., in Flanders, and for some years has unfortunately been unable to engage actively in his natural history interests. He has the largest collection of old horse brasses and harness ornaments in the country, it having some 1,500 varieties, and has further large collections of other pieces of historical interest.

DAY, F.Z.S., A.R.P.S., nature apher, became interested in life soon after demobilisation yal service in 1919. His photo- work has been exhibited at all ding international photographic ons and salons, and he was listed e-fourth in the world in 1939 as ning photographer. He is now ing in the photography of life and exhibits photographs ype almost exclusively. Hobbies architectural photography, aquarium keeping and the g of exotic moths. He has an e library of negatives and slides.

J. W. LESTER, F.Z.S., has always had a deep interest in all branches of natural history, and in particular in herpetology. He collected live animals in West Africa in 1930, and after a period at the Primley Zoological Gardens in charge of the tropical section, he joined the R.A.F. at the outbreak of the last war. He is now Curator of Reptiles at the Zoological Society of London, where his considerable knowledge of field natural history has been a great asset. His main interest is in the Anura, and as a Founder Member of the British Herpetological Society his aim is to foster a real interest in these studies and to welcome the chance of encouraging others.

R J. C. MURRAY is a school- by profession, but has been a history photographer since . One of his earliest recollec- the results of spilling a jam jar won frog's spawn on the draw- n carpet. He is well known as er on natural history subjects, contributor to many journals saines. He has also written and of two books on nature subjects e war. His photographs are many exhibitions and he is at engaged on a good deal of work tural colour photography both ut of water.

L. C. BUSHBY, F.Z.S., F.R.E.S., a native of Kent, found that delightful countryside an inspiration for one in whom a bent for natural history was apparent at an early age. Insects, terrestrial and aquatic, are his main interest, with botany a close second. After serving in the 1914-18 war and studying at the Imperial College of Science he was appointed Curator of Insects at the Zoological Society of London in 1923, a position he still holds. He had a long association with the founder of this journal and "witnessed its birth."

OLD COTTON became inter- Freshwater microscopy at the and soon found that his know- s of great help in solving the s of aquarists. He joined our y Board in 1928 and has contri- rticles ever since. He has a book on garden ponds and and began to concentrate on of fish diseases about ten years rved in the R.A.C. during the m tanks to tanks, as he says— dvisory work on aquatics now m a yearly post-bag of several d letters. A "glutton for work" following up several original d inventions in the aquarium

RAY PALMER, F.R.E.S., F.Z.S., naturalist and entomologist, has made the study of "pond life" his speciality. He was well acquainted with the founder of *The Aquarist* and has often contributed articles and photographs to these pages. He has had a long association with Letchworth Museum, where he was curator; he now resides in the neighbourhood of Ampthill and is an active member of the Bedfordshire Natural History Society, and he edits the *Bedfordshire Naturalist*.

FRANCES PERRY, F.L.S., first wrote for this journal in 1928. Holder of a diploma in horticulture, she writes many articles on horticultural subjects, gives television broadcasts on gardening and is the author of several well-known works, most familiar to aquarists being her *Water Gardening*. Mrs. Perry is lecturer and instructor for the Middlesex County Council, has one son and says that her hobby is horticulture, horticulture and more horticulture.

G. F. HERVEY, F.Z.S., well-known aquarist, and author of books on fish-keeping, is also an authority on card games and playing cards, and has many journalistic connections in this sphere. He was wounded on the Somme while serving as a second lieutenant in "the Buffs" in World War I. His lecture on the history of goldfish is the result of ten years patient research, and to-day he is the acknowledged authority on this subject. He is now engaged on collecting material for a bibliography of aquarium literature together with Mr. G. Palmer of the British Museum (Natural History).

Further Fame for Frogs—

by

Dr. EDWARD ELKAN

AS if to honour this journal that has looked after their interests now for twenty-five years, the generally despised amphibia have made another effort which—when it becomes generally known—will make them more famous and more sought after than ever.

Readers may remember articles that have appeared on these pages on *Xenopus laevis*, the South African claw footed toad, and its usefulness in pregnancy diagnosis. Since the test depended on the readiness of the females to spawn, after injections of pregnancy urine, only females were caught and imported; apart from those males that slipped past the scrutinising sorters, no males were kept at the laboratory because we had little use for them. This aspect of the matter has changed, and if recent reports are confirmed, the male toad or frog will prove an even better indicator for pregnancy than the female.

The discovery was made by a South American, Dr. Galli-Mainini, and published in *Semana Medica*, in 1947. His test animal was *Bufo arenarum* (Hensel). Other species like *Bufo marinus*, *Rana pipiens*, *Rana esculanta* and *Bufo d'Orbigny* have proved equally useful, and the ordinary toad, *Bufo bufo*, has recently been investigated in Sweden with equal success. Normally the testicles of these animals are at rest and do not produce sperms. Sperm production only occurs in the spring, under the influence of the pituitary gland (which is connected with the brain) and under the influence of the presence of females. The pituitary gland then excretes a soluble substance (gonadotrophic hormone), which circulates in the blood and stimulates the testicles into temporary activity.

The urine of pregnant women contains a very similar substance; it is not produced by the pituitary but by the placenta. There it is poured out, all during pregnancy, in considerable quantity, and we have no idea why this is so, or whether this placental hormone is in any way useful or essential for the development of the pregnancy or not. But on the toad or the frog the placental hormone has the same effect as the pituitary brand of hormone: it makes the female lay eggs and the male produce sperms.

Xenopus toads—used in the earlier tests referred to in this article

The sperms are excreted into the cloaca, where they mix with the urine. All that remains to do is to inject a responsive male with a few cubic centimetres of the suspected urine and to wait one to three hours. If a drop of the toad's urine is then placed under the microscope and live spermatozoa are found swimming about in it, then the urine was from a pregnant woman. Galli-Mainini tested this reaction on 1,400 cases and found it reliable in 99.7 per cent. The male toad's urine can either be collected by placing the toad on a platform in a perfectly dry jar—the urine then collects at the bottom, and can be taken up with pipette—or by introducing a short blunt pipette into the cloaca and aspirating a drop of urine. A toad can be used several times for this test.

So far so good, but I am sure the snags will not be long to appear as well. First of all toads seem to be more reliable than frogs, and even they must be kept in the warmth of an indoor cage for some weeks before they respond properly. Secondly: what is going to happen in the spring? Can we be sure that these males will not produce sperms on their own, even if we keep the females entirely out of their sight? Thirdly, *Bufo bufo*, useful as it may be, is by no means a very common toad even here, and I have not heard that anybody has succeeded in breeding it in large numbers. If any reader has experience in breeding large numbers of toads—here is a field for the enterprising. The trouble is that full grown males are most wanted, that toads grow very slowly, and that all batrachians (with the exception of *Xenopus*) are very difficult to feed after the metamorphosis. However, collaboration may, as elsewhere, produce results in this field. In any case we shall have to readjust our memories: the frog in its little house on the window sill may, from now on, not necessarily be kept there to indicate the weather!

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EDWARD ELKAN, M.D. Early activities: worrying his poor mother by going out with the fishing net and coming home with hundreds of beautiful black "fish," promptly denounced by the family doctor as common leeches. Also renowned for carrying snails, caterpillars and anything else that would crawl, home in his satchel and for having May-bugs escaping from his pockets during lessons. Very interested, in later years, in all branches of biology and in breeding tropicals of many colours. A microscope, donated by a benevolent uncle, started him at the age of 17 on a more scientific career, and his life is now divided between looking after patients on the one hand and after a large population of *Xenopus* on the other.

The Story of NORTHERN AQUARIA

by ERIC HARDY, F.Z.S.

MANY of the old enthusiasts in fish-keeping in the North will remember the famous aquaria of years long gone by, which flourished in Lord Street, Southport, at Blackpool Tower, and one or two other pioneers of public exhibitions of living fishes. But I think the earliest exponents of the art of fish-keeping in these parts were amateur students of natural history, like Thomas Pennant, to whom Gilbert White, of Selborne, wrote letters. When Pennant was tutor at the old Warrington Academy in the 18th century, he kept some of the Mersey salmon under observation, and coarse fish from the river above Warrington. He even made the pioneer experiments in the marking of salmon, weighing a young salmon which he caught there on February 7th, to be seven pounds, and after marking it with scissors on the dorsal fin, recovering it again, he claimed, in the following March, that it weighed seventeen pounds and a half.

A more enterprising fish-pond keeper of that century was Lord Cholmondeley, who, in his estate on the Cheshire side of Warrington, kept a pet thirty-five pounds pike, which was specially fed on "cows' bellies, chickens' guts and other garbage."

The first attempt at a scientific aquarium was probably that of the 13th Earl of Derby, who formed a zoological collection at Knowsley Park in 1834, and appointed Mr. T. J. Moore, of the Zoological Society staff at London, as his assistant. He then sent collectors scouring darkest Africa and unknown South America for new specimens, until his collection often exceeded that of London. He was subsequently elected president of the Zoological Society of London. The first mud fishes (*Protopterus*), from the Gambia, in West Africa, which reached this country, were brought by Lord Derby's collector, Mr. Whitfield, in 1843. They were placed in the warm tanks in the plant houses, were successfully melted out of their balls of hardened mud, in which they had been transported, and lived there for some time. Some of these fishes were, in all probability, sent to Professor Owen, and formed the basis of his well-known memoir.

One of the pioneers of salt-water aquaria in the North was Mr. C. L. Jackson, who, more than seventy years ago was responsible for the old Southport Aquarium in Lord Street. He was a friend of the famous Frank Buckland, inspector of Queen Victoria's salmon fisheries, and a contributor to the original London Zoo Aquarium. The most noteworthy inhabitant of the old Southport Aquarium was a conger eel, a female fish, caught at Fleetwood when only two or three pounds weight, and kept in the aquarium 5½ years, when it had attained a weight of ninety pounds, was 6 feet 5 inches in length, and 2 feet 6 inches in girth. The congers were a special attraction in this aquarium; another they kept grew to 27 pounds after two years' captivity, being distended with ova. Others in the aquarium weighed 90 pounds and 69 pounds, all with ova. Incidentally the record rod-caught British conger weighed 84 pounds (taken at Dungeness in 1933), and the record trawled specimen, 160 pounds. After this famous marine aquarium became defunct, the Wayfarers had a small tropical and fresh-water aquarium in the Arcade in Lord Street, between the wars.

In 1901, the present marine aquarium and biological station at Port Erin, Isle of Man, was built, under the initiative of the late Professor William Herdman of Liverpool. It was sited in the middle of that rich area of the Irish Sea where about 2,400 species of marine animals and 100 species of marine plants occur. Herbert C. Chadwick was the first curator of the Port Erin aquarium, which has been the scene of many interesting aquaria films, like that on the lobster. The old laboratory at Port Erin was opened on the shore below the Bellevue Hotel, in 1892, and the old aquarium was added alongside the lab. in March, 1893, to enable "the public to see something of the wonderful variety and interest of life in the ocean and on the seashore." The new aquarium, combining the fish hatchery and the biological station, was opened in the summer of 1902.

Photo: Eric Hardy

Port Erin Marine Biological Station, where large numbers of biology students from Liverpool and other Universities are working at the present time

In 1926 a Merseyside Aquarium Society was formed at Wallasey with the purpose of originating a public aquarium there, and in 1932 I was a guest when their aquarium of small tanks was opened by the mayor to the public in the old conservatories at Cliff House. It was of necessity an amateur affair, and when the local corporation declined to take over the responsibility for this aquarium, the society disbanded. Since then a privately-owned public aquarium, mainly of tropical fish, has been maintained at New Brighton, and in the post-war years, there have been formed in Liverpool a flourishing Merseyside Aquatic Society, and a Liverpool and District Aquarium Society. When a Liverpool animal dealer opened the Liverpool Zoological Park in the suburbs in 1932, he established a small and rather amateur tropical aquarium; but this, with the zoo, came to a sudden demise just before the war, for reasons I cannot disclose here. The best public aquarium ever seen on Merseyside was that established by Liverpool Corporation, in the basement of the public museums in William Brown Street, a victim of the blitz that has not been re-established. Warrington Museum also maintained a excellent pre-war public aquarium, famous for the tameness of the large eel that fed from the attendant's hand. This has not yet been resumed.

The most notable occupant of the old Liverpool Museum Aquarium was "Paddy," labelled a common seal, caught in the Mersey at New Brighton in 1919, and who lived there to the blitz. But I strongly suspect he was a grey seal. Some of the specimens in this museum were frequently

misnamed. The aquarium contained twenty-five fresh-water and salt-water (cold) tanks, and exhibited mostly British fresh-water fish, a few flounders and crabs, and an occasional short-lived lobster or two. Later it went in for the large foreign spiders, obtained in fruit imports. The aquarium might have seen more, from some of the costly expeditions the museum at one time sent abroad, but scientifically these expeditions were sometimes abortive. In 1915, a member of the staff was sent on a collecting "expedition" to Malaya, and just before the blitz, all the plants he brought back were still packed in the cellars, unclassified and unnamed, and there they "died," through nearly thirty years of neglected opportunity to sort them out! The corporation museum grant was about £12,000 a year. Perhaps the new museum to be rebuilt in future years will again give the help and encouragement to local natural history, and to ratepayers, that obtained in the original days when T. J. Moore, the 13th Earl of Derby's curator of Knowsley Zoo, was made its first curator at about 35/- a week. He did more for local natural history than all the subsequent high salaried staffs put together!

The North has still other aquaria, of course. My last visit to Belle Vue Zoo made a miserably wet Manchester day very enjoyable, with the collection of tropical fishes there. Another fresh-water aquarium is that of the small zoo at Upton-by-Chester. When Herdman maintained his sea fishery laboratories at Puffin Island (North Wales), and Piel Castle (Walney Island, near Barrow), last century, there were small private marine aquaria there, but neither of these marine stations exists to-day. The Freshwater Biological Association's collection at Wray Castle, Windermere, opened a new era in fresh-water study, and the salmon observation tanks on the Alwen, a Dee tributary near Druid Post Office, above the junction pool, has, in recent years, afforded zoologists unique opportunities to observe—and film—the spawning habits of salmon and other fresh-water fish. The latter is really a salmon observation tank, established by the zoology department of Liverpool University, in conjunction with the Dee Fishery Board, by the bridge at Pont Barcar. The live salmon caught in the trap at the bridge are first put in the keeping tank, with a controlled inflow. Next is a hatchery tank, and below this, right at the water's edge, the observation tank—a shallow, gravel-lined tank built in the bank of the stream with sluices to control the flow of water through it. A window of armour-plated glass separates the tank from the observation hut in which the studies are made—usually under a bleak and blasty vigil during the winter spawning season!

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ERIC HARDY, a long-standing contributor to *The Aquarist*, has been a Fellow of the Zoological Society since 1934, and in 1938 founded the Merseyside Naturalists' Association, of which he is now honorary secretary. During the war he served as a captain in the Army Pigeon Service, Royal Signals; he formed the Jerusalem Naturalists' Club, and for two years was its secretary and editor of its bi-monthly bulletins. He led several expeditions of the Middle East Biological Scheme, collecting specimens for various museums and universities. As a lecturer to natural history and aquarists' societies he has given many talks on British fishes, water birds, and the fishes and reptiles of the Jordan Valley and the Red Sea; since 1935 he has been a tutor for natural history courses organised by the W.E.A. in several Lancashire and Cheshire towns. He maintains a wide interest in natural history and for over 20 years has been writing for various nature and outdoor publications; is the honorary editor of *Nature Lover*, and the weekly angling correspondent for the *Liverpool Evening Express*.

Friends and Foes—1

Photo: Darien Leigh

Hydra—the individual on the right bears a small bud. Magnified × 5

FREQUENTLY introduced into ponds and aquaria together with plants gathered from the wild, *Hydra*, the fresh-water polyp, can be a thorough nuisance in breeding tanks. The most usual form of it is grey or light brown in colour and may be discovered attached to the leaves of plants or on the glass of the aquarium. Its long tentacles secure its food—any small animals moving in the water, including freshly hatched fish fry. *Hydra*, where present in large numbers, also constitutes a serious source of loss of any live foods, such as *Daphnia*, that are added.

It is not always seen in the extended form shown in the photograph, as when disturbed, or shortly after a meal, it contracts to a small blob that is difficult to distinguish.

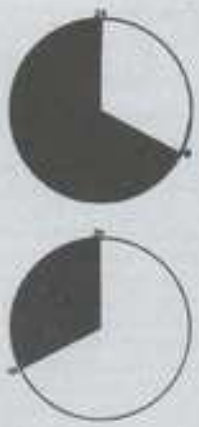
Hydra reproduces very rapidly in favourable conditions chiefly by means of small buds which form on the parent and then become detached. Any piece of the animal that may be cut off is likely to develop into a new individual, so this is not a recommended means of disposing of it. A rise in temperature to about 100° F. for a short time, or a rise to 80° F. for longer periods will kill it off, as will treatment of the tank and plants with salt solution. Gouramies will also clear up *Hydra* if no other food is available.

Every effort should be made to exclude it from tanks containing young fish, although on its own it forms an interesting subject for study.

AQUARIUM SCIENCE:

Light *and* Fish-Breeding

The duration and methods of lighting have been the subjects of experiments with sticklebacks



FISH breeders have long recognised that light plays an important part in the conditioning and preparation of their fish for breeding. Experiments[1] have been carried out to determine the importance of lighting in relation to other factors such as temperature, and to find out the best duration and manner of applying the light to the fish.

To avoid the effects of other aspects of the problem and to simplify the techniques employed, a fish with a simple sexual and reproductive cycle has been used in these experiments. Unlike many of the tropicals, the three-spined stickleback, a native cold water fish, has only one cycle each year; early development of the reproductive bodies, the sperms of the males and eggs of the females, occurs in the autumn, and after the winter dormant period secondary changes in preparation for breeding take place. The males appear in their bright nuptial colours and commence secreting a sticky substance from their kidneys; this serves as a cement for the nest which this species builds in the spring. At this time the ovaries of the females enlarge, so that the outline of the fish becomes plumper from the internal pressure of enlarging and mature eggs within her body.

Experiments

Sticklebacks caught during the winter months were placed in aquaria surrounded with cardboard shields (to eliminate the natural light), illuminated from above by electric lamps. Wattage, and the height of these above the water surface, was the same in all tanks. An incidental point that emerged during the tests was that the shade of the background to the tanks, i.e., whether the surrounding cardboard was black or white, did not influence the rate of maturation of the sticklebacks. A previous worker has reported that maturity of swordtails is hastened when they are kept against a black background.

Each series of tanks was exposed to lighting of varying duration and varying periodicity as follows:

The first series was provided with lighting for eight hours on the first day, and this period was increased by 10 minutes each day over the total time of the experiments, which was 48 days. Thus on the last day the fish were getting 16 hours of light.

A second series of tanks received just eight hours each day over the same total period.

In the third series lighting was provided for 20 minutes each *hour*, and this amount was increased progressively until at the 48th day it was 40 minutes each hour, so that in total the fish had received the same amount of light as those in the first series but in interrupted amounts.

The fourth series was illuminated throughout the whole of the 48 days without any periods of darkness at all.

Periodic lighting was arranged by the use of an electrical contact clock wired in the lamp circuit. Throughout the experiment the appearance, behaviour and condition of the fish were watched, and at the end of the time the sex organs of the animals were examined microscopically so that the state of development of the eggs and sperms could be checked. The temperature of the water was kept at the winter level of 40° F. all the time.

Observations

It was found that the appetite and degree of pigmentation of the fish corresponded to the amount of light they received, and in the series which were permanently illuminated (series four), the fish soon came into breeding condition. The males appeared in their bright colours and began to build nests, while the females were very distended with mature eggs. In addition the males showed their characteristically aggressive behaviour of the breeding season, and many fatalities occurred in this series of tanks from the fights which took place!

The fish in the second series of tanks, which had received a fixed daily amount of light, showed no changes in the ovaries of the females, but strangely enough, examination of the males revealed that changes were occurring in their testes which normally only occur in the autumn. When the low temperature at which the fish were kept is considered, this fact appears rather remarkable.

In the other series of tanks, the gradually increased amounts of light (first series) and the gradually increased periodical lighting in the third series, were without effect on the appearance, behaviour or sexual development of the males, but maturation of the eggs in the females occurred quite rapidly; the effect was most pronounced in the latter series in which interrupted lighting had been given.

Unsolved Problems

These experiments have shown the important part that light plays in the pre-breeding period, and that at least in the case of the stickleback, as a factor, light is more important than an increase of temperature, although under natural conditions, of course, this and other stimuli play their parts together. Several interesting facts were disclosed by the results, and as far as the aquarist is concerned, the point that where a fixed amount of light is to be given over any period it is more efficient to give this in short, gradually increasing periods, rather than "all in one lump," as it were, demands further investigation in other popular aquarium species.

Whether it is advisable to illuminate the aquarium throughout the whole day over long periods is not so certain, and in view of the work of Breder and Harris[2] on the effects of light on the orientation and stability of young fish, prolonged exposure to an intermittent light source may also be harmful. The list of the unknown in aquarium keeping is very long, and each new fact that emerges seems to tail in its wake a string of fresh problems. Only time and an experimental approach by fish-keepers can reduce the "unsolved problems" pile.

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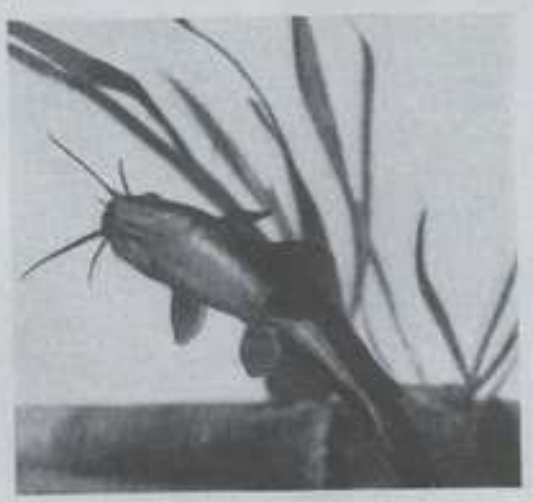
Catfishes

By
IAN HARMAN

★ *A family of fish of bizarre appearance but intriguing habits*

CATFISHES are an ugly group of creatures, but what they lack in physical beauty they make up for in interesting habits. Most aquarists class them as "scavengers," something to put in a tank to clear up food left by other fishes. But those with a more scientific, rather than æsthetic outlook will find plenty of scope for investigation in the ways of catfishes.

The family is a large one, and some kind or another of catfish is to be found in almost every part of the world. Many of them are of small size, and are well known tropicals. But in this short article we will confine ourselves to the more typical kinds. Some species are found in the sea, though mostly they are freshwater fishes. The typical members of the catfish family are distinguished—if you could call such a feature a distinction—by their whiskers or "feelers" which are attached to their lips, the number varying from one to four pairs.



Common North American Catfish
(Ameiurus nebulosus)

One of the best known representatives of the family is the common catfish (*Ameiurus nebulosus*), of North America. Before the war this fish was to be purchased from dealers for a shilling or so.

It is, quite frankly, a somewhat repulsive creature in appearance, with a smooth scaleless skin like that of an eel or a tench. In colour it is blackish above, and brownish green on the sides, paler below, and sometimes the body seems to have a pinkish tinge in certain lights. The catfish has a broad blunt head with a wicked-looking mouth, that seems to stretch from "ear to ear," as they say. The broad mouth is useful to the fish, however, as it acts as a scoop, enabling its owner to take up mouthfuls of bottom matter and extract anything edible. The whiskers are really greatly elongated barbels, and no doubt they act as organs of touch, helping the fish to find its way about at night, when it is most active. In the present species the whiskers number eight—two on the top lip, four on the bottom, and one at each corner of the mouth. When at rest the whiskers are carried limp, but on being roused, they become erect. The eyes are small and sinister-looking, particularly when the fish indulges in its habit of rolling them in menacing fashion. The body is thickest at the head, and tapers gradually to a rather long, rounded tail. The dorsal fin is short and spiky, and below this is another fin (the adipose), which is usually folded close to the body. The pectoral fins are carried parallel to the body, and the ventrals are small and situated about the middle of the body. The anal fin is rather long and is carried extended.

Though classed as a scavenger, the catfish is not essentially a bottom fish, though it does spend much of its time grubbing about near the bottom of the tank. By nature it is a big eater, eternally hungry, ready to bolt down anything in the way of live food that it sees. Though it prefers worms and suchlike, it will eat and thrive on practically any kind of food. The catfish is said to be able to eat its own weight in food at a single sitting. Under such conditions the stomach becomes almost a sphere in shape. But after a day it subsides, and the catfish is ready to stuff itself up once more.

As far as I know this fish has not been bred in captivity, probably because it was so easily obtainable pre-war that nobody bothered seriously about breeding the species. The breeding habits are extremely interesting, being somewhat akin to those of our common stickleback. The eggs are deposited in nests of mud, and these are constructed by both parents. When the fry hatch out, the male catfish takes on the duties of nursemaid to the family, and has been described as leading them in schools, and fussing over them like a hen with her chicks. The sexes are apparently very much alike in external form.

There is only one representative of the catfish family in Europe, and that is the wels of Central Europe (but not Great Britain). This is a monster fish, which grows to ten or twelve feet in length, and attains a weight in the region of 400 lb. Though its normal range is rivers east of the Rhine, the wels lives happily enough in this country. A fine specimen exhibited in the London Zoo Aquarium, about ten years ago, four feet long, was taken from the Duke of Bedford's lake at Woburn, the species having been introduced there some sixty years previously.

Another odd and interesting member of the family is the electric catfish (*Malapterus electricus*), of the Nile. This is quite a small fish, seldom reaching more than a foot in length, but it is a truly formidable one for its companions. It has a most unpleasant way of obtaining its food. Ignoring what can be found for the searching, it sidles up to other fish and touches them, imparting an electric shock to the victim, which causes it to disgorge the contents of its stomach. This the catfish then proceeds to make a meal of. The electrical apparatus is derived from the integument (according to Boulenger), "and is controlled by a single nerve on each side of the fish, proceeding from a huge cell at the anterior extremity of the spinal cord."

The electric catfish is said to be in the habit of sheltering its young in its mouth, and has, apparently, not been bred in aquaria.

OIL HEATING

AQUARISTS who use oil burners to heat their tropical tanks or fish-houses will find that fumes from the rather impure paraffin supplied these days may be reduced by adopting the following procedure.

When the lamp is due for refilling, do not use the oil straight from the can but first filter it through a folded piece of gauze or muslin.

Do not use a material which will add fibres to the filtrate, and choose one fine enough to hold back the smallest particles from the oil.

if maintained by artificial means, leads to infectious parasitic diseases, and is very undesirable.

(v) Aeration

Devotees of the aerator have accused me of being an enemy of the implement. That is not so. Although I do not use artificial aeration myself because I stick to my principles of giving fishes plenty of living space and a good margin of safety, I fully realise the necessity of artificial aeration in some instances, and its advantage as an emergency measure. Whilst not therefore advising anyone against its use, I think such usage should be qualified by an understanding of its disadvantages, which are as follows :—

(a) Stock which is kept in highly aerated waters consistently built up to the maximum dissolved oxygen content, is very susceptible to oxygen depletions and will not readily adapt itself to waters of lower oxygen content as in the average aquarium. Consistent aeration therefore limits interchangeability of stock.

(b) In tropical tanks one of the most frequent sources of chills and congestions during the winter months is the use of artificial aeration in which the indrawn air is at room or outside ambient temperature, anything up to 40° F. lower than the tank temperature. The remedy is simply that of arranging the air intake so that it is as warm or warmer than that of the tank.

(c) The aerator is not a substitute for a larger tank. A given body of water contains a maximum of dissolved oxygen, beyond which it cannot support more than a given number of fishes. Artificial aeration may keep that body of water oxygenated to its maximum, but it cannot provide more than that, and consequently cannot permit of the keeping of more fishes.

(vi) Heating

The heating of tropical aquaria of more than twelve gallons capacity can lead to chills and congestions in exactly the same way as the injudicious use of aeration. In order to maintain a fairly large quantity of water at a safe minimum temperature it is a common practice to use a single immersion heater of fairly high wattage and to control it thermostatically. If the thermometer by which the thermostat control is set is at the extreme end of the tank, away from the heater, then the water immediately around the heater, and in an uprising stream, is bound to be exceptionally warm. If the thermometer is adjacent to the heater then the water at the extreme end of the tank is likely to be dangerously cold. In each case the temperature difference is quite marked and unnaturally so, as it is in vertical zones, through which the fish can swim from one side of the tank to the other, instead of being in natural horizontal zones from the bottom of the tank upwards. Why it is that fishes can swim from a warm top layer of water to a much cooler bottom layer of water without chilling, whereas they can't swim safely through similar zonal differences from one side of a tank to another, I do not pretend to understand, but that is the fact. Here the answer is to spread the heating by the use of a number of heaters and of lower wattage in the larger aquaria, and to arrange the heater centrally in the smaller tanks, so that the rising heat spreads out evenly on either side.

(vii) Indiscriminate use of Correctives

If water was a consistent chemical substance of known characteristics not varying in every part of the country, it would be possible to determine its reactions and behaviour under all conditions, and to produce mineral combinations and pH correctives to meet these conditions. This does not happen to be the case, for the aqueous solution we call water, and in which our fishes live, is as varied in its combinations as the grains of sand on the shore. I have already mentioned three broad directions in which water may vary, and that in regard to its total dissolved solids. Water may contain very little in solution, when it is described as a " thin " water ; it may contain a moderate quantity of solids contributing to its hardness characteristic and be called a medium water, or it may contain an excess of solids and be recognised as a " thick " water. The variation within this range lies between 50 and 5,000 parts per million of solid content, and does not take into account the different combinations of chemicals making up the solid content. The acidity or alkalinity as indicated by pH colotimetric methods of determination shows only the hydrogen ion concentration, and is no indication of the t.d.s. characteristics previously mentioned. I have mentioned these points to try and point out the absurdity of hoping to obtain a combination of rectifying salts of any nature whatever, which can be used safely in all aquariums for corrective purposes. The use of such salts increases the total dissolved solid content of the water, and whilst they may be beneficial in " thin " waters, harmless in medium waters, they can be definitely detrimental in " heavy " waters, wherein the t.d.s. is already too high for good fish-keeping. The obvious moral is to know something about the water supply before embarking upon the use of any form of corrective treatment calling for the addition of rectifying salts. In waters like the Birmingham and Manchester districts, the use of such rectifying salts can be quite successful in encouraging plant development and in toning up fishes. Medium and heavy waters, however, increase their t.d.s. quite rapidly through evaporation losses, and if these are not taken into account, the addition of correctives can be harmful. Similarly the pH reaction in an aquarium can be very misleading, as it will vary according to the dissolved gases. In a heavily planted aquarium, the daytime pH will be highly alkaline, and is likely to be equally as highly acid during the night-time, the former through oxygen, the latter through carbon dioxide.

Correction for pH should be made on the natural chemical characteristics of the water, and should not be undertaken without due regard to the nature of those characteristics. The indiscriminate use of correctives, without regard to these factors, has helped to swell my postbag. I believe that when we know more about it we might conceivably keep fish in a perfect water, made and maintained synthetically, but at this stage we must tread very warily.

(viii) Aquarium Cements and Furnishings

Cases of death due to toxicity do not occur very frequently but when they do, high mortality results. The source of such troubles lies in glass bedding media, chemical rockwork, and some kinds of plastics, oxides of metals and, in fact, any toxic substance of which water can be the solvent. When toxic chemicals are dropped into the tank accidentally the results are obvious and usually almost immediate. When the trouble is due to the solvent action of the water upon the body concerned it is apt to be insidious in its effect and accumulative in its action. A few fishes die first, the numbers increasing rapidly as the degree of toxicity gets worse.

The golden rule to apply in regard to all forms of glass bedding media is to regard them as potentially toxic, and after use to allow the tank to be filled and emptied of its water two or three times to get rid of all the easy solubles. Some forms of bedding putty call for the use of a polymerising fluid to set and chemically combine their ingredients, the which might quite easily be toxic until the chemical action is completed. Working instructions are supplied

with all such materials and they should be followed faithfully. If one tries to take a short cut by omitting one of the instructions, or by adding some additional ingredient beyond that recommended, then trouble is likely to result, and it is no use blaming the supplier.

Natural rockwork is usually harmless, but in the case of soft spas, these dissolve too quickly and increase the t.d.s. to dangerous proportions, and hence should be avoided. Slags from road heaps or chemical tips, however highly coloured and attractive, can be extremely toxic.

So far I have no personal experience of trouble with plastics, but I would refer my readers to reports which have appeared concerning these. The marketed plastic aquarium appliances are quite harmless, but trouble might be experienced with highly coloured objects not intended for use in the aquarium anyway.

(ix) Bottom Ballasts

Toxic conditions from bottom ballasts are almost unknown, and the present-day variety of well graded clean aquarium ballasts offered by the trade have almost completely eliminated such troubles.

The use of sand instead of such graded ballasts does, however, constitute a danger in another direction and lies in the close packing of such sand, if it is too fine. When this happens the plant life dies at the root crowns, air is excluded from the sand, which goes black, and excessive organic decay and bacterial activity produces toxic gases, and fish die from asphyxia.

The use of soil or loam is open to question. In general, it can be a breeding ground for bacteria unless extremely well covered with heavy ballast, or previously sterilised. Covered or sterilised it is doubtful whether it is very operative in encouraging plant growth, and consequently it is best excluded. Where plant growing only is concerned a clean loam mixed with peat can be used, covered lightly with ballast to keep it down, and to keep it from discolouring the water.

The greatest trouble occurs in garden ponds in which considerable quantities of loam or garden soil have been used for plant growing. This generally follows the autumnal accumulation of dead leaves and other vegetable detritus, and the bacterial forms included with the loam just romp home. Thin layers of top ballast in the pond rapidly become washed off the soil, certain kinds of which break down into very fine flocculent matter. Not only does this encourage bacterial and fungoid developments but, floating in the water, also encourages the development of free-swimming algæ. Their presence leads to " murky " water and their death adds to the organic decay.

This then, concludes my review of the broad principles of the physical characteristics in aquarium keeping which can lead to troubles and loss of fishes. In the main they are simple things, but because they are so simple and commonplace, so frequently get overlooked.

LONDON'S *Goldfish Exhibition*

AT the six-day exhibition held by the Goldfish Society of Great Britain, earlier this month in London, there was plenty to be seen that was of interest to the aquarist and to the casual visitor. It is the ultimate aim of this society to pedigree members' individual fish, and at the exhibition goldfish were judged according to their conformity to the F.B.A.S. standards; fishes obtaining 80 per cent. of the total points were awarded certificates.

A separate room was occupied by the tanks in the two classes for furnished aquaria; one class was open to entries from other aquarium societies, and the other was for members' entries. A novel feature of the exhibition was the manner in which light was provided for the tanks. Electric lamps were placed between the tanks and shielded by specially made adapters, so that economy of lighting and some very pleasing effects were secured. The whole exhibition gave plenty of evidence of enthusiasm backed by hard work that had made the show possible.

Top photograph shows the layout at the Exhibition of tanks for Classes A, B and C, the breeders' classes. Details of the standards required were clearly displayed on illustrated labels placed between the tanks

Some of the tanks in the Furnished Aquaria Class for other societies, are seen in the left photograph, and above is a close-up of the tank judged first in the members' Furnished Aquaria Section

OUR READERS *Write—*

Readers are invited to express their views and opinions on subjects of interest to aquarists. A selection from queries received will also be answered here. The Editor reserves the right to shorten letters when considered necessary and is not responsible for the opinions expressed by correspondents.

Trouble-free Thermostats

HERE is a tip which I hope you will consider worth passing on to fellow aquarists. I have experienced a fair amount of trouble with my non-submersible type of thermostat (in use with an all-over shade) due to condensation creeping through the top of the instrument and eventually causing a short across the points. To overcome this I have made a small sleeve to fit over the top of the thermostat as follows: obtain a two-inch length of bicycle tyre inner tube, thoroughly clean it and then seal one end with rubber solution. When dry cut a small hole about halfway along the tube. The supply and heater wires are passed through this hole from the inside; the tube is then slipped past the glass top of the thermostat, thus making it waterproof. I have had this device in use now for some months and I have had no further trouble caused through condensation.

A. E. Knight, Secretary,
Oxford Aquarium and Pool Society.

Cabinet Heating

I WISH to heat a small tropical aquarium by means of a cabinet containing electric bulbs underneath the tank and would be glad if you could tell me if it is necessary to protect the base of the tank when using electricity—the base is slate. Is it of any advantage to paint the lower half of the bulbs to deflect the heat upwards, and if so what is the best colour please?

J. G. Euston,
Leicester.

It is not necessary to protect the slate base from the heat of the lamps, since, unlike the direct flame of an oil-burner or a gas-jet, localised over-heating does not occur. Rather than painting the bulbs it will be better to paint the inside of the cabinet white to reflect the heat to the tank, and to paint the exterior of the cabinet a dark colour, preferably black, to diminish heat loss to the surrounding air. Dark colours absorb heat and lighter ones reflect it.

Egg Parasites

I AM rather perturbed at what would appear to be the infestation of my tanks with an apparently unknown species of parasite. I qualify this statement by adding that I have described or shown this parasite to everyone in the Bristol Aquarist Society of repute and with one accord they agree that they have never seen anything like it. The most curious part of the affair is that the parasite only attacks eggs.

To start at the beginning, I spawned a trio of mountain minnows (two males, one female) one morning two months ago; by six o'clock in the evening the infertile eggs were plainly visible—having assumed a whitish appearance. The remainder, some 80 to 100, were perfectly clear. The following day the eggs were still clear and I anticipated a handsome reward in the shape of young minnows. By six o'clock that evening, however, something had obviously gone wrong; the bottom portions of the eggs had become white, and in many cases there were just empty collapsed pieces of transparent skin left adhering to the glass and plants. I siphoned two or three of these infected eggs out and placed them under the microscope and the parasite was revealed. The eggs contained approximately thirty disc-like creatures, not quite round, very slow-moving, and appeared to be dark in colour. When the parasite was in a certain position I noticed that it appeared to be covered in what I can only describe as sequins; as it undulated about little points of brilliant light seemed to reflect from it.

This has occurred four times to date, and each time I have lost really good spawnings from different pairs of minnows, despite the boiling of the sand and strong salt and permanganate solution sterilisation of both tank and plants. During this period I have successfully spawned and reared young *Barbus nigrofasciatus* in another tank, and I had begun to think that the infestation had originated in the roe of the female minnows. Now, however, I know that it is common to at least three species of fish, for, upon inspecting some new batches of spawn to-day, I find barbs' eggs, zebra eggs and minnow eggs all infected in three separate tanks. This has had an extremely discouraging effect and I do not know what steps to take to combat the pest. I would be glad to receive any details of a remedy.

A. E. Burgoyne, Reporting Secretary,
Bristol Aquarist Society.

It is, of course, important to distinguish between Infusoria, which will always be found in the vicinity of eggs that have died, whatever the cause, and other organisms which may be present and are actually responsible for the death of the ova. In this case, however, Mr. Burgoyne's observations point clearly to the presence of a parasitic protozoan that is directly attacking the live eggs. At the moment we are not aware of the exact identity of this organism. Salt water treatment is usually a specific remedy for all types of protozoa, and it is rather disturbing to find that in this case no good has resulted from it. The sterilisation must be extremely rigorous and applied to sand, plants and to the fish (mild salt baths in the

use of the latter). It is difficult to see from whence this parasite arises and how it passes the periods in which eggs are not present for it to feed on, assuming that it uses these solely as food. Any reader having information on this subject is invited to write to us.

School Aquarium

FOR some years we have kept a coldwater aquarium and we are now anxious to set up a tropical tank with the heater and thermostat, which the children of this school have bought with their pennies. They are all very keen and we wondered if you know of any readers who could provide us with some young fish now that the breeding season is on us. We do feel that we can promote a healthy interest among the children, but as you know, our funds are almost nil and fish are expensive! Any help will be very much appreciated.

L. H. RACKSTRAW, Headmaster,
Beaconsfield C.E. Primary School,
Bucks.

Natural Lighting for Aquaria

Helios Photo-blue (Daylight) Lamp; manufactured by Helios Electric Lamp and Glassworks Ltd., Angel House, London, N.1.

In the past the lighting of aquaria has been somewhat stereotyped in pattern, the average aquarist contenting himself, through lack of any alternatives, with the conventional top-lighting given by household electric lamps. The main disadvantage of ordinary electric lamps is that they give too much yellow-red and not enough blue-violet light.

To appreciate the full range of colour in fishes it is desirable to have a light source with a correctly balanced colour content. The Helios Photo-blue (Daylight) lamp has been developed for this purpose, and the result has been achieved by coating the lamp with porcelain containing a corrective blue dye.

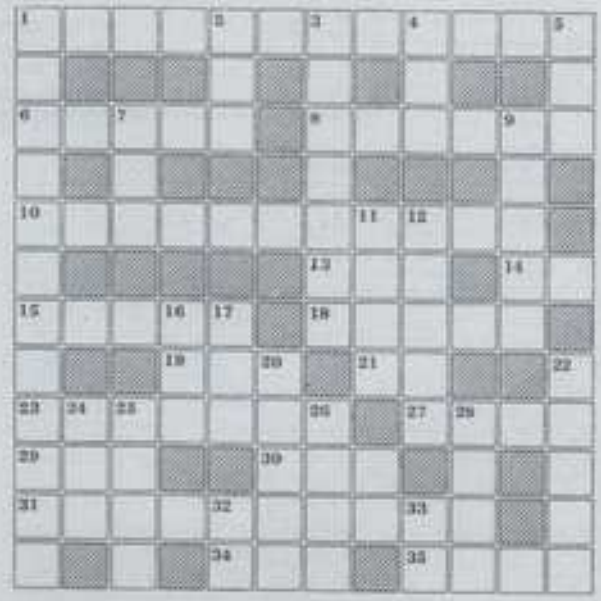
Trials I have carried out have shown that the use of these lamps gives a gratifying improvement in aquaria; the greenness of plants has been increased and the water has been given depth and clarity—the whole taking on a more natural appearance. It was noted that the lamps could withstand the severe conditions of humidity imposed by tropical tanks, both the tubular "strip light" and the normal bayonet cap household fitting type being satisfactory.

Helios (Daylight) lamps should make a welcome addition to any well-appointed aquarium.

F. E. CHILDS.

The AQUARIST Crossword

Compiled by J. LAUGHLAND



CLUES ACROSS

1 This cichlid shelters fry in its mouth (12)
6 Weapon for swordfish, ornament for *Xiphophorus* (5)
8 Green flagellated cells—genus of algæ (6)
10 Genus of bladderworts (11)
13 Sounds as if you know this world organisation—in sun or star (1, 1, 1)
14 Briefly regarding in the reeds (2)
15 Nattterjacks for instance (5)
18 Like a snake (5)
19 Roe made into a short turnover (3)
21 "Juice" in roach? Indirectly! (1, 1)
23 Tail at one end, cooler at the other (7)
27 A fish dinner in a shake! (4)
29 Fish that is almost ideal (5)
30 Just wet earth (3)
31 Genus of salamander (10)
34 Little Peggy marks site for a pond (3)
35 Does the Alpine newt miss them? (4)

CLUES DOWN

1 Smallest livebearer (8, 4)
2 What the fish did when they saw the net (3)
3 *Harti* completes the name (7)
4 Visitor from Sargasso Sea (3)
5 Style of the king fish? (7)
7 Water boatman's propeller (3)
9 Source of the eggs (5)
11 Indian coin (4)
12 British fish. Upset O char? (4)
16 Very noticeable on the three-spot gourami (5)
17 Home of most fishes (5)
20 Aimer: no, not archer fish; chinks or fissures (5)
22 For water gardens or wind instruments (5)
24 Girl in a damp spot (5)
25 Little Helen, too! (4)
26 These fishes breathe atmospheric air (4)
28 Twist ventral and caudal (4)
32 Time up for a politician (1, 1)
33 Artist (1, 1)

SOLUTION ON PAGE 52

FIVE-MINUTE TEASER

"These four Browns are very confusing," I said to the Club Secretary. "I understand that Fred Brown breeds guppies, Tom Brown mollies, Joe Brown swordtails, and Harry Brown angel fish."

"Then you understand wrong," he replied. "In fact, you've got them all wrong. And here are some more facts for you. Fred does not breed angels, and Joe does not breed mollies. Further, Fred does not breed mollies if Joe breeds angels; Joe does not breed guppies if Harry breeds mollies; and if Fred breeds mollies Harry does not breed swords. Now you can work out who breeds what." Can you?

G. F. H.

(Solution, and another "Teaser," next month).

Notes and News of AQUARISTS' SOCIETIES

★ Monthly reports from the secretaries of aquarists' societies for publication on this page should reach the Editor by the 10th day of the month. Only items of general interest to all readers, e.g., reports of shows, lectures, outings and announcements of coming events, should be sent.

CAPTAIN L. C. Betts gave a lecture on the "Care and Maintenance of the Goldfish" to members of the **Luton and District Aquarists' and Pondkeepers' Society** at their last meeting. He also judged a table show of fighting fish and shubunkins arranged by members of the Society.

KEEN interest and enthusiasm on the part of members of the **Suffolk Aquarists' and Pondkeepers' Association** has resulted in the production of the first number of the S.A.P.A. Review, journal of the Society, which they are hoping to produce each quarter. The secretary wishes to arrange an exchange with any other societies also producing their own journals.

BREEDING goldfish varieties was the subject of a lecture given by Mr. C. Parslow to the **Surrey Aquarists' Circle** at their April meeting. He outlined the methods of preparing tanks or ponds for breeding, conditioning the fish for spawning and explained in detail how the fry may be reared; the lecturer emphasised the demand of each fish for more space as its size increases. A keen discussion by members on the use of aeration in rearing fry followed, and the generics of varieties of goldfish also received attention.

MEMBERSHIP of the **Worcester and District Aquarium and Pondkeepers' Society** now stands at twenty, and this new society has made plans for several shows of a non-competitive nature to take place this year. At the May meeting the subject for discussion was the spawning of coldwater fishes.

Southport Aquarists' Pond-hunt

Photo "Southport Guardian"

FILMS on trout and pond life were shown to members of the **Southport Aquarist Society** at their March meeting. An interesting display of twenty-three varieties of tropical plants, and as many examples of live foods as could be collected, was a feature of special value to beginners at this meeting. During the afternoon ramble on Easter Sunday, members secured large catches of *Daphnia*, and some members setting up ponds were able to collect a number of water plants. A group of ramblers, by one of the several ponds examined during the trip, is shown in the photograph above.

AT the April meeting of the **Ilford and District Aquarists' and Pond keepers' Society** members were given tips by Mr. Gloyn of the F.B.A.S. on how to obtain picturesque results when setting up a tank. Thoughts of the home aquarium competition of this society, to be held in September, gave Mr. Gloyn's listeners particular reason to take note of his advice. Earlier this month members enjoyed an outing to Whipsnade Zoo.

RECENT talks heard by members of the **Watford Aquarists' Society** include one given by Mr. Radford on the guppy and one accompanied by lantern slides given by Mr. L. Katterns on the construction of a fish-house. A table show was held at the first meeting in April, at which members displayed swordtails, danios and goldfish, among other species; the number of entries for this event was particularly gratifying.

THE first home aquarium competition was held by the **Havering Park Aquarist and Pondkeepers' Society** last month; senior and junior awards were made. The Society is planning to exhibit at the Three Towns Show this year, and hope to repeat their last year's success.

LIVEBEARERS were the subjects of a table show held recently by the **Bridlington and District Aquarist Society**, and all members were given the chance of judging the fish. All entries were in very fine condition.

OVER 650 aquarists and friends of the **Nottingham and District Aquarists' Society** came to London in a specially chartered train for their day's outing to the London Zoo last month. Organised parties were conducted round the servicing passageways of the Zoo aquarium, and members of the Society expressed gratitude to the Zoo authorities for their co-operation in making their visitors' day a most interesting and enjoyable one. At the April meeting members were given a lecture on marine aquaria by Mr. Gerald Iles, of the Belle Vue Aquarium Society, and this month a lecture by Captain L. C. Betts on the cult of the goldfish is looked forward to.

HOME decorated aquaria was the subject of a very interesting lecture given by Mr. Russell Holland to a large audience of the **East London Aquarists' and Pondkeepers' Association** at the April meeting. The annual exhibition of this society will take place on June 10th and 11th next month at All Saints Church Old Hall, Romford Road, Forest Gate.

A COLDWATER fish show was held for members of the **Eastcote and District Aquarist Society** at their April meeting. Goldfish, shubunkins and carp were among the entries, and all members had a chance to judge the fish, three of them judging the "first prize," which was a pair of goldfish belonging to Mr. C. L. Stephens. This month a show of livebearers was arranged.

CHANGE of Secretary for the **Blair Aquatic Society** of Finchley, North London, is reported. The new secretary is Mr. R. Bushnell, 36, Glebe Road, Finchley, N.3.

THE **Uxbridge and District Aquarist Society** had a short talk delivered by the secretary at the April meeting. Mr. Forder spoke on the subject of the garden pond. He dealt with changes occurring in spring and described his own success in spawning shubunkins last month. A trip for members to the London Zoo this month is arranged, and it is hoped that the society will be able to have a guide to show them over the aquarium and behind the tanks.

MEMBERS of the **South London Aquarists** are planning to visit the London Zoo Aquarium on Sunday, June 12th. This will be their second visit. The May meeting is a lecture by Mr. G. T. C. Morris, on fish photography.

MANY members of the **Blair Aquatic Society** are becoming actively interested in the keeping of reptiles and with the idea of obtaining further knowledge on this subject the society is visiting Mr. Lester, the Curator of the Reptile House at the London Zoo, this month. The society is amassing quite a useful collection of books on aquatic and similar matters in its library, and these are loaned to the members at a nominal weekly charge.

TWO members of the Twenty Club gave lectures at the last April meeting of the **East London Aquarists' and Pondkeepers' Association**. Mrs. Meadows spoke on the blue gourami, and the dwarf gourami was the subject of the talk by Mr. Hart. At the first meeting for this month plans were completed for the society's forthcoming show on June 10th.

AT the April meeting of the **Bristol Aquarists' Society** members thoroughly enjoyed a talkie film show of "Secrets of Nature" series, and at the May meeting a return visit of Mr. T. J. Linn from the Department of Zoology, Bristol University, who gave a talk on "Live Foods and Enemies," was thoroughly enjoyed by a crowded meeting. All specimens were supplied by members. The June meeting will take the form of a coach outing to the village of Weare, some twenty miles from Bristol, where ponds and gardens will be visited. It is hoped the Mid-Somerset A.S. will be able to meet there also. The date of the Annual Open Show has been fixed for the 9th and 10th November next, at the Drill Hall, Old Market Street, Bristol. Applications for show schedules (ready shortly), to be made to the Show Secretary, R. V. Coombs, 9, Marsknoll Road, Bristol, 4.

BELLE Vue Aquarium Society members now number 125. They heard a lecture by Mr. W. H. Cotton of Birmingham on the health of fishes at their April meeting, which took place at the Belle Vue Zoological Gardens. At the same venue, early this month, a lecture on the anatomy and physiology of the fish was given by Mr. F. J. Brown, M.Sc., and during his talk the lecturer showed specimens which were of great interest to his listeners.

Northern Societies' Federation

THE Annual General Meeting of the **Federation of Northern Aquarium Societies** was held at Belle Vue Zoological Gardens, Manchester, on Saturday, the 30th April. The Chairman mentioned his satisfaction at the progress made during the year, and the fact that five additional societies had joined, making a total of sixteen, was considered excellent. Two other assemblies had been held during the year under review, both of which had been very well attended and had proved of great value. The Federation's first bulletin had brought many complimentary notices, and the scientific section were encouraged to continue the excellent work they had started. The Fifth (Autumn) Assembly has been arranged for Sunday, October 9th, 1949. Tickets, inclusive of all meals, gratuities, etc., would be 10/6 each, and the Secretary is now prepared to accept reservations.

New Societies

A NEW society in Kent has been formed in the Broadstairs area, and at a well-attended meeting last month the title of the society was decided as the **East Kent Aquarists' Society.** The Secretary is Mr. R. S. Gabriel, "Cylden," Vale Road, Broadstairs, Kent, and meetings are to be held on the last Thursday in every month at the Beathcat, St. Peters, Broadstairs, at 8 p.m.

Forthcoming Events

AQUARISTS visiting Belgium in July should make a note of the first exhibition of the **Association of Antwerp Aquarium and Terrarium Clubs** (V.A.A.T.V.) to be held there from the 1st to the 12th of that month. The title of the exhibition is "The Aquarium in the Living Room," and all further information may be obtained from the secretary, Bredastreet, 70, Antwerp, Belgium.

EAST LONDON SHOW

East London Aquarists' and Pondkeepers' Association will be holding its Annual Exhibition on the 10th and 11th of June at the Old Hall, All Saints Church, Romford Road, Forest Gate, near Manor Park Broadway, London. The hall is opposite Woodgrange Park Station.

Crossword Solution

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

NATIONAL AQUARIUM EXHIBITION

Exhibition of fish and aquaria, with traders' stands, to be held at the Royal Horticultural Hall, Vincent Square, S.W.1., on the 16th, 17th and 18th June.

SCARISBRICK ANNUAL SHOW

A marquee, displaying tropical and coldwater fishes, will form a part of the Scarisbrick Agricultural Society's Annual Show, to be held in Scarisbrick on June 18th. This is believed to be the first time such a public display of fish has been arranged in that area.

News from the

PUBLIC AQUARIUMS

Bristol Zoo Aquarium

The gardens are open to visitors every day of the week. Weekdays at 9 a.m., Sundays at 11 a.m. Closing time during the summer months is about 7.30 p.m.

During the past few weeks all the tropical tanks have been completely rearranged, and the fish can now be seen in much better settings. Very choice plants have been used and for their benefit the lighting system has been greatly improved. The collection of fish now include tiger barbs, albino swordtails, neon tetras, striplight tetras, knife fish, angel fish, rednoses, rosy barbs, glass fish, brilliant tetras, flame fish, blue gouramies, banded pencil fish, rainbow fish, beacon fish, leopard loach, pencil fish, rosy tetras, black mollies, glowlight fish and harlequins.

In the cold water section the goldfish are now displayed in a tank which has been lined with a black shiny material. The combination of rich red fish, beautiful green lilies and a black setting, makes a most delightful picture which should undoubtedly be seen by all visitors to our gardens. Amongst other cold water specimens to be seen are pike and very fine trout which survived the hot periods last year, when, for the first time, we used a refrigerating plant to keep the temperature of their water down to 50° F.

Recent additions to the Zoo collection are 200 wall lizards and 100 green lizards.

Chessington Zoo Aquarium

The aquarium is open every day of the week from 10.30 a.m. to 7 p.m. Latest additions to the tropical section are some fine specimens of pencil fish, *Poecilobrycon auratus* and *Hyphessobrycon rosaceus*; the reptile section has been supplemented with green and wall lizards, and an excellent specimen of the adder is on show.

Edinburgh Zoo Aquarium

Open every day from 11 a.m. to 7 p.m. Spring breeding has got well under way and successful spawnings of angels, white cloud mountain minnows, flame fish, black widows and bloodfins have occurred. Some of these species have this year spawned rather earlier than usual.

Coldwater species are also weeks ahead of their normal spawning times, probably due to the open winter experienced in the north. Goldfish, golden rudd and roach have all spawned. All exhibition fish are looking in fine condition at the present time. Pride of place in the tropical section must go to the angels and the glowlight tetras—always popular exhibits.

Paignton Zoo Aquarium

Admission to the aquarium is included in the price of admission to Paignton Zoo (adults 1/6, children 1/-). The Zoo is open from 10 a.m. until sunset. The aquarium consists of, on one side, 65 tropical fish tanks, displaying many varieties (which are constantly being added to), and on the other side crocodiles and other reptiles and amphibia are to be seen. Of particular beauty at the present time is a pair of Agama lizards which are in full colour. The many rare and beautiful tropical plants, in bloom most of the year, will prove an added interest.

The aquarist will be astonished to see the pond in the Tropical House, where a variety of fishes, ranging from 14-inch hi-goi to the ubiquitous guppy, live in harmony. It is a fact that despite many hours spent watching these hi-goi, not one has ever been seen to eat a smaller fish. In this pond are water lilies and water hyacinth to gladden the eye of the pond keeper. The Aquarium and Reptile sections are under the supervision of Mr. H. Sinclair, F.Z.S., who will be pleased to meet any readers of *The Aquarist*.

The above picture illustrates how easily the Sedivac is used. It is very simple and presents no difficulty to any aquarist. Full particulars are given in U-Needa Products' full page advertisement.

PREPAID ADVERTISEMENTS

4d. per word (12 words minimum). Box No. 6d. extra.

FOR SALE

FISHING Tackle for the Junior Angler supplied on Wholesale Terms to Aquatic Stores, etc. Our latest lists are ready and trial orders and free expert advice regarding stocking are available. Why not let us hear from you. Our keenest prices and finest quality tackle are assured. "Superfine" Fishing Tackle, 9, Crouch Hill, London, N.4.

AQUARIUMS, fish, plants, heaters, thermostats, aerators, stands, live foods, birds, pets, seed, cages. Cambridge Aviaries, Cambridge Road, Kingston, Surrey. (Callers only).

FOR SALE, 21 Aquariums, 3 ft. wide, 2 ft. deep, 18 ins. high. 16 with glass all round, iron bottoms. 5 frames only with iron bottoms, £45 the lot, or near offer. General Manager, Ramsgate Olympia, Ramsgate, Kent.

MICRO Worms. Make certain of an all-the-year-round supply of this amazing new live food. Culture and full instructions 2/6. Prompt despatch. D. Joel, "Malvern," Victoria Avenue, Laindon, Essex.

MILLER'S aquarium offer. What you have been waiting for: Bow fronted tanks, 24 × 12 × 12, £5 10 0; 24 × 15 × 12, £6 10 0. Order now. Carriage 7/6 extra. Also 1 in. × ¼ in. angle iron frames, 24 × 12 × 12, 18/-; 24 × 15 × 12, 20/-. Carr. 1/- extra. Dealers S.A.E. please. 54, Zermatt Road, Thornton Heath, Surrey.

"RELIABLE" thermostat, heater and thermometer, 30/-; the three. White worm culture, 1/3 in stamps. Aquarium Shop, 12B, Rushcroft Road, Lambeth, S.W.2.

INNES: Exotic Aquarium Fishes, 10th edition, just out, 48/6. The Standard Book for all Keepers of Tropical Fish. Bailey Bros. & Swinfen, Ltd., 26/27, Hatton Garden, London, E.C.1.

NEWCASTLE-ON-TYNE Aquarists, visit Whitfield's Pet Stores, 33, Clayton Street, for fish, plants, aquariums, frames, thermostats, heaters, aerators, etc.

BRINE shrimp eggs, guaranteed fresh and fertile, 2/9 packet. Double size, 5/- post free. Mapson, Exotic Fish Breeder, Apple Tree Cottage, Tipnoe, Headle, Hants.

REPLACEMENT bags for Sedijets, superior to originals, 1/11 post paid. 59, Bartlett Street, Darlington.

PLANTS, Vallisneria, Sagittaria Cabomba, Indian fern, Amazon Swords, etc. Floating water lettuce from 4/- doz., also tropical fish. S.A.E. to Mr. Spencer, 52, Turnberry Road, Great Barr, Birmingham, 22a.

BLUE Butterfly wholesale supplies. Please state quantity required and price offered. Box 2036, *The Aquarist*, The Butts, Half Acre, Brentford, Middlesex.

TROPICAL and coldwater plants, fish, snails, aquarium frames and accessories, water lilies and pond plants. S.A.E. for list, Swift, Tye Nurseries and Aquatic Plant Grower, South Hanningfield, Chelmsford.

FOR SALE—about 150 glass battery containers, 7/6 each or 5/- each by taking the lot. Apply Manager, 313, High Road, Mountnessing, Essex.

WANTED TO PURCHASE

WANTED to purchase—large numbers of tropical and cold-water fish, including White Clouds, Nigger, Tiger and Rosy Barbs, Glowlights, Catfish, etc. Breeders please quote wholesale prices. We will send cans for despatch by rail. Cash by return. The Elmdale Aquarium, Commeadow Lane, Worcester.

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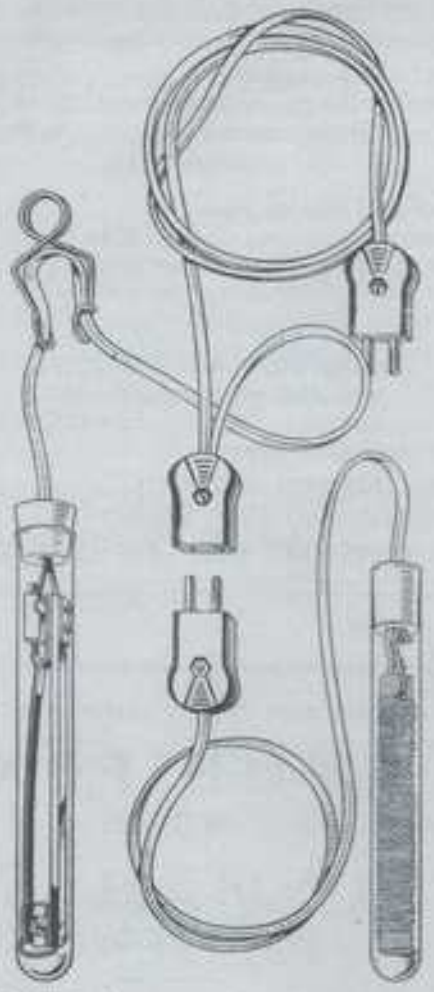

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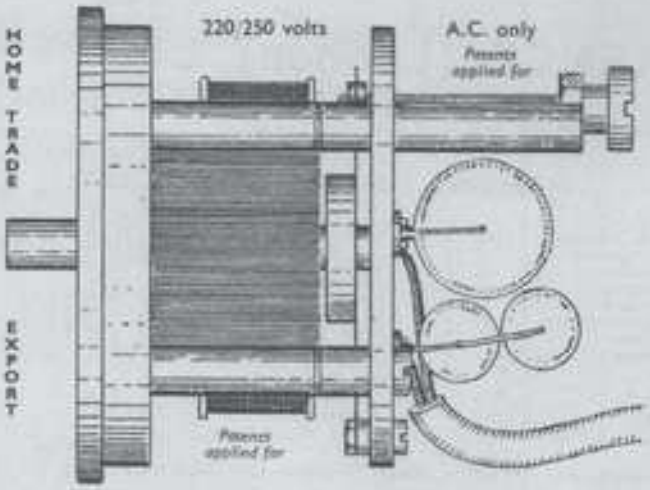

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