The AQUARIST
AND PONDKEEPER

Founded in 1924 as "The Amateur Aquarist"

THE BUTTS, HALF ACRE, BRENTFORD, MIDDLESEX

Telephone: EALing 4703

PUBLISHED MONTHLY

SUBSCRIPTION RATES

The Aquarist will be sent post free for one year to any address for £1 2s. 0d. Half-yearly 11s. 0d. Canada, U.S.A. $3.00 yearly; $1.75 half-yearly.

QUERIES

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

Correspondence with intending contributors is welcomed.

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

The Editor accepts no responsibility for views expressed by contributors.

Contents

	Page
Editorial	183
Fish-House Designs	184
Pyrrhulina rachoviana	189
Angel Fish Varieties	190
Exotic Water Plants and Aquarium Decor	192
The Importance of Swimming Space	196
Aquarist's Notebook	197
Cultivation of the Anubias	198
News from Aquarists' Societies	200

VOL. XXIII No. 9 1958

Editorial

AN interesting social phenomenon of the past few years is the development of spare-time activities usually referred to in the form of the explicit "do-it-yourself." The spate of books, magazines and equipment that has occurred, to encourage the numerous devotees of all the possible forms of do-it-yourself, is satisfying evidence that the gloomy prognostications of those who suggested that the advent of television would spell death to home hobbies and spare-time interests have not yet come true. Aquarium-keeping has, of course, always been a do-it-yourself activity for most of us, and quite often one involving the acquisition of all manner of ancillary skills.

It seems, however, that aquarists in Britain have not yet realised to the fullest extent the possibilities of do-it-yourself in this hobby. Aquarists who specialise in native coldwater fishes have plenty of opportunity to "collect-them-themselves," but for tropical fishkeepers this has not hitherto been given a thought. Now, in recent issues of *The Aquarium* (U.S.A.) have appeared invitations to readers to "be among the first to go on a safari for aquarists!" A collector of tropical fishes is organising "collecting trips" into British Guiana ("the only South American country in which English is the spoken language"), with excursions into "the interior" by amphibious plane; he will "assume complete responsibility for the entertainment of clients." This really is something, as our (North) American friends might say.

What a chance to dodge the worst of our winter! And imagine, on your return, your sun-tanned self leaning casually over your aquarium pointing out to your friends the *Moenkhausia browni* that you netted "up the Potaro River above the Kaieteur Fall." Think of the surprised look on your dealer's face when you walk in and offer him a spare can of rarities with a light "Sorry I haven't been in for a while. I collected these last week up the Demerara River—would you like 'em?" It all makes us green with envy as we draw our chair closer to the fire and look sorrowfully at those two newts we trapped (with difficulty) in the Hogsmill last summer.

FISH-HOUSE DESIGN

by Dr. F. N. GHADIALLY

(*Photographs by the author*)

ALMOST every aspect of fish-keeping has received greater attention from writers on aquatic topics than the subject of design and construction of fish houses. There are so many aspects to this problem, and personal tastes and experiences play so decisive a role in the design and lay-out, that it is well-nigh impossible even to begin to describe the ideal fish house.

The type of structure, its site, its size, the type of fuel employed for heating—the insulation, the type of staging and lay-out of tanks, the purpose for which they are to be employed (breeding, plant propagation, photography, show tanks, etc.) and above all the pocket of the person concerned, all influence the ultimate resolution of this problem. It would therefore be of limited interest and value to the reader if I were only to describe my present fish house. It would perhaps be better to discuss the problem on a much broader basis and to deal briefly with some of the problems that arise.

Though a fish house implies a structure standing on its own, separate from the main dwelling place, it would be advisable not to limit our discussion arbitrarily in this manner, for many aquarists use a spare room or the basement of their home to house a collection of fish tanks. For the purpose of this article I shall include all such collections of tanks, housed in either a room or an external structure, in the term "fish house".

Evolution to a Fish House

Like most aquarists I started off with a single tank in the living room. As the number of tanks increased it became obvious that if the peace and harmony of the home was to be maintained, these would have to be found special quarters. The process of breeding tropical fishes demands the emptying and cleaning of tanks and the shifting of considerable quantities of water, some of which sooner or later finds its way on to the furniture and the carpet. Only in a well-designed fish house can one pour gallons of water on to the floor with impunity. (The sense of freedom derived from this simple act can be a great satisfaction in itself!)

One of the long wall sections (10 ft.) made of red cedar wood is seen being packed with glass wool and covered on the inner side with hardboard before erection. The cavity nearest to the camera is seen without its glass wool

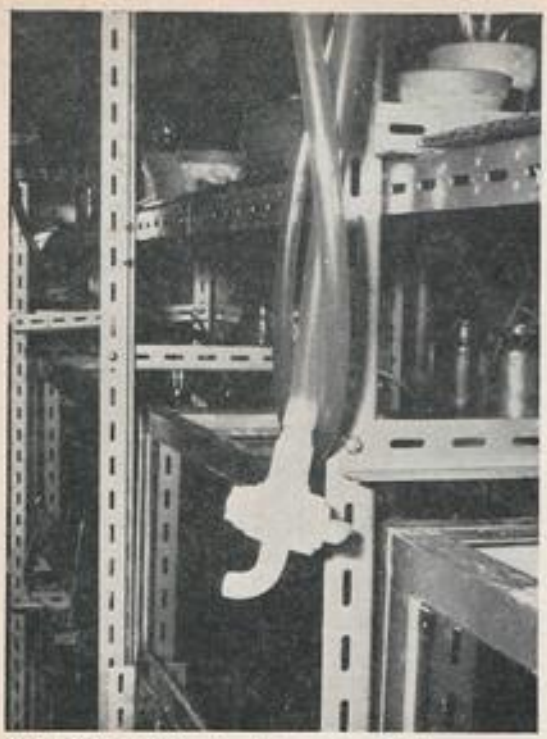
Photo : Alan Faulkner-Taylor

A wide-angle lens was used to obtain this general view of Dr. Ghadially's fish house, as seen from the entrance

At first facilities were not available to build a fish house and the best I could do was to move the fish tanks into a spare bedroom. I was soon to discover that this was a bad mistake. The house I lived in was an old one and the state of the floor boards and joists caused considerable concern. I lived in perpetual terror of the floor collapsing and the heavy tanks going through the ceiling into the room below. Cheerful aquarist friends lost no opportunity to exaggerate the dangers and add to the feeling of impending doom. It was also observed too late that the bedroom was cold and draughty, and hence the electricity bill showed a sharp increase.

Finally, one day a major accident occurred to a big tank holding about 40 gallons of water. A piece of rock-work slipped through my hand and smashed the bottom glass of the tank. The place was flooded and water percolated through the ceiling into the lounge below with disastrous results. It was therefore decided to move the collection of tanks into a basement room.

Here I had considerable success. The almost total absence of natural light did not prove detrimental to plant life or fishes. A large number and variety of fishes were bred successfully and first-class plants were raised by artificial light. However, heating expenses were rather high. The collection of tanks had now increased to about 30 and I also built a large gas-heated tropical-fish pool. When I moved from this house, I decided to house my



A view of the slotted-angle staging in the fish house is given here, and also shown is one of the several points at which tap water is supplied through polythene taps from PVC tubing

fishes away from the main building, in a pre-cast-concrete garage. The insulation was hopelessly inadequate and heating expenses were high. Many novel systems of heating, automatic feeding, water circulation, etc. were tried out and, with the experience gained, a new fish house (in current use) was designed. My present fish house is a well-insulated structure which I shall describe in detail below.

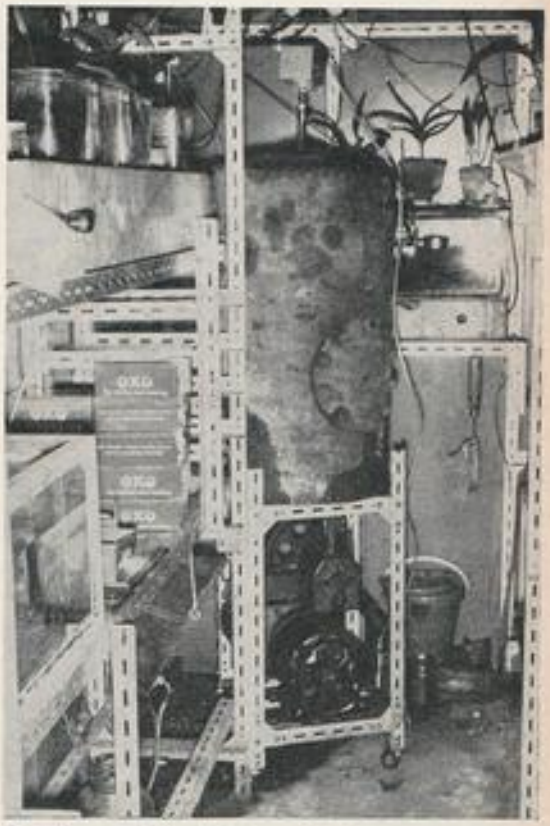
Type of Structure

Many aquarists create a fish house by adapting an already existing structure. The following are the ones commonly employed: (1) a greenhouse; (2) an old wash-house or other similar brick or stone structure; (3) an old air-raid shelter (either above or below ground); (4) a garden shed. A greenhouse is, in my opinion, a highly unsuitable location to house a large collection of fish tanks, as heat-insulation is almost non-existent; the loss of heat is tremendous, particularly in the winter months. On the other hand, the interior becomes very hot on sunny days and water temperature can rise to dangerous levels. Too much light turns the water green. In spite of this, modified greenhouses are used as fish houses by many aquarists. Double-glazing helps to retain the heat but even a double-glazed greenhouse is still much inferior to many other types built with wood or bricks and insulated properly.

Outbuildings, air-raid shelters, etc. can make excellent fish houses if lined by insulating material. They should never be used without such treatment. The expense of properly insulating a structure is soon paid off by the saving in fuel achieved by this means.

My present fish house is of sectional construction. It is made of Canadian red-cedar wood, which is rot-resistant and does not need painting or creosoting. It is lined inside with Masonite oil-bonded hardboard, with a cavity of 2 in. which is packed with glass wool. The roof is of similar construction except that it has eight double-glazed glass panels set into it. The fish house is 20 ft. long, 5 ft. wide and 6 ft. 6 in. high to the eaves (internal dimensions).

Some readers may feel that an all-glass roof would have been better. There are two objections to this. Natural light is difficult to control, and if methods for quick and easy control are not provided then algae will form and the water will turn green. The second objection is that glass is a very poor insulator of heat. An all-glass roof would lose so much heat that it is cheaper to use electric lamps to get the light than natural light. In fact, natural light is not the cheapest but the most expensive form of illumination (this statement is valid only for non-tropical climates). Let us calculate the heat losses and you will see what I mean.



Far-end corner of the fish house with the air-compressor unit mounted on a trolley. At its base is the ½ h.p. motor, above it the 30 gallons storage tank for air and at the top is the pressure-control switch

Heat Losses

The amount of heat lost will depend firstly upon the difference between the temperature of the air inside the fish house and that prevailing in the air outside. Ignoring the action of winds for simplicity, and assuming that the average outside temperature will be about 50°F. (winter and summer average) and that an inside temperature of 80°F. will be maintained, we can proceed to calculate the heat loss from the walls and from the roof.

First we must calculate the total area of all the walls.

	Area (sq. ft.)
Two walls each measuring 20 ft. by 6 ft. 6 in.	260
Two sides each measuring 5 ft. by 6 ft. 6 in.	65
Total area of walls	325

Heat loss through the walls can be calculated thus:

Total area × temperature difference × U

U is the heat transmission in British Thermal Units (B.Th.U.)/ sq. ft./hour/°F. temperature difference, of a composite object such as a fish-house wall made of wood, glass wool and hardboard. (This value can be calculated from heating and ventilating engineers' reference books.) With U equal to 0.1,

Heat loss = 325 sq. ft. × 30° × 0.1 = 975 B.Th.U./hr.

The total area of the roof of the structure in consideration is 150 sq. ft. Let us consider what its heat loss would be if it was made of glass (single-glazed).

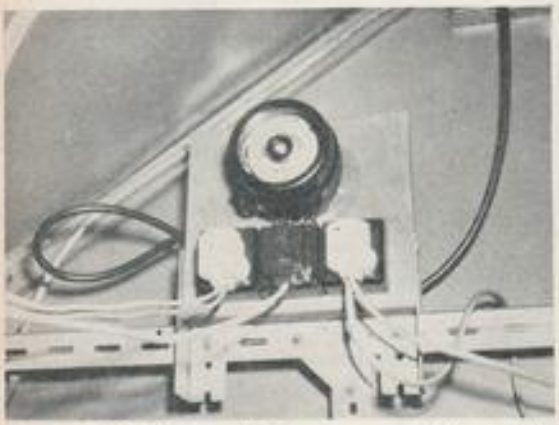
Heat loss from a single-glazed roof = Total area × temperature difference × k

k is the heat transmission in B.Th.U./sq. ft./hr./°F. temperature difference of a non-composite object such as glass.

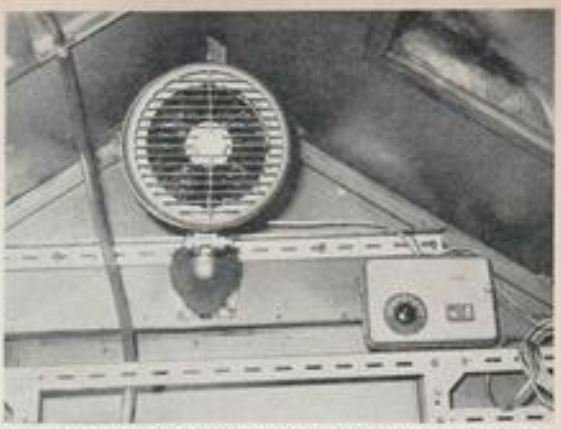
Heat loss = 150 sq. ft. × 30° × 7.3 = 32,850 B.Th.U./hr.

Compare this with the 975 B.Th.U. lost through the walls. In short, about 33 times as much heat would be lost through the roof as through all the walls put together. Further calculations show that it would cost about £300 a year in electricity bills to keep the place at the required temperature!

Now let us see what improvement can be achieved by a double-glazed roof.



Lamps used for lighting and heating are connected through this time switch



Space-heating is provided by the fan-blower heater beneath the fish-house roof and controlled by a thermostat housed in the rectangular box seen in the bottom right corner of the picture

Heat loss from double-glazed roof = 150 sq. ft. × 30° × 1.8 = 8,100 B.Th. U./hr.

This shows that about eight to nine times as much heat would be lost through the double-glazed roof as through all the walls put together. A great improvement on single-glazing but calculations show that the annual cost for electricity would be about £80. Even this, you will agree, is quite expensive, and further you will observe that approximately 18s. in every pound spent is due to the heat loss through the glass roof. The sole reason for having a glass roof is to let daylight in, so it would not be unfair to say that daylight is going to cost us about £72 a year. It was obvious therefore that considerable economy could be effected if the area of glass used was cut down to a minimum. Hence I decided to have just eight double-glazed glass panels set in the roof with a total area of 25 sq. ft., and the rest of the roof was made of wood, hardboard and glass wool just like the walls.

If you calculate the amount of heat lost as shown previously you will find that 25 sq. ft. of double-glazed roof windows will lose 1350 B.Th.U./hr., whereas the remaining 125 sq. ft. insulated with glass wool will lose only 375 B.Th.U./hr. We can now make a total like this:

	Heat loss (B.Th.U.)
Through double-glazed windows in roof..	1350
Through rest of roof	375
Through walls	975
Total	2,700

Cost of Heating

Cost per year can be calculated in the following manner. First calculate the kilowatts (kw) required. This is obtained by dividing the total B.Th.U. by 3415. Thus kw required will be $\frac{2700}{3415}$

Cost per year = kw × 24 hr. × 365 days × cost/kw.

Where I live the tariff for electricity is 0.825d./unit, so that the annual cost is $\frac{2700}{3415} \times 24 \times 365 \times 0.825$ or £22 16s. This, you will agree, is a very economical proposition for a fairly large fish house holding many thousands of fishes. However, it must be pointed out that the actual

Heating and lighting are provided by submerged electric lamps. This picture also shows the glass tube, spanning two adjacent tanks, used in the water-circulating system

electricity bill will be higher because we have ignored the fact that the structure is not a sealed box. There are bound to be some leaks, some changes of air, if due to no other reason than the fact that I have to open and shut the door many times a day to get in and out of the fish house. These are variable factors difficult to assess accurately and hence an accurate prediction of the cost is impossible. Nevertheless calculations of the type shown above are of fundamental importance in designing a well-insulated fish house.

We have so far here ignored the floor. I like a solid concrete floor. It should be at least 6 in. thick, as it has to take quite a load. It should be made slightly saucer-shaped and should be provided with one or two soak-away pits or drains to dispose of any water that falls on to the floor or is poured on the floor when cleaning out tanks. There should be a damp course on the place where the wooden hut rests on the concrete base, and the hut should overhang the concrete; this will help to keep the wood dry and hence it will be less likely to rot, although red cedar is rot-resistant and needs no protection from the weather. I have painted the wood with linseed oil. If this were not done, rain would soak into it. The water would then evaporate and cool the fish-house wall and thus lead to additional heat loss. It would be much better if the water just ran off the sides of the hut and did not soak in.

Methods of Heating

In a well-insulated fish house electricity is undoubtedly the best fuel to employ. Electricity is considered a costly fuel but in the amateur's small fish house so little is used if the place is well-insulated that it really does not matter. It is said that electricity is approximately 30 per cent. dearer than solid fuel. This is rather a theoretical ideal: with bad boiler management one can soon whittle down the apparent advantage. At any rate, solid-fuel boilers need regular attention and the heat is certainly more difficult to control.

Gas- and paraffin-fired boilers are of only theoretical interest (I have used the former). They stand in between solid fuel and electricity for cost of running. However, capital costs of installation are much higher and they, too, need watching and fooling about with if they are to function properly. Nothing can equal the ease, accuracy and cleanliness obtained by using electric power for heating. In a large commercial establishment it might be worth while to use solid fuel but in an amateur's small fish house the total amount saved is too small to bother about.

I would like to mention that one of the cheapest ways of heating fish tanks that I know of is by burning small gas jets under each tank. I have a friend who has used this system for a long time. I know another aquarist who burns little paraffin lamps under each tank. How they and their fishes stand the foul atmosphere that exists in their houses I have never been able to understand.

Having decided to heat by electricity I had two courses open: either I could heat individual tanks or I could employ space-heating. Theoretically space-heating seems ideal, until you set foot into a space-heated fish house. If you want to maintain a temperature of about 78°F. in your tanks you have got to raise the space temperature to about 90°-92°F. Yes, the difference has got to be as big as that; a mere 80° or 82°F. air temperature will not do. The reason for this is quite simple. There is continuous evaporation of water from the tank surface, which, of course, has a cooling effect on the water temperature. If you employ powerful aeration and also circulate the water as I do, then this evaporation and cooling is further increased.

Now, a temperature of 90°-95°F. with the air nearly fully saturated with water vapour is not very pleasant. In fact, I doubt whether many of us could tolerate it longer than about 5-10 minutes at a time. I have tried this type of space-heating for a brief period and, without any exaggeration, if I had to choose between spending half an hour in such a fish house or half an hour in a refrigerator, I would choose the latter every time! Such a high space-temperature is absolutely intolerable and would turn a pleasant hobby into an unbearable ordeal. Those who space-heat their fish houses are usually content to run their tanks at 70°-72°F., with a space temperature of about 80°-82°F. Even that is anything but pleasant but I suppose one could could get used to it in time.

Space-heating is also more costly than heating individual tanks. A higher space temperature means a higher gradient between the temperature inside and outside the fish house. This, of course, leads to a greater heat loss per hour. At the moment I employ what might be called a dual fluctuating system of heating.

On the wall at one end of the fish house is a 3 kw General Electric Co. fan-blower heater regulated by an air thermostat. The function of that heater and thermostat is to see that the space-temperature never falls below 72°F. In each tank one or more electric-light bulbs (carbon-filament type) are partially immersed so that they supply light as well as heat, directly to the water. The large tanks have two lamps, the small ones have only one, and by using lamps of varying wattages, a reasonable control can be exercised on the temperature in each tank. (This technique was described by the author in *The Aquarist*, May, 1950.)

All the tanks are wired in parallel and there is no thermostat in the circuit. Instead of that they are wired through a time-switch, capable of executing two make-and-break operations every day. The number of hours a day that the lamps stay on can be adjusted. In winter months the time-switch was so adjusted that the lamps were off for only 4 hours every day, and when the weather is warmer, they are off for 12-15 hours a day. Thus the temperature in the tanks is not held constant throughout the 24 hours, but shows fluctuations which can be varied at will. A cool period with a drop of as much as 10°F. at night can be produced by such a system. The dual system also provides a considerable safety factor. For even if one system fails the other is quite capable of preventing a serious drop of temperature. The good insulation of the fish house is a further aid in this direction.

One more problem has to be tackled—heat stratification; hot air, being lighter, tends to accumulate under the roof.

Since the part-glass roof is the weakest spot as far as insulation goes, it would be uneconomical to let the hot air gather under the roof. Two blower fans are employed to throw the hot air from the roof to the floor of the fish house. This also corrects the tendency for the bottom rows of tanks to run cooler. The fans are not run continuously. They are wired through a reverse-acting thermostat situated in the roof space. When the roof temperature rises (i.e. heat builds up under the roof) the thermostat switches the fans on. When the temperature is equalised and hence the floor-level temperature rises and roof temperature falls the thermostat switches the fans off.

Staging the Tanks

My staging is made entirely from slotted-angle-iron, commercially obtainable, which has been rust-proofed and and has a metallic-bronze finish. Unfortunately, the material is a bit too light (and it is expensive) for our purpose but if sufficient vertical members are incorporated into the staging, a first-class job results. It is an extremely adaptable and useful material. About 900 ft. of slotted-angle was used to construct the staging in my fish house. This consists of supports for three rows of aquaria (each tank 12 in. wide by 12 in. high) of various lengths on the left side of the hut, two rows of tanks 15 in. wide by 15 in. high on the right side and a row of 6 in. by 6 in. fighting-fish tanks tucked away under one of the eaves. Cross-members span across the roof, bracing up the staging on either side and also supporting electrical equipment and various gadgets required in the fish house. At no point is the staging attached to the house; it stands free on the concrete base.

The tanks are made of angle-iron frames (1¼-1½ in. angle) which were shot-blasted and rust-proofed with Galvafroid. Some were painted metallic green, others grey and some cream. Different rows have different colours. All tanks were glazed with ¼ in. polished plate glass.

Air and Water Supply

Air is supplied from an ex-army compressor driven by a ½-h.p. motor. This pumps air into a 30 gallons tank equipped with a pressure switch which cuts the motor out when the pressure reaches 80 lb./sq. in. (it cuts in at 10 lb./sq. in.) The air is led through a pressure-reduction device and fed into air lines at 4 lb./sq. in. About 60 diffusers, two long air-lifts, to operate the circulating ranges, and violent aeration for the brine-shrimp hatcher, all come from this air tank. The compressor runs for just under 5 minutes to fill the tank up and then it rests for the next 90 minutes, when the tank gradually empties. Every 2 months the tank is found to be about one-third full of water and has to be drained out; as the fish-house air is compressed the water vapour condenses and settles into the tank.

For the first time, I now have all the air I want. No other pump or combination of pumps has ever given me anything like the quantity of air I have at my disposal at the moment. I am convinced that this is the only type of pump suitable for the aquarist with a large fish house. Incidentally the parts for this pump cost about £15, so it is not much more expensive than some of the larger pumps offered for sale to aquarists. Needless to say it can pump infinitely more air than the largest of these pumps.

A network of ½ in. polyvinyl chloride (PVC) tubing and polythene taps bring tap water to all tanks. An ion-exchange-resin filter provides water many times purer than ordinary distilled water for special purposes.

Orchids and cacti are grown on shelves on the staging above the tanks, and they add considerable beauty and colour to the fish house. They are watered with warm water from the fish tanks. Excess of water drips from the pots back into the tanks. The fishes come to no harm and the water plants perhaps derive some benefit. I have recently discovered a lazy way of watering my cacti and orchids. I open the fish-house door to let the cold air in and turn the space thermostat down by 10°F. This causes a "rainfall" (condensation) and "fog" in the fish house, so that everything is soaked with water.

Electrical Wiring

Polyvinyl chloride-covered cables and the new flat-pin fused 13 amp. plugs and sockets are used throughout. Two switchboards between them provide a total of 15 separate outlets to run various electrical gadgets. Main switch and fuses are located outside the fish house. It is intended to introduce a watt-hour meter in the circuit at a future date.

It gives me great pleasure to acknowledge the help given by Mr. D. Inman of the Ashton Aquarists' Society with advice on heating problems during the construction of the fish house and in the compilation of this article.

REVIEW

British Journal of Herpetology, Vol. 2, No. 6. The British Herpetological Society, c/o Zoological Society of London, Regent's Park, London N.W.1.

THIS is the official organ of the British Herpetological Society, whose interests are the furtherance of knowledge and interest in reptiles and amphibians. The Society, which every reptile-keeper should join, has a postal lending library and members receive free copies of the *Journal*, which is issued twice yearly.

The current issue has papers on box tortoises (*Terrepene c. bauri*), the cave salamander ((*Hydromantes* Gistel, three-horned chameleons (*Chamaeleo jacksoni*) and the Australian frog (*Mixophyes fasciolatus*), as well as reviews of recent herpetological books.

The *Journal* is available for the recording of the findings (they must, of course, be original) of any member-enthusiast, which makes it especially interesting. Whilst much of its room is usually devoted to British frog- and toad-breeding records, it does offer a wide variety of subjects in the papers printed, as is shown by the current issue. The Society is most fortunate in having the Editorship in the capable and experienced hands of Dr. A. d'A. Bellairs, himself the author of many books on reptiles.

It has been my opinion for some time that the Society should actively encourage papers on the practical side of reptile-keeping. Members could pool advice and experience and the result would be most helpful to the beginner. In its present format the *Journal* does nothing to encourage the beginner or casual reader and I consider this a poor policy. It was with great interest therefore that I read a note in the current issue to the effect that "The Editor would welcome more articles on the keeping of reptiles and amphibians in captivity and on general topics such as hibernation." The future issues should therefore be of greatly increased value to the collector.

I should like to see notes (again compiled from pooled experience) on the treatment of reptile diseases; here I think the *Journal* could be of great use to all collectors.

I would stress that the papers published are of very high standard and great interest. Dr. E. Elkan's paper on the "Cave Salamander" in the current issue is typical of his excellent work, which is frequently present in the *Journal*.

I strongly recommend the *Journal* to anyone who is interested in information (albeit of a specialised nature) about reptiles and amphibians.

H.R.B.

Pyrrhulina rachoviana

Pyrrhulina rachoviana

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

FAMILY: Characidae, from Greek *charax*—a sea fish.

SPECIES: *Pyrrhulina*, from Latin *pyrrhul*—red, or purplish, and Latin *ina*—little; *rachoviana*, after Rachow, a German writer and aquarist.

A SLIM, streamlined native of Argentina, *Pyrrhulina rachoviana* reaches a maximum size of just under 2 inches—an admirable size for a medium aquarium, say 24 in. by 12 in. by 12 in., furnished with broad-leaved plants. It can, of course, be kept in a community tank, being of a peaceful disposition, but not being of outstanding coloration it shows better with a few companions of its own species.

It is difficult to know why it is called the "little red", because even the male, which is more colourful than the female, shows very little red, and sometimes none. Perhaps "little red" refers to that very fact and "little" is not meant as "small", but more in the sense of "lacking".

Young fish show a turquoise spot just behind the eyes, but this fades considerably as they grow older. The body is divided roughly into a brownish-red upper half, and an increasingly pale lower half, by a zig-zag line traversing the whole length of the body from behind the opercula to the base of the caudal peduncle. Red spots are reputed to show along this line in male fish, but some observers have reported their complete absence.

Male and female both show a black area on dorsal fins, this in the male being at the tip and intense, in the female more towards the centre and comparatively pale. For the rest, traces of orange outline the fins.

Breeding

Water should be slightly on the acid side if it is intended to attempt breeding these fish: between pH 6.2 and 6.5, which can generally be induced by the provision of a layer of granulated peat beneath the compost.

In this "favourable" water, with an adequate supply of the usual live foods, and a temperature ranging from 75° to 80°F., the female will soon be noticeably plumper as she fills with eggs. At the same time the male will intensify whatever colour he possesses, and show a marked interest in his companion.

He will spend some time examining plants or stones and fanning them vigorously with his fins, then darting back to the female and endeavouring to coax her to inspect his handiwork. When she is ready, and not before, she will condescend to accompany him, assisted by nudges and pushings by her impatient escort.

Eventually she becomes as excited as the male and real spawning begins. Eggs are semi-adhesive and remain where they are dropped. Spawning lasts about 2 or 2½ hours. The female can, if so desired, be removed after she is spent, but this is not usually essential. The male stays on guard, continuously fanning the eggs and on constant watch for any intruders. A finger inserted near the eggs at this time will have a marked effect upon him. Afraid of the finger, and afraid for the safety of his future sons and daughters, he will not know whether to retreat or fight. Feverishly he will swim, as close as he dare, to the finger, hesitating, darting forward, moving back, swimming round, trying his best to appear aggressive, but not really succeeding. Except as an attempt to make him demonstrate his fishy instincts, the experimental insertion of any object into his private domain is unnecessary and not to be recommended, in case he decides to "protect" the eggs by swallowing them!

Within 2 days at the temperatures mentioned above the egg membranes are broken by emergent fry—tiny glass splinters almost impossible to see without the aid of a hand-lens. At first clinging precariously to friendly plants or glass, the fry wait for the development of their swim bladders. The only exercise they will take at this time will be an occasional short, unsteady dash from resting place to resting place.

Eventually, however, barring accidents, they assume the horizontal and move freely about the tank seeking Infusoria. An adequate supply of these will ensure that the youngsters start off on the right fin, and several cultures should have been started as soon as the male first manifested interest in the female.

Use for Blanket Weed

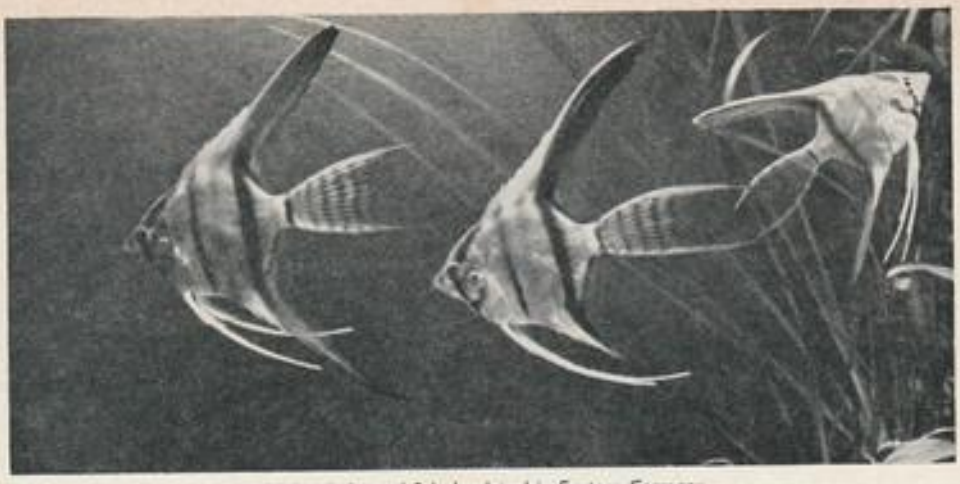
If you are the fortunate possessor of an out-door pond you are probably also the unfortunate possessor of a quantity of filamentous algae or blanket weed. A little of this can now be put to an excellent use. Take a small amount and squeeze it into a tight ball, afterwards placing it at the bottom of a jam-jar. It won't stay there, but tends to unwind itself and spread out. So place a few stones on top of it; fill the jar with tap water and leave. Within several days a good culture of infusorians will begin to develop. Once started it will increase with truly astonishing rapidity. The tiny creatures will tend to collect just below the meniscus of the water, and can be removed in quantity with the assistance of a fountain-pen filler or similar tool.

A drop or two of this culture at frequent intervals will provide adequate food for the fry with the minimum risk of pollution. Try to keep the water of the culture at the same temperature as that of the aquarium. This can best be achieved by floating the jar in the aquarium itself. Too sudden a change of temperature or of pH could destroy the culture and start pollution. Water removed from the jar can be replaced by an equal quantity taken from the tank.

On such a diet the fry will make noticeable progress from day to day. After a week or 10 days start introducing them to small live foods such as *Cyclops* nauplii, new-hatched brine shrimp, micro worm, young *Daphnia* and the like. Start culling weak or deformed specimens as soon as they are seen, thus ensuring the survival of the fittest and a possible improvement of future breeding stock.

Other fishes are always glad of a few fish fry for tit-bits, so there should be no quandary as to what to do with the

(*Please turn to page* 191)



Veil-tailed angel fish developed in Eastern Germany

Angel Fish Varieties

A Challenge to the British Aquarist

by JOHN S. VINDEN

IF any fish can claim credit for establishing the tropical fish hobby in this country, surely it is the angel fish. It is a fish that appeals both to the beginner and the specialist; it is easy to keep; cheap to buy, long-lived, peaceful for a cichlid and unique in appearance. It is, perhaps, its un-fishlike shape that appeals chiefly, for its popularity has spread far from the confines of aquarium tanks, and it is now to be seen on wall-paper, textiles and in other decorative forms.

The angel fishes are found in the Amazon basin, and in some of the surrounding watersheds. There are said to be three species that have, at one time or another, been seen in aquarium tanks. These species are *Pterophyllum scalare*, *P. eimekei* and *P. altum*. The first-named is said to be the largest, and the other two can be distinguished by the fact that in *P. altum* there is a deep indentation just above the snout. This species is not available commercially though *P. scalare* is sometimes on offer. There is said to be a difference in the eye colour of *P. scalare* and *P. eimekei*, but this is not a sure guide to identification since variations can occur in both species.

There is now some doubt as to whether *P. eimekei* is a valid species at all, or whether it is but a local variety of *P. scalare*. It has been proposed in Germany that it should be named correctly *P. scalare* var. *eimekei*. At all events most of the angels now available are the descendants of both *scalare* and *eimekei*, and I think it would be difficult to obtain a pure strain of either.

Colour Varieties

The keeping and breeding of the normal angel fish is a straightforward matter and has been described so often that it is not proposed to go into it in the present article. Since the war, however, various mutations have occurred in breeders' tanks, and we now have several cultivated varieties of angels which differ from the normal fish in colour, form, temperament and hardiness. None of these strains is English in origin, and I shall later suggest that there is yet another variety, hiding just round the corner, that will be produced sooner or later. British breeders should be on their mettle, for there is no reason why this prize should go to either the U.S.A. or Germany, for the raw materials are in this country, and I am optimistic

Black angel fish developed in California, U.S.A.

Photo: Laurence E. Perkins

Angel fish (Pterophyllum eimekei)

enough to suppose that we have enough skilled and patient breeders to make good use of them.

If and when a mutation occurs the new fish may have features that are considered desirable (from the aquarist's point of view) or undesirable, and if, for instance, a breeder produced a brood of angels with short stunted fins and little colour, he would not be able to dispose of them in spite of their having an undoubted scientific value. If on the other hand he produced an angel with horizontal bars he would have a fish for which there would be a good demand. Some years ago some odd angels appeared in which the black bars were almost missing. These so-called "blue angels" were not an improvement on the ordinary fish, and so failed to become popular. Black fish, however, are desirable, as is witnessed by the popularity of mollies, black swords, black fighting fish, moors and the like, so when rumours reached this country that black angels had been produced, we awaited their arrival with great interest. Some 3 years ago the first specimens arrived and we were not disappointed.

Black Angels

These black angels first appeared in California in a spawning of ordinary angels. Most of the fry were normal, but a few of them were intense black, some were of the intermediate type, now known as lace angels, and which had previously appeared in spawnings of normal fish, and the majority were ordinary *eimekei*. It was found at once that the darker the fish, the more delicate it was, and to rear them successfully it was necessary to separate them from the more robust normally coloured fry. Temperamentally they appear to be more aggressive than the ordinary angel, and once they are half grown they can be more than a match for similar-sized normal fish. The adult blacks are not quite so easy to maintain as normal angels, and some individuals are fussy about eating, and must be tempted by offering them a wide choice of suitable foods. The results will well repay the trouble, for on a good diet they will grow fast and soon get into breeding condition.

Spawnings from two blacks often fail to develop, and more success has been attained in this country by crossing a black and a good lace angel. Hatchings from such a cross should produce from 10 to 20 per cent. of black fish, a larger percentage of lace and a large proportion of normal angels. These figures will vary according to the ancestry of the parents.

After the black angel was a half-black, which was developed in Holland. In this fish the posterior half is black and the anterior half is normal. These fish are said to be much hardier than the blacks but, as far as I am aware, they have no yet been seen in this country.

Veil-tailed Angel

An even more interesting mutation occurred some time ago in Eastern Germany, and was introduced to this country some 15 months ago by Shirley Aquatics Ltd. This is the "schleierscalare" or veil-tailed angel in which all the fins are developed to an extraordinary extent. This fish, unlike the black angel, appears to be as hardy as its ancestors, and also shows no aggressive tendencies. It has been discovered that spawning a pair of these fish is difficult, and many of the resulting young show undesirable features. If, however, a veil is crossed with a normal fish 50 per cent. of the young take after one parent and 50 per cent. after the other.

The variety of angel that I suggest may be produced by a go-ahead British breeder is the "veil-tailed black" or "veil-tailed lace" angel! There is no doubt that it would be a winner, and there is no theoretical reason why it should not be produced by crossing a black and a veil. In theory it would not be too easy to rear the young, so aquarists who merely require ease of breeding should not attempt this cross. The experienced angel breeder, and there are hundreds of them, might find this a highly profitable undertaking, and even if he failed to produce a new variety, his breeding stock could still be used to advantage to produce the existing strains of veils and black angels.

Tropical Fishkeeper's Refresher Course

(*continued from page* 189)

under-sized, weakly specimens which will never be any good.

I know that in some circles the feeding of one fish to another would be regarded as cruelty. To many of the fry so disposed of, I contend that it is probably a merciful relief from a miserable existence, quick and painless.

Of course, if the weakness is occasioned by the presence of external or internal parasites, a condition which is not always apparent even to an experienced aquarist, the possibility of spreading these around cannot be entirely ignored. The cautious will therefore probably ignore what I have said; those willing to take a chance will not.

Pyrrhulina rachoviana is not fussy about food, and will take dried food if nothing else is available. I maintain, however, that live foods are, and always will be, the best for growth, health and development.

Exotic Water Plants and Aquarium Decor

by DUNCAN SCULTHORPE

(Photographs by the author)

IT is useful biologically, and convenient from the point of view of a writer, to be able to classify a subject as large as "water plants" into handy sections which are quite distinct, but whose members have some common features. Unfortunately this proves to be very difficult.

As early as 1890 such a classification of all water plants had been attempted, and although this is still used, with a few modifications, it depends upon botanical features of structure and reproduction and is therefore useless for the purpose of the aquarist, involving as it does a large number of technical terms. Some writers have suggested that water plants should be divided into (*a*) those grown for underwater effect, (*b*) those rooted underwater but with some or all of their foliage raised to the surface or above, and (*c*) those grown as floating plants. This, like all classifications, is subject to several exceptions; *Ceratopteris thalictroides* will grow equally well as a rooted plant or as a floating plant, the *Aponogeton* are all grown at first for underwater effect but later produce surface leaves and aerial flowers, and similarly *Lobelia dortmanna* and *Hottonia palustris* are grown for underwater effect but have aerial flower stems. Into what category should these, and similar plants, be placed?

A more satisfactory general classification, but still subject to certain limitations, divides water plants into (*a*) those grown from cuttings, rooting adventitiously from the lower nodes of the stems, (*b*) those grown as individual plants rooting from a prominent crown, rhizome or bulb, and (*c*) those grown as floating plants. To spend time thinking of exceptions to these categories is not to be idle; it makes one realise how difficult it is to classify any arbitrary group of plants or animals in a way that satisfies every purpose.

Common Aquarium Plants

The more common aquarium plants are well known and worthy of only a few extra comments. *Vallisneria spiralis* var. *torta* is rather more interesting to look at than the ordinary straight-leaved variety, but both plants have an intriguing method of flower production. The female plant produces a single whitish-pink flower in a spathe on a spirally coiled stalk which grows just to the surface. The male plant produces many flowers which are released from a spathe low down near the crown; they float to the surface and burst open shedding their pollen into the water. After fertilisation the stalk of the female plant usually contracts, drawing the capsule to the bottom.

A similar method of reproduction occurs in *Elodea canadensis*, thus relating the two genera and placing them together in the family Hydrocharitaceae. The female flowers of *Elodea* are common, but the male ones extremely rare in this country, where the plant spreads mainly by fragmentation. *Vallisneria* comes from America and Southern Europe but has been naturalised here and flourishes in the warm water of mill effluents. It grows well in aquaria, given good top light, and produces many runners from the crown which propagate the plant quickly. All the *Elodea* species are grown as cuttings and are easily acclimatised to both cold and warm water; *E. canadensis* and *E. callitrichoides* are water-pollinated, and because

Vallisneria spiralis var. torta

Cabomba caroliniana

Hygrophila polysperma

Cardamine lyrata is the conspicuous plant in this picture. To its left Myriophyllum prismatum can be seen

E. densa and *E. crispa* are insect-pollinated they are placed in different genera (*Egeria densa* and *Lagarosiphon major* respectively). All grow rapidly but it is difficult to maintain fully clothed stems and long leaves for any considerable time.

There are several species of *Sagittaria* used by aquarists—*S. natans, lorata* and *sinensis* the most frequent. They produce white, three-petalled flowers under good top light, without producing the familiar arrowhead aerial leaves of the native species. Propagation is by seed—as many as 16 to 20 flowers may be produced on the stem, which, incidentally, grows amazingly fast, about an inch an hour! Runners are also produced, as in *Vallisneria*, and it is often said that you shouldn't keep the two plants together in one tank because of the competition. I could never see how such competition differed from that between two plants of *Vallisneria* placed an inch or so apart in the usual way; I always keep some of both genera in the same tank.

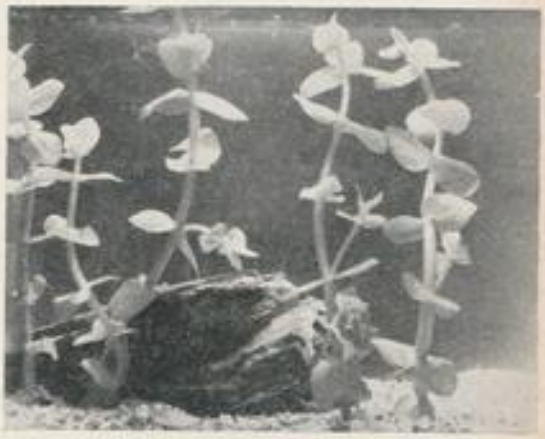
There are three genera of common bushy, fine-leaved plants known to almost every aquarist: *Cabomba, Ambulia* and *Myriophyllum*. *Cabomba* and *Ambulia* (known also as *Limnophila*) are similar in appearance, differing in the way the leaves are set on the stem, and all the species available are worth growing. Only one is really worthwhile from the point of view of being out of the ordinary, and that is *Cabomba rosaefolia*, with its light-red foliage; unfortunately it is rarely offered for sale by the main dealers. I have always preferred *Myriophyllum*, being attracted by its denser, finer foliage. A large number of species are available, among them the native *M. spicatum, M. verticillatum* and *M. alternifolium*, but there are two species which are quite uncommon. The red variety from Georgia in the U.S.A. is attractive, but sunlight seemes to be necessary to maintain the colour; I am often left wondering whether the red is merely an accumulation of carotenoid pigments in the cells and in some way parallel to the red colour produced beneath leaves of *Ludwigia* and some *Cryptocoryne* in strong light. *Myriophyllum proserpinacoides* is quite distinct from the other green species and is fast growing as a coldwater, tropical or bog plant.

Hygrophila polysperma will always be popular as an aquarium plant; its light-green leaves, bushy habit when pruned and ease of culture make it both attractive and adaptable to almost any situation in both cold and tropical aquaria. It is propagated by cuttings (roots being produced at the lower nodes in a very short time) as are *H. stricta*, for larger tanks, and all the members of the *Ludwigia*. All these plants are really bog species but will thrive for a considerable time under water.

Ludwigia palustris is a native plant, but all the other species are from warmer regions, mainly of North America. *L. mulertii, L. ramosus, L. natans* and a few others all have the same general appearance, with oval or elliptical leaves whose under surface becomes a distinct bronze-red tint in good light. *L. arcuta* is, however, a rare species and worth looking out for, as its needle-like leaves distinguish it sharply from the other members of its genus. The flowers of all the *Ludwigia* species are rarely produced underwater but are formed singly in the leaf axils; they have no petals and are inconspicuous.

Cryptocoryne, Ceratopteris and *Echinodorus* are the three most common genera of plants grown singly and not as bunches. There are about a dozen species of *Cryptocoryne* available; some of them, *C. bechetti, C. cordata, C. willisii, C. hartelliana* (*affinis*), are common in aquaria and soon grow into attractive bushy plants up to about 6 or 8 in. in height when given a medium amount of top light. The bronze leaves of *C. cordata* are quite individual, but all the other species are of varying shades of green; indeed the leaves on one plant often vary in their colouring. Of the rarer species, *C. griffithi* has broad leaves with brown mottling, and a number of others have furled and undulating leaves of brighter green, e.g. *C. ciliata* and *C. somphongsi*, which is a new introduction from Siam.

All this genus grow as bog plants, when they flower freely; some species may by chance flower regularly in aquaria, when the ingenious floral structure can be studied. The aroid flower pushes up to the surface, where its lip opens and small insects are attracted down the tube, which is watertight and contains stamens and pistil. After pollination the insects fly out none the worse for their stay under water. Several points arise from this; is the flower parallel in internal structure to that of *Arum maculatum* (cuckoo pint)? What attracts the insects? Is it nectar



An unusual water plant: Maculiamia

The tall plant is Najas microdon. In front of the slate is Samolus parviflorus

Left, the fine-leaved willow moss (Fontinalis gracilis); Lobelia dortmanna is in front of the rock

or some foetid odour, and what is the mechanism within the flower for effecting pollination?

Ceratopteris is a true fern growing in tropical and sub-tropical regions all over the world, sometimes on damp soil, usually an aquatic, free-floating or rooted. *C. thalictroides* when young has small but broad, slightly indented leaves; this is often sold as "broad-leaf Indian fern" but is not a distinct species, and if allowed to grow, its leaves, like those of all ferns, become successively more and more deeply cut. Young plants develop on the parent fronds and if detached and allowed to float grow well and may soon be rooted in the gravel. The plant throws up many fertile fronds, bearing spores, if grown as a bog plant, and these are very finely cut. Another species grows only as a floating plant with rounded, scarcely-divided leaves; this is *C. pteroides*. *Ceratopteris* is the only fern grown as a food crop for use as a cooked vegetable or as salad.

The common Amazon swordplant is *Echinodorus brevipedicellatus*, but there are other species with narrower leaves, and a dwarf species known as *E. repens* or as *E. intermedius* is a very fast grower, carpeting the gravel in a very short time. All the *Echinodorus* species spread, like *Cryptocoryne*, by runners producing young plants at the nodes. Under suitable conditions, growth of the larger Amazon swords is rapid, but there is a tendency for blue-green and filamentous green algae to spread over the leaf surface if the light is too bright.

With that survey of the more common water plants used in aquaria, I am now going to deal, in more detail, with the rarer and more unusual genera.

Unusual Aquarium Plants

Amongst the cuttings or bunch plants, *Cardamine lyrata* is the only member of the family Cruciferae which the aquarist uses in his tanks. It is really a bog plant but grows well submerged, its thin stems bearing rounded leaves with indentations. The stalks of the leaves adjust themselves when the plant is settling down so that each leaf is exposed to the most light, i.e. towards the front and top of the tank, and so the full leaf surfaces are shown to the onlooker. The plant grows quickly, rooting from all the lower nodes, and it needs pruning if the aquarist wishes to grow it as a bush; it always looks very pretty set down in front of rocks.

Three other genera are grown in a similar way, and also have rounded leaves. *Bacopa* (*Herpestis*) is used in aquaria as two species: *B. amplexicaulis* and *B. monnieri*; both have round, succulent leaves closely set on slow-growing stems which need at least 6 hours of light per day. Both species come from the U.S.A. but we have a native plant similar in appearance, but with thinner leaves; this is *Lysimachia nummularia* and belongs to the Primulaceae. Thirdly, there is a very unusual plant *Macuillamia*, which has fragrant, egg-shaped leaves clasping the thick, succulent stem in pairs. All these genera of plants are useful for side and corner planting and look most impressive when kept trimmed and grown as bushes.

The greenhouse plant *Tradescantia fluminensis*, so often grown indoors and in hanging baskets, will grow quite well under water, and by judicious pruning may be trained nto a bushy plant. Its variegated form, which has similiar

Two new Potamogeton species for the tropical aquarium; left, P. japonicus; right, species unidentified

Water wistaria (Synnema triflorum); Acorus pusillus is growing in front of the sandstone

ovate leaves set in pairs up the stem, is also well worth trying.

There are four genera of plants grown as cuttings which have slender rather than rounded leaves. *Heteranthera zosteraefolia* is a native of South America, growing in mud and shallow water, in the full glare of the sun. In aquaria, it needs strong light and under such conditions forms dense masses of silky, pale-green foliage which, if allowed to reach the surface, bear small flowers. These are pale blue and show the relationship of *Heteranthera* to the beautiful bog plant, *Pontederia cordata*, the pickerel plant. Water hedge, *Didiplis diandra*, is a delicate plant from North Carolina, with narrow, linear leaves set close together on the stems. *Hydrilla verticillata* is a rare member of the Hydrocharitaceae (cf. *Elodea*, *Vallisneria*), which has whorls of sessile linear leaves, slightly toothed and pale green in colour. Another species of this genus grows in up to 6 feet of water in Esthwaite Water in the Lake District, rooting in blue-green clayey mud with a very low content of organic matter; it has, however, never been observed in flower.

The fourth genus is *Najas*, the only genus of the family Najadaceae. *Najas microdon* is most frequently grown in aquaria and has beautiful sprays of dark-green, toothed leaves which sheath the reddish brown, much-branched stems. It is, however, brittle and has not a well-developed root system. Three species of *Najas* grow in the British Isles; all are rare, and one of them is thought to have been introduced with Egyptian cotton, for it flourishes in water warmed by a mill outflow in a canal near one of Lancashire's main cotton towns.

Amongst the fine-leaved species grown in bunches is *Fontinalis gracilis*, a warm-water relative of our native *F. antipyretica*. It is a moss, and does not need a strong light; for this reason and because of its attractive dark-green colour, I have always found it useful for corners and background planting. Other species such as *Ceratophyllum demersum* (hornwort), *Ranunculus aquatilis* and *Hottonia palustris* have magnificent fine foliage, but are not really suitable for warm water, and grow well only in coldwater tanks and ponds. It is a pity, because the flowers of *Ranunculus* and *Hottonia* are very pretty.

The genus *Potamogeton* is a very large one with many species native to the fresh water of this country. All are aquatic herbs and difficult to classify because of their plasticity of structure. There are two recently introduced species which grow well in tropical aquaria; these are *P. japonicus* and an unidentified species. One has narrow leaves set close together on the ascending stems, and axillary shoots appear very quickly, and the other has beautifully furled leaves of a fresh-green colour. Both grow rapidly, and without compost or anything other than gravel.

The last plant of the group grown as cuttings is of spectacular appearance, but grows rapidly with very little attention; it is *Synnema triflorum*, the "water wistaria". It has leaves similar to those of *Ceratopteris*, but they are closely set on a prominent stem, from which axillary shoots arise at frequent intervals. This beautiful, light-green plant does need plenty of room if it is to display its foliage to the best effect.

In the next and last article of this series unusual species that are grown as individual plants, and the floating plants, will be discussed.

" . . . And then I put them on to brine shrimp and sifted Daphnia . . . . "

The Importance of Swimming Space

by A. BOARDER

THE amount of swimming space allowed for fishes in a tank is of paramount importance. Without space fishes will not thrive, although they may exist for a time, especially if an aerator is in use.

Why is it that nearly all beginners have to try to crowd as many fishes as they can into their tanks? There seems to be a well-founded idea among embryo fish-keepers that unless the tank is filled with fishes then the object of an aquarist has not been attained. This is far from the case, as it is much easier to keep a few fishes in a tank in a healthy condition than it is with too many. It is possible that beginners are misled by the tanks of fishes sometimes seen at pet shops, where dozens of fish are crowded into a tank in the window. I have seen such tanks in shop windows with goldfish so overcrowded that they can scarcely swim without bumping into another fish. Why are fish displayed in such conditions? An enormous number of fish must be lost, as many in such tanks can be seen to be dying. The fish must be purchased very cheaply, as otherwise the shopkeeper would not be able to gamble with their lives so easily.

It is not in the proper fish-dealer's shops that such conditions are likely to be seen, but where a shopkeeper has birds and other pets and the sole goldfish tank this is invariably packed with fish in a very unhappy condition. I saw one such tank at a sea-side shop recently and the fish were in such poor condition that not one of them had the dorsal fin extended. The poor creatures all had closed fins and hollow bellies. It appeared as if even their swim bladders were quite empty, and they were only able to swim about at an angle of 40 degrees, just wobbling along from one end of the tank to the other; some were lying on their sides on the bottom, obviously nearly dead. Such conditions are unlikely to encourage anyone to buy fish, and I could not help thinking of the advice I have often given to intending purchasers of goldfish. I have recommended them to buy only those fish with an erect dorsal fin, but in the shop mentioned there was not a single fish with its dorsal fin held erect!

I have also seen such conditions in a large store where dozens of fishes are kept in a show tank constructed to hold but a few. If only a few fishes were displayed, in a well set-up tank, the public would be more likely to buy and would at least get a better idea of how many they should try to keep. It is only when the fish-keeper gets more experience and visits an aquarist exhibition that he is likely to see fishes kept under ideal conditions. Many never reach that stage. They buy fishes which are unhealthy and already on their way out, and because they are unsuccessful with them they lose interest and leave the hobby. How much better for all it would be if the fishes had been exhibited and sold in a healthy condition.

I wonder if much of the trouble has been caused since the importation of goldfish from abroad was allowed after the war? Up to that time it was possible to see and buy healthy British-bred fish which had every chance of surviving, but once they were imported in mass at a very cheap rate shop-keepers were able to pack them into tanks without thought about whether they were overcrowded or not. In other words, the fish became too cheap.

When I saw the goldfish wobbling about in their overcrowded tank I wondered if I could possibly have brought any of them back to health. From the look of them I doubt it very much; what hopes then had a beginner to be able to keep such fish?

Sometimes I have found one of my young fantails in a tank which I had thought contained no fish at all. Such a fish has been in the tank for 3 or 4 months with absolutely

(*Please turn to page* 199)

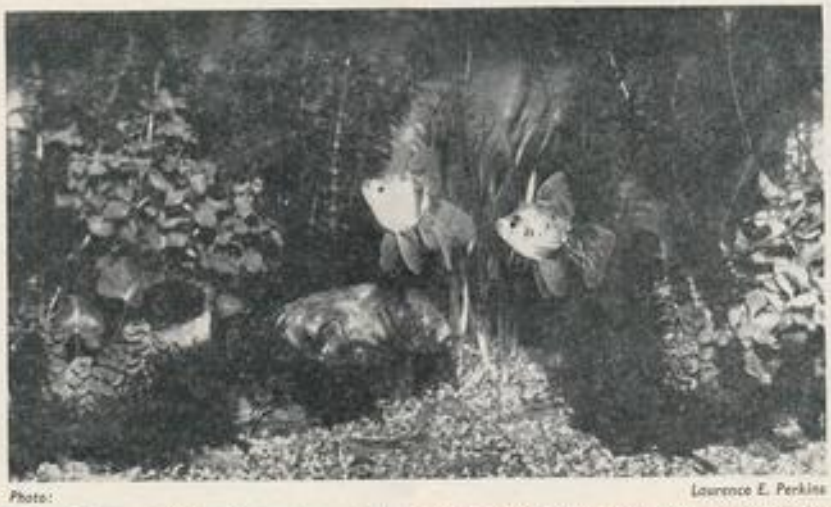


Photo: Laurence E. Perkins

A few fish in a well-planted aquarium not only present a better picture but will be healthier than fish in an overcrowded tank

AQUARIST'S Notebook——

by

RAYMOND YATES

A FEW, a very few, aquarists keep records of their stocks. The great majority of us just don't bother. However, with the arrival of another British Aquarists' Festival the thought occurred to me to check up on how many different varieties I had kept since the last Festival a year ago. I noted down the names on paper and found the total to be under 40. I also noticed with surprise the absence of quite a few old favourites like mollies and guppies and most of the cichlids. In no particular order my list for the last 12 months reads: pompadour, black shark, comb-tails, angel, bleeding-heart tetra, clown loach, harlequins, *Rasbora leptosoma, R. hengali, R. borapetensis,* zebra danio, swords, platys, leeri gourami, *Badis,* neons, tiger barbs, chocolate gourami, paradise, glowlights, ulreys, *Panchax dayii, Aphyosemion australe, Aplocheilus lineatus,* fighters, *Barbus arulius,* penguins, *Corydoras julii, C. arcuatus, C. myersi* and *C. melanistius, Pelmatochromis kribensis, Moenkhausia* and opaline gourami. Coldwater fishes include common goldfish, shubunkins, golden orfe, catfish, sticklebacks and dogfish. There was a time when I was very much a cichlid fan, but of late these are poorly represented in my list.

Looking through the list I see that 14 of the above varieties are no longer with me, for one reason or another: *Pelmatochromis, Corydoras julii, Aphyosemion australe, Aplocheilus lineatus,* ulreys, glowlights, paradise, chocolate gourami, neons, *Badis,* platys, *Rasbora leptosoma, R. hengali* and pompadour. I thought this list might be of interest to other hobbyists who may have a record of their own comings and goings, and as a guide to one enthusiast's personal tastes.

* * *

In the early days of motoring, when goggles were as essential as they are now for skin-diving, the supreme insult offered by urchins to passing motorists was to call them them "Fish-face." I was reminded of this when reading Bernard Newman's fascinating book *Road to Rome,* where a connection is drawn between the faces of the fishes in Monaco Aquarium and the gamblers at the Casino. The suggestion is put forward that the faces of the fishes seem to be more intelligent than those of the gamblers, and that there is a definite resemblance between the octopuses and the croupiers. Be that as it may, some fishes have more intelligent-looking faces than others. This is generally given by the presence of a gleam in the eye, as for example, most of the cichlids, black widows, etc. Goldfish, on the other hand, always look quite bovine, if one could use such an expression with anything other than a cowfish, or perhaps a bullhead.

* * *

Blind cave fishes have been reported from South America and from Africa but I had not heard of them in Europe. However, I came across a reference to some such fish in Cedric Salter's *Guide to Spain,* in the section dealing with Majorca. About 32 miles from Palma are some wonderful caves and grottoes called the Cuevas del Drach, which were believed by the ancients to be one of the five entrances to the underworld. The author mentions that far underground is a huge lake in which the fish are born dead-white and without eyes, having come from countless generations of fishes which have lived in darkness. Has any reader any first-hand experience of these grottoes? It would be interesting to know what these fishes are.

* * *

It is commonplace nowadays to see fish designs in pottery, ornaments, plastic sheeting, curtains, towels, wallpaper and transfers and even on the films one is now getting used to seeing aquaria on display in the living quarters portrayed. However, a recent film of the crime-thriller type entitled "The Line Up" goes one better. A part of the action takes place in the Steinhart Aquarium at San Francisco, and there is one delightful period when the archer fish are shown demonstrating their accuracy at shooting down flies before the visitors.

* * *

I read something recently from a wife who disliked her husband's hobby. It didn't happen to be fish-keeping but it might have been. I must admit that all the wives of aquarists I know are either enthusiastic or else manage to appear so. The effect of the hobby on the divorce courts is unknown, as yet, but I suppose there are some wives who really hate fish. What does one do to break down their resistance apart from appointing them a club official or buying them a new outfit? There have been a lot of cartoons on this topic and some fish-keepers must have met this trouble and won through. A discussion on these lines at a club meeting would be entertaining, if risky. Perhaps some reader (under a *nom de plume*) could tell us how he dealt with this trouble.

* * *

Whatever we may say individually we are all biased one way or another throughout life and we are for or against certain people, colours, methods, ideas and beliefs all our lives. It is just the same in the aquarium hobby. Everyone who has been in the hobby any length of time tends to have fixed ideas. Sometimes these strong views are the result of long experience but more often are due to misfortune, ignorance, misinformation, carelessness or sharp practice. When a fish-keeper expresses a view at variance with your own it is often interesting to follow up and find out exactly what makes him take the view he does. A great many people allow one single incident to influence their thinking in a particular channel, and this often proves to be the case with hobbyists who, to you, seem unreasonable.

I have done a lot of photography, but I would never dream of telling somebody unknown to me that he was doing something wrong when taking a picture. Most people don't want to be told, anyway—they prefer to learn by the usual method of trial and error. Similarly, in the aquarium hobby few aquarists like even friendly criticism of their set-ups. Too many of us are ever ready to advise others, and thus we appear patronising. When you are looking at other peoples' set-ups forget your own likes and dislikes; try to see it through their eyes. Instead of telling them what they should have done, say "Excellent, what a splendid tank—that so-and-so looks really grand." Now you can introduce your own views this way. "Do you know, I have never seen such large angels kept with such tiny neons—how do you do it?" or "You are lucky to be able to use limestone in your tank; when I try it the water goes milky and becomes quite hard." You will find that most aquarists who are disliked are "know-alls" or "told-you-so" types and dealers in disgrace are either thought to be underhanded or give the impression "It's your money we want, not you."

AQUARIUM PLANTS FOR THE CONNOISSEUR

Cultivation of the *Anubias*

by W. L. MANDEVILLE

THIS series of articles is not concerned with the biological significance of aquatic plants; aquarists generally have moved from the assumption that a sprig of *Elodea* in a goldfish bowl fulfils all the symbiotic relationship between plants and animals, to the realisation that living, growing, healthy plants will not only establish this relationship, but at the same time, by colour contrast, variation of form and leaf structure and suitable positioning, add considerably to the decor of the tank.

Often, however, the desire for quick results leads to the acquisition of rapid- and rampant-growing species. The common privet in a newly planted garden is a case in point; easily obtained, comparatively cheap, and quick to establish, but followed by years of relentless clipping until one sighs for something more stable and less laborious. So with aquatic plants; plants which show the quickest profit-return to the grower, are again those which propagate readily, grow profusely and ultimately require the maximum of cultural attention if any semblance of a really decorative fish tank is to be presented.

Obviously, if any alternative is to be suggested, two things must be borne in mind. First, that the plants suggested should be available; then a clear, and if possible, illustrated description of the plants concerned, with a detailed summary of their cultivation and application: not addressed to the aquarist using plants for purely utilitarian purposes, or to the one setting up the first tank; but to those aquarists requiring an interesting specimen plant in the tank, and to plant-culturists prepared to spend some time and patience in increasing our meagre stocks of the more rarely grown aquatic plants.

Anubias

It is only incidental that the first group with which we deal begins with "A", an alphabetical sequence is not intended, but the association of *Anubias* with Africa is easily memorised; this genus of water plants is confined to Africa, and should plants of superficial resemblance, but with a different origin be described as *Anubias*, the description is suspect.

Characteristics of importance to the aquarist are the persistence of leaf-form when submerged, each leaf lasting over a year, the variety of leaf-form available within the genus (lanceolate, heart-shaped, arrow and spearhead being known) and the slow steady growth which makes these plants ideal for permanent decoration.

Anubias lanceolata. (Origin: Tropical Africa and Nigeria.) At maturity this plant carries lanceolate leaves of a dark-green colour 2½ in. wide, narrowing to a point, up to 6 in. in length, carried on stems of the same length. A fair description of the plant is conveyed by its popular name "water aspidistra". Maturity is retarded by submersion, but leaf formation is accelerated. There is a narrow-leaved form, *A. lanceolata-angustifolia*, with leaves only three-quarters of an inch wide.

A "dominant" plant in the decor of a tank, with a very

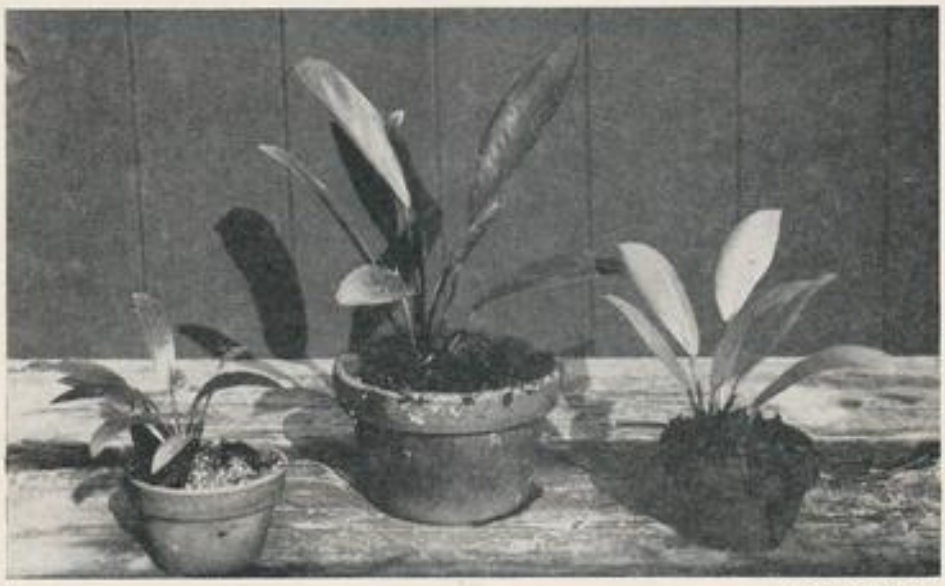


Photo: Shirley Aquatics Ltd.

Left to right: Anubias nana, A. lanceolata and A. congensis

strong root system, and a leaf structure that will defy the attentions of cichlids. *Cryptocoryne* will grow in close proximity below it, and gardening can be forgotten for months at a time.

Anubias congensis. (Origin: Congo and Spanish Guinea.) A larger species than *A. lanceolata*, with a much broader leaf-form, up to 4½ in. wide and 10 in. long, carried on 6 in. stems. The leaves are of a paler green than those of *A. lanceolata*.

At maturity a plant for very large aquaria. The larger leaves and lighter coloration act as a foil to *A. lanceolata* when planted to the rear of that species. During the period of steady growth it can be used as a "focal" feature in tanks with a depth of 15 in. or over.

Anubias nana. The smallest of the *Anubias*, with a leaf 1½ in. wide, and 2½ in. in length, carried on stems of equal length. Grown submerged and carrying its full complement of leaves, this plant adds depth and distinction to any aquascape.

Propagation of Anubias

The family Oraceae, to which *Anubias* belong, are all water-loving bog plants with very strong root-stocks. Divisions are made by cutting this root-stock between the intersections from which the leaves spring, leaving some leaves on each division. After dabbing the cut with a weak solution of potassium permanganate, the divisions are planted in pots containing half-an-inch of clean soil, covered by 3 to 4 in. of fine gravel.

These divisions can be grown on slowly, fully submerged in a decorative tank; but size-growth and leaf formation are accelerated by continued growth under bog conditions. Mature plants will only produce flowers and seeds when grown as a bog plant. The sheaf-like flowers develop into egg-shaped clusters of elliptical seeds, which are slow to germinate and take about 2 years to grow to a saleable size.

General Notes and Cultivation

In the plant-propagation house at Shirley Aquatics Ltd., where these observations were made, the first difficulty was in establishing parent plants from native sources after the unavoidable damage resulting from transportation; but after 2 years of careful cultivation, the species mentioned can be seen in all stages of growth from seedlings to maturity. As might be expected from their origin, the whole group have a wide temperature tolerance, withstanding temperatures into the upper nineties Fahrenheit; nor are they fussy about light, being equally at home in poorly lighted situations and where brilliant light obtains.

In propagation under bog conditions humidity is essential, and to stimulate the production of leaves some nourishment is advisable. All *Anubias* have a virile root system which is best confined within a planting pot, which restricts root-spread, enables some fertiliser to be used and encourages leaf-growth rather than over-all increase of size. For use in a decorative fish tank, it is wise to drill small holes in the sides of the planting pot to encourage circulation through the planting medium; the pot is then concealed with rockwork and buried in compost.

The adaptability of *Anubias* to subnerged conditions has advantage. Should a tank become infested with filamentous algae, the *Anubias* can be lifted out, given "bog" conditions to clear the algae and replaced when clean, but in waters of varying density the *Anubias* seem to keep any algal growth in check when they have established themselves satisfactorily. Temperature, light and humidity are ideal in the plant-propagation house; the average aquarist would need to provide base-heating for his bog tank, with cover glasses to preserve humidity, should he wish to cultivate, but within many fish houses this genus of plants would thrive and make interesting specimen plants, with the possibility of eventual inflorescence and the certainty of increase by root-division.

Initial cost of everything is always dependent upon demand and availability, and when *Anubias* are offered from cultivated sources the cost of raising them must be taken into account; but also consideration should be given to their long persistence within a tank, and it is this feature which makes them so desirable for long-term decoration.

The Importance of Swimming Space

(*continued from page* 196)

no food from me, yet it has been alive and perfectly healthy. It is certain that it has been able to get some nourishment from somewhere, but in any case the fish has been as big or bigger than many of the other youngsters which have had constant feeding. Fish packed together do not thrive. They just exist, and this only when constant aeration is used. Any tank about 24 in. by 12 in. by 12 in. will look splendid if well set-up with about four 2-2½ in. goldfish therein. In this they have space to grow and thrive and are less likely to contract any disease.

Think how unnatural it is to try to keep a large number of fish in a small volume. The average tank of size mentioned above is 2 cubic feet in capacity. If such a container could be lowered into an average lake and suddenly closed, I wonder how many fishes would be found in this volume? If a hundred such casts were made it is doubtful if the average number of fishes caught would be more than one small fish per catch.

One might suppose that it is the amount of food given to fishes in a tank which makes them grow, but this is not the only problem. Space is so very important that no matter what kinds of food are given and in what quantities the aquarist will never be successful in rearing large numbers of coldwater fishes in crowded tanks. I have especially mentioned coldwater fishes as I consider that it is far easier to keep a larger number of tropicals in a tank than coldwater fishes.

The aquarist who is breeding fishes for exhibition purposes knows only too well that unless he is able to give plenty of swimming space he is not likely to rear good strong fishes which would stand a chance of winning a prize. The beginner, too, should be content with a very few healthy fishes instead of a large number of unhealthy specimens. It would be much cheaper for him and would ensure that he continued in the hobby instead of becoming one of the sadly disappointed ones.

The Editor and staff of *The Aquarist* wish all our readers a Merry Christmas and a peaceful and Happy New Year

News from AQUARISTS' SOCIETIES

Monthly reports from Secretaries of aquarists' societies for inclusion on this page should reach the Editor by the 12th of the month preceding the month of publication.

THE BRITISH AQUARISTS' FESTIVAL 1958

VISITORS to this year's B.A.F. at Manchester left with vivid impressions of a splendid show and of a job well done, and the Federation of Northern Aquarists Societies must be congratulated on putting up such a fine show. There is no doubt that aquarists in the south of England would be surprised at the style and scale of presentation and at the large numbers who visited the show. This year the Federation allowed each competing society to present its exhibits in a group in as neat a manner as possible, but the elaborate designs seen for the past 3 years were not repeated. Instead of the showy stands, each society displayed tanks more or less in rows, which enabled aquarists to examine the fishes much more closely than had been possible before.

The coldwater section was a great improvement on the past few years and this class alone had six times as many entries as there were last year. Several good coldwater fishes were also seen in the furnished tanks. The "Aquascapes" were very entertaining and there was usually a small group of visitors round these exhibits all day long. The number of visitors was gratifying to the organisers especially on Sunday, when the hall was full for most of the time. This brand new hall, erected on the site of the old cinder-covered car park, is 100 yards long and about 40 yards wide, and well fitted with heaters and adequate lighting. Dealers were kept busy at their stands during the exhibition, and as so many of the visitors were in fact newcomers to the hobby this has been taken as a sign that fish-keeping is once again an expanding hobby in this country.

The results were as follow:

Best Fish in the Show: J. Hodgetts (Burnley A.S.). Best Society Furnished Aquarium: 1, Accrington 68½ pts.; 2, Independent 68¼ pts.; 3, Belle Vue 67½ pts. Best individual furnished aquaria (tropical): 1, G. Longsden (Ashton) 78½ pts.; 2, T. L. Anderton (Rochdale) 77½ pts.; 3, H. Loder (Burnley) 76½ pts. Best individual furnished aquaria (coldwater): 1, M. Welch (Nottingham) 81½ pts.; G. Longsden (Ashton) 77½ pts.; 3, B. Smith (Accrington) 75 pts. Best "Aquascape" furnished aquaria: 1, C. Hill (Nottingham) 78 pts.; 2, J. Pettifer (Accrington) 74 pts.; 3, V. Stephenson (Accrington (70 pts.) Guppies: 1, F. Witham (Burnley); 2, A. Bloom (Belle Vue); 3 Mrs. M. Chapman (Burnley). Livebearers A.O.V.: 1, B. Leigh (Belle Vue); 2, N. J. Boardman (Belle Vue); 3, Mr. Beswick (Ashton). Best Coldwater Fish: 1, Mrs. I. M. Fletcher (Rochdale); 2, D. Johnson (Stretford); 3, J. Coupe (Belle Vue). Angels: 1, Dr. A. T. Linton (Middleton); 2, B. Leigh (Belle Vue); 3, Mr. Rhodes (Ashton). Dwarf Cichlids: 1, Mr. Smart (Ashton); 2, N. T. Boardman (Belle Vue); 3, H. Loder (Burnley). Cichlids A.O.V.: 1, Mr. Pengilley (Burnley); 2, M. Hunt (Nottingham); 3, M. Knowles (Sheffield). Fighters: 1, D. Ormerod (Accrington); 2, H. Loder (Burnley); 3, A. Stackhouse (Middleton). Labyrintha: 1, B. Leigh (Belle Vue); 2, W. New (Macclesfield); 3, Dr. A. T. Linton (Middleton). Barbs: 1, R. Hudson (Rochdale); 2, A. Saxton (Nottingham); 3, E. Townend (Sheffield). Characins: 1, J. Hodgetts (Burnley); 2, J. Ruddlestone and B. Stackhouse (Middleton) tied. Carps and Minnows: 1, F. Bentley (Belle Vue); 2, Mr. Pengilley (Burnley) 3, J. Hodgetts (Burnley). Catfishes: 1, J. Hodgetts (Burnley); 2, J. Hodgetts (Burnley); 3, J. Hill (Belle Vue). Egglaying Tooth Carps: 1, D. Ormerod (Accrington); 2, Mr. Pengilley (Burnley); 3, Mr. Pengilley (Burnley). A. V. other than above classes: 1, F. Witham (Burnley); 2, E. Mooney (Skipton); 3, L. Lewis (Burnley). Breeders (Egglayers): 1, J. Williamson (Belle Vue); 2, N. J. Boardman (Belle Vue); 3, Mr. Pengilley (Burnley). Breeders (Livebearers): 1, J. Bennett (Middleton); 2, Mr. Rhodes (Ashton); 3, B. Leigh (Belle Vue). Plants A.V.: 1, J. Bennett (Middleton); 2, B. Cheshire (Belle Vue). The "Roses" Shield presented for Inter-Society competition between Lancashire and Yorkshire Clubs was won by Lancashire and the Special Prize for the Society whose members won the greatest number of points went to Burnley. The Special Prize for the most Tidy Stand was won by Accrington.

* * *

SUCCESSFUL BRISTOL SHOW

THE annual show of the **Bristol Aquarist Society** attracted 483 exhibits there being close on a thousand fish. The Best Fish of the Show was a Bubble-eye, shown by Mr. B. I. Upchurch and the points trophy was awarded to Mr. W. Hicks of Bristol. The results were as follow:

Goldfish: 1, H. Aston; 2 and 3, H. T. Jago. 3 in. Bristol Shubunkins: 1 and 2, W. Hicks; 3, S. Lloyd. 5 in. Bristol Shubunkins: 1, 2 and 3, W. Hicks. Veiltails: 1, B. J. Upchurch; 2, V. Capaldi; 3, M. Welch. Moors: 1 and 2, N. O. Grimston; 3, B. J. Upchurch. Telescopes, Oranda's, Lionheads, Bubbleeyes: 1, B. J. Upchurch; 2, E. A. Mason; 3, R. W. Savage. Nymphs and Comets: 1, W. G. Bryant; 2, J. E. Palmer; 3, H. C. B. Thomas. Scaled Fantails: 1, M. Welch; 2, G. Harper; 3, A. W. Rudge. Calico Fantails: 1 and 2, P. J. Simmonds; 3, B. J. Upchurch. River Fish: 1, R. Simpkins; 2, P. J. Simmonds; 3, K. Emery. Bristol Shubunkins, bred 1958: 1 and 2, L. G. Emery; 3, W. Hicks. Moors, bred 1958: 1, 2 and 3, N. O. Grimston. A.O.V. Fancy Fish, bred 1958: 1, 2, C. D. Roe; 3, P. J. Simmonds. Breeders team of Shubunkins, bred 1958: 1, H. V. Jenkins; 2 and 3, W. Hicks. Breeders team of Twintails, bred 1958: 1, N. O. Grimston; 2 and 3, B. J. Upchurch. Bristol Shubunkins, matched pairs: 1 and 2, L. G. Emery; 3, W. J. Burns. Coldwater Furnished Aquaria: 1 and 2, S. J. Davis; 3, W. G. Bryant. Inter-Club Furnished Aquaria: 1, Bristol Aquarist Society; 2, Bristol Aquarist Society (Keynsham Branch); 3, Bristol Tropical Fish Club. Coldwater Plants: 1, S. J. Davis; 2, S. Lloyd; 3, S. J. Davis. Tropical Furnished Aquaria: 1, L. E. G. Challenger; 2, Mrs. I. M. Stone; 3, J. T. Holmes. Tropical Plants: 1, L. E. J. Challenger; 2, L. Phillips; 3, L. E. J. Challenger. Fighting Fish: 1, H. Rundle; 2, R. King; 3, R. S. Wigg. Labyrintha (excluding Fighting Fish): 1, F. A. Mould; 2, H. Rundle; 3, L. Littleton. Barbs: 1, R. S. Wiggs; 2 and 3, H. Rundle. Characins: 1, W. H. Webb; 2, Scott Morgan; 3, H. Rundle. Cichlids: 1, G. S. Stone; 2, Miss M. Hill; 3, Mr. and Mrs. J. J. Holmes. A.O.V. Egglayers: 1, W. H. Webb; 2, Scott Morgan; 3, H. Rundle. Mollies: 1, O. M. Iles; 2, W. H. Webb; 3, Vince and Wheeler. Guppies Short Tail: 1, L. G. Somers; 2, Vince and Wheeler; 3, R. S. Potter. Guppies, long tail: 1, R. Janes; 2, R. F. Bryant; 3, L. Phillips. Guppies, females: 1, R. Janes; 2, D. Bayldon; 3, Vince and Wheeler. Swordtails: 1, Scott Morgan; 2, L. Littleton; 3, H. Rundle. Platies: 1, L. R. J. Holmes; 2, H. Rundle; 3, Scott Morgan. Breeders Egglayers, 1958: 1, D. Bayldon; 2, Mr. and Mrs. J. J. Holmes; 3, D. Bayldon.

* * *

A TALK on preparing a programme for breeding and rearing guppies to show standards illustrated by line drawings was given at a recent meeting of **Birkenhead and District A. and H.S.**, by T. B. Johnston. Later in the month a social evening was held, members wives and friends participating in "tombola" complete with prizes.

* * *

AT the first November meeting of the **East London Aquarists' and Pondkeepers' Association**, a club member, Mr. A. Fairweather, showed some most interesting films and among the subjects dealt with was the spawning of Siamese fighting fish, Black Widows and Gouramis. These films, in colour, were most appreciated by the 40 or so members who attended. At the second meeting, Mr. J. G Langstone, of the Metropolitan Water Board, gave a lecture on the London water supply.

* * *

LONDON'S fishkeepers were represented at the Federation of **Northern Aquarists' Societies** open show at Belle Vue, solely by the Independent Aquarists' Society, Mrs. Jay Joyce, their P.R.O., entered a furnished tank, and was happy to gain second award card, and pleasantly surprised to receive a special Diploma also. The show secretary is now Mr. Henry Walters, of 8, Offord Road, N., in place of Mr. Terry Pizzala, whose television activities prevent him from attending.

* * *

MEMBERS of many Societies will mourn the passing of Mr. W. J. Burns of Bideford on the 7th November.

A kindly little man, ready to help anyone who cared to ask his advice on fishkeeping, his patience with the novice was a gem rarely found in those with such skill, and knowledge of fishkeeping and breeding of fancy Goldfish. Shubunkins and Moors bred by Mr. Burns were well known at all Exhibitions and Shows, whether competitive or not.

Always willing, he would carry his fish many miles in order to help the small Society, often to the detriment of his much loved fish. The world of fishkeeping has indeed lost a friend.

* * *

THE results of the **Leeds and District Aquarist Society** show held recently were as follow:—Individual Furnished (Tropical): 1, K. Denham; 2, E. Dobson; 3, D. Hynes. Junior Prize: Master Alder. Individual Furnished (Coldwater): 1, G. Boothroyd; 2, K. Tate; 3 A. Singleton. Inter-Society Furnished (Tropical): 1, Bradford; 2, Pontefract; 3, Skipton. Fighters: 1, C. R. Wilson; 2, H. Cranswick; 3, K. Barrett. A.O.V. Labyrinths: 1, D. L. Cadman; 2, and 3 D. Patrick. Livebearers: 1, K. Smith; 2, C. R. Wilson; 3, J. Goodwin. Characins: 1 and 2, D. L. Cadman; 3, C. R. Wilson. Barbs: 1, H. Cranswick; 2, D. Cadman; 3, F. Holloway. A.O.V. Egglayers: 1, F. Holloway; 2, R. Thompson; 3, R. W. Rhodes. Breeders' Livebearers: 1, K. Smith; 2, and 3 D. Patrick. Breeders' Egglayers: 1, J. Cousins; 2, F. Holloway; 3, G. Cust.

* * *

AT the annual general meeting of the **Yeovil and District Aquarist Society** the following officers were elected:—President, Mr. N. Stainer; chairman, Mr. A. Dominy; vice-chairman, Mr. G. Aston; secretary and treasurer, Mr. D. Langdon, 98, Preston Grove, Yeovil.

At the November meeting an interesting talk was given by Mr. G. Aston on "Characins," and his two Cups for the best Goldfish won at Bath and Bristol were on view.

* * *

Secretary Change

CHELSEA Aquarium Society: Mrs. A. Witcomb, 16 Harcourt Terrace, London, S.W. 10.