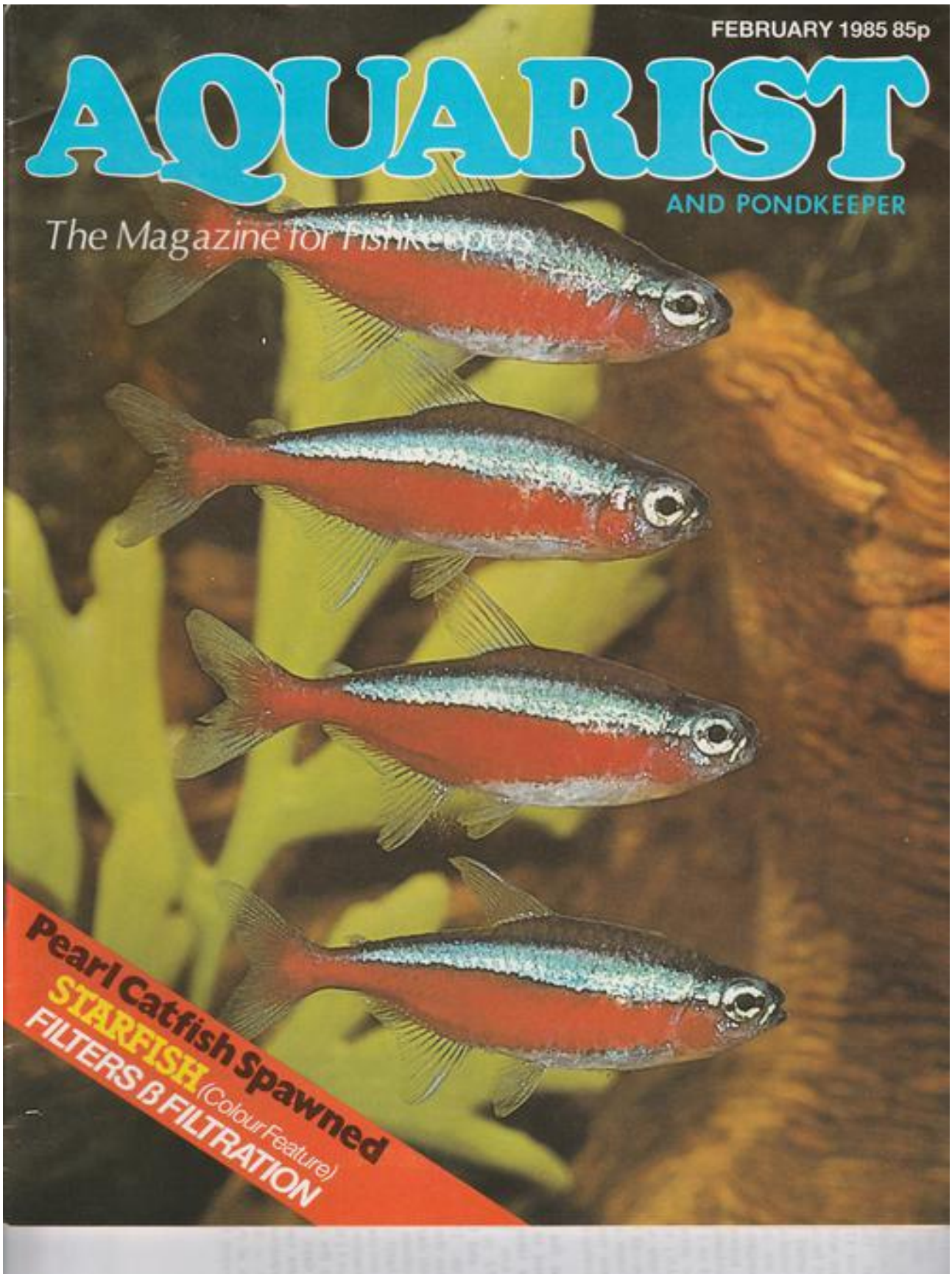
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AQUARIST
AND PONDKEEPER
The Magazine for Fishkeepers
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FILTERS & FILTRATION

COVER STORY *Photo: A. van den Nieuwenhuizen*

There are four main types of 'Neons' available within the hobby, the Neon proper, the Black Neon, the Green Neon and the subject of our Cover Story this month, the Cardinal. All have undergone nomenclature changes as a result of research, mostly carried out on anatomical features. The Cardinal, for example, was the focus of a great deal of attention during the mid to late 1950's following its description under two different names, *Cheirodon axelrodi* and *Hyphessobrycon cardinalis*.

In 1957, the International Commission on Zoological Nomenclature voted in favour of the former name on priority grounds. Priority in this case was just one day, the name *C. axelrodi* having been published on 20 February 1956, while *H. cardinalis* appeared in print the day after! Recently, there has been a further change, resulting from a major publication by Stanley Weitzman and William Fink entitled: 'Relationships of the Neon Tetras, a group of Southern American freshwater fishes (Teleostei, Characidae), with comments on the phylogeny of New World Characiforms' (Bulletin of the Museum of Comparative Zoology, Vol. 150, No. 6, 22 December 1983).

This paper now recognises that Cardinals and Neons are more closely related than their different generic names suggest and has, accordingly, renamed the Cardinal, *Paracheirodon axelrodi*.

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AQUARIST

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WATER FILTRATION

by Ian Sellick

WATER is a substance we very much take for granted as aquarists. We are aware of many of its properties but often make the assumption that what comes out of the tap is fine for our freshwater fishes. Once it is in our tanks, it becomes apparent that the water is being modified by the tank's inmates, and that something needs to be done to it to maintain the crystal clarity of the substance that pours from our taps.

This water treatment may broadly be put under the heading filtration, if we omit any direct chemical treatment on first use, such as dechlorination, which strictly speaking does not actually remove substances from the water. There are a number of different facets to filtration, depending on what needs to be removed. These may be conveniently initially divided into two groups—mechanical filtration that removes suspended particles, and chemical filtration that removes dissolved material.

Chemical filtration

The removal of chemicals dissolved in water is a complex business and ranges from removal of all chemicals to removal of specific types of chemicals.

Water is a very good solvent for an enormous range of substances, many of which are harmful to fish, and some of which are necessary. Water filtration for fish should therefore be specific enough to distinguish between the two. In practice, this is only attainable by combinations of filter types. Firstly, we will look at the 'remove everything' situation.

Chemicals dissolved in water, be they metals such as calcium and magnesium, copper and lead; radicles such as carbonate or sulphate; or organic substances such as tannins and alcohols, are water soluble because they ionise. This means that they form ions that are positive in the case of metals (*cations*) and the hydrogen ions from acids, or negative in the case of sulphates, chlorides and the like (*anions*).

This ionic property can be exploited to remove these substances from water using ion-exchange resins. Put simply, these are substances that remove cations from water and replaces them with other cations, or remove anions and replace them with other anions. For aquarium purposes, the exchange must be of deleterious ions for beneficial ones or unimportant ones.

In a domestic water softener, the water coming from the tap may be hard due to the presence of calcium (Ca^{2+}) and magnesium (Mg^{2+}) ions. These are replaced by sodium (Na^{+}) ions, 2 sodiums for every calcium or magnesium exchanged. This is not particularly helpful for aquarium use, as too much sodium is probably more harmful to many fish than too much calcium or magnesium. So here, we remove the cations and replace with hydrogen (H^{+}). All will be removed: not only the metals, but also ammonium ions. Unfortunately, an excess of H^{+} ions causes acidity, which in this case would be acidity in part due to strong mineral acids (HCl and H_2SO_4), but also due to 'carbonic acid' formed from the liaison of the hydrogen ions and the carbonates and bicarbonates present in the water. This can be removed by aeration to drive off CO_2, but the water is no good for fish until this is done.

The other side of the equation is the removal of anions. Chlorides, sulphates, carbonates, etc, are exchanged for hydroxide (OH^{-}). This is strongly alkaline and is equally bad for fish. By putting the two types together though, it can be seen that the outcomes cancel each other out:

$$H^{+} + OH^{-} \longrightarrow \text{water } (H_2O)$$

Ion exchange resins for aquarium filters are usually thus "mixed bed" resins, and produce pure water (but usually deoxygenated water, incidentally). They cannot be re-used once they have had all their available exchanges performed and must usually be thrown away. Alternatively, it is possible to pass water sequentially through the two types of resin and achieve the same result, in which case each type of resin can be recharged (regenerated) with more of the exchange ions when they run out.

Complete ion exchange like this is, however, a process fraught with difficulties when used as a filter in a running aquarium, and is usually only used to treat water before adding to the tank, eg when making soft water for fish such as discus. When used in a filter, it needs constant monitoring of the outflow to ensure, firstly, that the water doesn't become too soft, and secondly that the resins haven't given out (consider, for instance, the effect on tank pH if either resin ran out before the other!!).

Selective ion exchange resins are available, and are very useful filter media, usually used in outside canister filters (power filters), or sometimes just put in bags suspended in the tank.

The most useful of these is the ammonia ion exchanger, sold by numerous manufacturers. Unlike ion-exchange *resins*, the exchange in this case occurs in a natural mineral, a zeolite called clinoptilite. This exchanges NH_4^{+} for sodium. As the amount of ammonia present in aquaria

is small, sub parts per million range normally, the amount of sodium added is immaterial. This substances may be regenerated by soaking in salt water for 24 hours and rinsing very well in tap water before use. It should be borne in mind that it will only exchange NH_4^+ ions and not ammonia (NH_3). The former is not actually poisonous to fish, the latter is. However, at pH levels below about 7·5 nearly all ammonia present in water is as the ammonium ion; as the water is progressively more alkaline, more NH_3 is present. However, this is an equilibrium phenomenon, and the zeolite will gradually remove ammonia as it changes to ammonium to replace that already absorbed.

Some anion exchange resins will also remove nitrite (NO_2^-) and nitrate (NO_3^-), but so far there is no specific substance to remove the former, although the latter may now be removed with a proprietary product. Converting nitrite to nitrate is a simple process of oxidation, usually occurring naturally, helped by the aquarist, as dealt with below under 'Biological Filtration'.

Substances such as large organic molecules dissolved in water cause problems in ion exchange resins, as some may bind irreversibly or otherwise be dealt with in a damaging manner. It is more usual to remove these using activated charcoal. The sorts of chemicals encountered in aquaria are tannic and humic acids, leached out of dead leaves, bog wood used as decoration, etc., and chemicals added deliberately, usually organic dyes such as methylene blue, malachite green etc., used as fish medicines. Charcoal is organic material from many sources that is burnt under controlled conditions to give a porous carbon residue that will itself burn further in the presence of oxygen to give carbon dioxide and an ash residue. Charcoals can be made from a variety of materials, wood, coconut shell, bone, coal, lignite, paper pulp being the commonest. Of these, the usual aquarium charcoals are made from the first three.

While the actual way charcoal 'works' is still poorly known, we can make some general remarks. The most important aspect of the usefullness of charcoal is its surface area. It is possible to measure this in the laboratory (by the adsorption of nitrogen or iodine usually, then relating the quantity taken as being equal to a layer one molecule thick over the entire surface, hence surface area can be calculated). The sorts of figures obtained are 1200-1400 square metres per gram for coconut shell charcoal and some coal charcoals, down to as low as 700 for some wood charcoals and 300 for paper pulp charcoals. To give an idea of what this means, an ounce of the best grade charcoal has a surface area about equivalent to ten football pitches!!

These figures only apply to activated charcoal. This is charcoal that has been cleaned, for instance by steaming under pressure, to remove the tars and oils that form and clog up the surface, when the original material is burnt anoxically to produce the charcoal.

In order to get such a huge surface area in such a small amount of material, the surface must be vastly sculptured. It seems that activated charcoal is a mass of tiny pores, and it is these that trap molecules from the water, air or whatever medium the charcoal is in. Unlike ion exchange resins, charcoals are totally non-ionic. They will not remove any ionised substance, so can be used in any type of water without affecting factors such as hardness or acidity and alkalinity. However, long molecule organic acids such as tannic and humic acids are removed, as are organic dyes, proteins, protein breakdown products such as amino-acids etc., and most general molecular 'debris' originating from biological activity, whether catabolic or anabolic (breaking down or building).

If charcoal is conceptualised as a serious of pores that 'sieve' the water for molecules, it can be seen that the bigger the molecules, the more rapidly the pores will block. Thus, in a dirty tank with, say, protein loose in the water, charcoal will need replacing more often than if all it has to do is remove the odd dose of methylene blue and a small amount of humic acids. Charcoal can be tested for exhaustion by its ability to remove methylene blue, and cannot be readily regenerated. The usual maxim is to buy the best you can get: i.e. always *activated* charcoal, preferably coconut shell or bone, and replace regularly. A final point is that of all the charcoals, these two are those most easily *wetted*. Many activated charcoals tend to repel water and are next to useless for water (i.e. aquarium) filtration, but are great in the cooker hood in your kitchen.

Both the preceding chemical filters suffer from clogging without prefiltration, so in all situations, large debris should be removed first by mechanical means (filter wool or foam). As ion exchange resins are clogged by organic material, water should be charcoal filtered too before passing over zeolites.

Biological filtration

This is essentially a chemical filtration process that uses bacteria as a living medium to actually modify the water passing through a bed in which they live. They work oxidatively and thus, like all such living organisms, require both an energy source and oxygen to survive. Remove either and the bacteria will die and decay, polluting the water body they are in.

The usual biological filter in aquaria is the undergravel filter where water is passed through a gravel bed which acts as a substrate for the bacteria. Other types are foam in an internal or exteernal canister filter, porous pebbles, both natural (eg dolomite) or artificial (ceramic pieces) that may be used in canister filters or out of the water. The latter, as in the overhead trickle filters manufactured by one or two companies, overcome the depletion of oxygen problem by having the water trickle through the medium in air, not surrounded by water. This is the situation in sewage works, where the water to be purified is sprayed by a rotating boom over a circular bed of clinker exposed to the air.

Any large bits of debris are trapped at the filter surface and broken down either by autolysis or microbiological degradation, and the breakdown products passed through the filter to emerge as harmless substances, or

soluble organics that can be charcoal filtered. This debris will eventually restrict water flow through the filter, particularly in sponge ones, so these should be cleaned regularly in cold water to remove this debris (do not use hot water as this will kill the bacteria that actually do the work). Fish excreta, (in freshwater fish this is largely ammonia), pass into the filter and are oxidised by the bacteria, initially into nitrites and then into nitrates.

$$\text{bacteria} + O_2 \quad \text{bacteria} + O_2$$

$$NH_3 \dashrightarrow NO_2^- \dashrightarrow NO_3^-$$

Some oxidation of ammonia, and of protein breakdown products such as amines (NH_2) will occur naturally, leading to high nitrite levels after feeding, and on a continuing basis if nitrates are not formed by further oxidation. The latter step does not occur without a considerable input of energy, as provided by the bacteria, and does not happen spontaneously.

The chemicals in this nitrogen scheme are all toxic to fish, ammonia more than nitrite more than nitrate: this means that you can convert several 'lots' of ammonia to nitrite before it in turn becomes toxic, and several lots of nitrite to nitrate before it becomes a problem. Nitrate may be used by aquatic plants (including algae) and is usually kept at a safe level by water changes. It can also be removed by the ion-exchangers mentioned previously.

A new innovation in aquarium filtration is denitrification. This happens naturally in some instances, or in specially constructed filters. These work in the reverse way to oxidative biological filtration; that is, in the absence of oxygen. The bacteria are anaerobic bacteria that actually use the nitrate, together with a source of carbon to grow and develop. Surplus nitrate not used for maintenance of the colony is released ultimately as nitrogen. (*see equation below*)

This process seems to require, incidentally, the presence of a small amount of iron.

Mechanical filtration

Whether by power canister filter, internal or external, air-operated box filter, or whatever, mechanical filtration involves passing water through a substrate that in some way traps the particles suspended in it. This is usually done on some sort of porous pad that allows the water through, but whose holes and passages will retain the particles.

Filter wool is the commonest mechanical filter medium and consists of strands of polyester fibre forming a mat. These do not sieve the water, but trap particles by entanglement in the body of the medium. Thus filter wool becomes clogged and dirty throughout its mass, and may actually trap smaller particles better once some material has accumulated. Foams work in much the same way, but are more usually used as a substrate for biological action.

Polyester wools may have an (incidental) electrostatic charge which may help them to accumulate material, although this will tend to leak away in water (some wools get 'dirty' all by themselves if not stored in air-tight containers by this attraction for dust particles in the air).

True sieve filters do not appear to be used in aquaria, although they are widely used in industry. These are usually membranes with pores on the surface that reject particles larger than the pore diameter. With suitable prefiltration to remove the largest material, it should be possible to construct a membrane filter that will even filter out bacteria, although any such membrane would have quite a short life.

The final type of mechanical filtration will filter out particles as small as bacteria and relies on a natural medium to screen the water. This is the diatomaceous earth filter. The medium in this case is the skeletons of millions of diatoms. Diatoms have hard carcasses that are beautifully sculptured with patterns of holes. The filter has a very fine mesh bag to which the diatomaceous earth is adhered by a continual vortex created in the filter by a pump; the particles are driven to the centre and stay there. Filtration occurs both through the depth of the filter layer as larger particles are trapped on the surface or between the diatoms, whereas small particles such as bacteria, algal cells, colloidal material (eg clay) which will go through a normal filter, are retained by the pores in the diatoms themselves.

Unlike a membrane with a similar pore size which is continuous and thus only needs to be a matter of microns thick, diatoms do not pack conveniently into a continuous layer, so quite a thick coating needs to be applied for adequate filtration.

Diatomaceous earth filters have largely disappeared from the scene, but this is a widely used industrial filtration principle, and is a useful aquatic option.

One day it may well be that other established industrial procedures such as ultrafiltration and reverse osmosis will also be applied to aquarium systems to clean and purify water. In the meantime, the choice of filter procedures available is able to cope with virtually any potential application, with relevant changes of scale. Combinations of mechanical and biological filtration are the usual methods nowadays, but ion-exchange and adsorption have their considerable uses. Whatever system is used, remember filters must be maintained too, even biological ones, and nothing really beats changing some water for good quality, unused stuff!!

carbon hydrogen nitrate amines Amino acids

$$(C)_n + (H)_n + (NO_3)_n \dashrightarrow (NH_2)_n + (C)_n + (O)_n \dashrightarrow [C_n(NH_2)_nO_n] \dashrightarrow \text{Protein}$$

$$\text{and } 2(NO_3) \dashrightarrow N_2 + 3O_2$$

[n = any number as required].

THE IN BETWEEN FISH

by Jack Hems

The *Gyrinocheilidae* is a very small family (three or four members of a single genus at most) of freshwater fishes found in running waters in south-east Asia (Thailand and Cambodia) and represented to aquarists by one species named *Gyrinocheilus aymonieri*, which was described for science by Tirant during the second half of the nineteenth century. None the less it did not become available to tropical aquarium keepers in the west until 1955, says the authoritative Dr. Günther F. Sterba in his classic *Freshwater Fishes of the World*.

We cannot know who coined the popular epithets of Chinese Algae Eater, Chinese Loach and Siamese Loach for a fish that is neither a native of China nor a loach (taxonomically speaking, the *Gyrinocheilidae* fits into a slot between the *Cyprinidae* (Carps) and the *Cobitidae* (Loaches)); yet both dealers and aquarists have used these incorrect labels for years: a usage which has irritated many a serious aquarist beyond words.

G. aymonieri is an elongated fish, with a longish-based dorsal fin situated midway on the back. The pectorals, when folded back, extend to a point in line with the foremost rays of the dorsal appendage. The ventral fins begin opposite the middle rays of the dorsal fin. The anal fin is placed near the base of the caudal fin which, when spread, is seen to have a quite wide-spaced lobes. The paired fins are used as props to support the fish when it is lying quiescent on a roughly horizontal or vertical surface.

The hooded mouth is situated ventrally and is provided with sucking lips, rasp-like in texture, arranged in moveable folds ideally formed for clamping onto objects when feeding. The main diet of the fish is the moss-like algae which grows on such things as stones and the glass walls of the aquarium. It is hardly necessary to emphasize the point that, when the lips are pressed tight to a chosen surface water is prevented from entering the mouth cavity. Nature, however, has provided *G. aymonieri* with a water inlet just above the gill-cover. This clearly visible opening permits water to circulate freely inside the gill chamber. Thus extraction of oxygen from the water is not impeded. Interestingly, the throat is bare of the pharyngeal processes which are a common feature of the cyprinids and cobitids.

The general colour of *G. aymonieri* is pale olive to grey, shading to silvery with hints of gold on the underparts. About ten black blotches adorn a dark horizontal band that stretches from the snout, through the gold rimmed eye, to the root of the tail. Above this band, on the dorsal surface, are twinning dark blotches. There are a lot of dark specks over the crown of the head and in the vicinity of the gill-opening. The scales are small and most of them appear to have brown centres.

In the wild state, *G. aymonieri* attains a length of about 10 in. In the aquarium it seldom exceeds half this size. It is a truly hardy fish and stands a wide range of temperature with no ill-effects. For all that, it is not advisable to subject it to any abrupt change of temperature as, for example, a sudden change to living room temperature. Such a change must be brought about very gradually.

As has been mentioned above, the basic food of this fish is the moss-like algae that forms on submerged or habitually damp surfaces. It will not, however, consume anything akin to slimy blue-green algae, or tangled-thread types of algae. Besides algae, the fish will suck in crumbled flake food, minute live food such as tiny *Daphnia* and tiny nematodes. Sun- or oven-dried lettuce, or duckweed, may be used as a substitute for algae.

Sexing mature fish is not difficult. The female of the species is the heavier built of the two, that is in similar-sized fish kept in the same tank. Another thing, the male has small tubercules on the snout, the female has fewer, or hardly any.

Continued on page 27

Your questions answered...

Having problems? Send your queries to our panel of experts who will be pleased to be of service. Every query receives a personal answer and, in addition, we will publish a selection of the most interesting questions and responses each month. Please indicate clearly on the top left hand corner of your envelope which department you wish your query to go to. All letters must be accompanied by a S.A.E. and addressed to:

Your Questions Answered, The Aquarist & Pondkeeper, The Butts, Brentford, Middlesex TW8 8BN.

TROPICAL

Dr. C. Andrews

Tropical

brackish aquaria...

Can you give me some information on setting up and maintaining a brackish aquarium?

To begin with, you should have a look at *Brackish Aquariums* by M. Gos (T.F.H., 1979), which is (I believe) the only book available that is devoted to the subject. Fortunately it is reasonably priced at about £2.

A brackish aquarium can be as small or large as you wish. It should, however, be all glass with a glass or plastic cover, since (just as with marine tanks) the saltwater in a brackish aquarium will cause corrosion problems if metal is used.

Use undergravel filtration, perhaps with cockleshell and coral sand as a substrate (as in a marine tank). The brackish aquarium must be well aerated, although generally speaking most of the fish which you are likely to keep are very hardy.

Use about 1-2 tablespoons of a marine salt mix for 10 litres of water to create the required slightly salty conditions.

The Scat, *Scatophagus argus*, is a good brackish aquarium species

Heat the tank to the mid to upper 20'sC. and provide lighting either just for viewing the fish or for growing plants as well (if they are going to be present).

Suitable fish include Malayan angels (*Monodactylus*), Scats (*Scatophagus*), various Mollies (*Poecilia*), certain rainbow fish (*Melanotaenia*) and Killifish, and Puffers (*Tetraodia*), whilst suitable plants include various *Vallisneria* species and *Sagittaria* species, *Hygrophila*, *Elodea* and *Ceratophyllum*.

Most brackish water fish will feed well on a diet of good quality marine flaked foods and tablet foods, and regularly, partial water changes, are also crucial to their well-being.

Brackish tanks are increasing in popularity, so is it not time that someone formed a specialist society on this branch of the hobby?

water chemistry...

Can you give me some information on pH and water hardness, and how to control water chemistry in the aquarium?

The acidity/alkalinity of a solution is measured in terms of pH values from 1-14. Pure water has a pH of 7 and is said to be 'neutral', while more 'acid' water has a lower pH and more 'alkaline' water a higher pH. Water hardness is related to the amounts of dissolved salts which are present. The general or total hardness (GH) consists of carbonate hardness (KH) plus non-carbonate hardness (NKH), and is expressed as dH. When water has a general hardness of 4°dH or less, it is termed 'soft' and contains little in the way of dissolved salts. The dH value increases with the hardness and at a general hardness of 30°dH or more, the water is considered 'very hard' and contains large amounts of dissolved salts.

Most aquarists rely largely upon tap water to fill their tanks. The pH and hardness of tap water may vary from region to region. Whilst the pH is often neutral to slightly alkaline (pH 7·0-7·5), the hardness may differ considerably. Before setting up an aquarium or even a pond, it is a good idea to check the pH and hardness of the tap water using a test kit available from a local aquarium shop. Depending upon the fish to be kept, it may be necessary to modify the pH and/or hardness.

Some tropical freshwater aquarium fish prefer soft, slightly acid water (general hardness around 5°dH or less, pH 5·5-6·5). Fish such as tetras, certain barbs, killifish, discus, etc. thrive under these conditions. Water may be more acid by allowing it to stand in contact with aquarium peat for one or more weeks before use in the aquarium. Approximately two handfuls of peat (loosely tied in the leg of a pair of tights) should be added to every 10-15 litres (2-3 gallons) of water. This water should be tested to determine when the desired pH is reached. A pH of about 5·0 is the lower safe limit for most fish preferring more acidic conditions.

Hard water can be softened by dilution with clean rainwater, which is itself often quite acid. In industrial areas, the rainwater may be rather polluted, although this may be offset by collecting rainwater in a continuously overflowing water butt. This often dilutes any pollutants that are present. You will need to carry out one or two siting shots to determine

COLDWATER

Arthur Boarder

PLANTS

Vivian De Thabrew

KOI

Hilda Allen

MARINE

Graham Cox

DISCUS

Eberhard Schulze

how much rainwater to how much tap water is required to achieve the desired hardness. Of course, the process of softening and pH reduction may be carried out in one step by allowing peat to stand in contact with clean rainwater.

Certain aquarium fish (eg. Rift Valley cichlids) require harder, more alkaline water (general hardness 10-15° dH, pH 7·5-8·0). These conditions may be created by allowing water to stand in contact with limestone-bearing rocks or cockle shell, or even by the addition of a little sodium bicarbonate. (Limestone rocks may be detected by the addition of a drop of dilute acid (even vinegar)—if it foams it contains limestone). The addition of 1-2 teaspoons of marine salt per 10 litres (2·2 gallons) water often produces hard, alkaline conditions. Water thus treated should be tested before it is used in the aquarium to check that the desired pH and hardness has been reached. Once again, you will have to experiment a little to achieve the desired results. However, special salt mixes may be purchased to create ideal water conditions for Rift Valley cichlids, and, of course, water of the required pH and specific gravity for a marine tank is produced from one of the available seawater mixes.

Having set up the aquarium with water of the required pH and hardness, this may be maintained by regular partial water changes—about 25% every two to three weeks—with water of similar quality. As a result of the biological processes of fish and plants, which can markedly affect pH and carbonate hardness of aquarium water, these two parameters should be measured every week or so. The non-carbonate hardness fluctuates less dramatically, and should be measured about once a month. In this way, potentially dangerous fluctuations may be detected before they have any harmful effects. **C.A.**

Coldwater

food for Orfes . . .

I have some Golden Orfe in my pond and understand that they prefer live foods. Where can I get some during the winter months?

Although it may be said that Orfe prefer live foods it does not mean that they will not take dried foods such as pellets and flakes. Most fishes we keep would prefer live foods and if you offered a goldfish a piece of dry bread and a worm, it is certain that the latter would be eaten first. However, it is quite possible to get some forms of live foods during the winter. White worms can be bred all the year round and during mild spells in the winter earth worms may be dug up, but they may be deeper down. You can also get maggots and worms from a dealer in angling supplies. Frozen types of animal food can also be obtained but when used it should be soaked and thawed out before being used. This is because Orfe prefer to feed near the surface and are not bottom feeders normally. **A.B.**

Plants

pot plants in aquaria . . .

You may be interested in an experiment I have had going for the last two months. I have a very large house plant—a Spider Plant, which produces a prodigious number of plantlets. Some of these I have put under water to see what happens. Some of them are planted in nothing but gravel, with undergravel filtration. These appear to be all right, although some of the leaves are turning brown there is some new growth. The others are in a large jar in about 1 in. of ordinary planting compost under a thin layer of gravel. These appear to be very healthy indeed, although I can find no sign of new growth. Is there any reason why I could not use these plants as I would use Vallisneria or Sagittaria?

I was indeed interested to learn of your experiment with pot plants. It is true that many species of land plants (usually essentially bog plants) will survive in aquarium conditions for a few weeks. In fact many of the plants offered on the market today as aquarium plants are in fact bog plants or land plants. Examples of these are: *Alternanthera sessilis* (Parrot Leaf), *Caladium*, *Chlorophytum* (Variegated Wheat Plant), *Cordyline terminalis*, *Dieffenbachia*, *Pittonia argyroneura* (Snake skin Plant), *Pilea cadierei* (Aluminium Plant), *Syngonium* (Star Dust Plant). Bog plants are capable of surviving in submerse conditions for a few months before they perish. Land plants will survive a few weeks underwater before undergoing total physiological breakdown and then rot away, as you have probably observed by now in your own experiments. So my advice to you is to grow these pretty house plants in pots or plant troughs, but not in submerse aquarium conditions.

Spider Plant, *Chlorophytum*

V.T.

EDITOR'S NOTE

In our January issue Hilda Allen expressed reluctance in advising a Koi owner to heat his outdoor ponds. We wish to state that this opinion was in no way intended to detract from the general usefulness of pool heaters.

Koi

continuous pumping . . .

Having sorted out my pond and filter I would like to thank you for your advice and pose a final question.

At what time should I switch off my pump for the winter, and when should it be re-started?

Biological filtration requires continuous operation at all times, and pumps should not be switched off at the onset of colder weather. You will find that the domestic central-heating pump you are using is very reliable, and quite cheap to run on a permanent basis using no more electricity than a 100 watt light bulb.

The water return, which can be lowered to avoid excessive cooling, will effectively keep open a necessary hole when ice covers the rest of the pond, thereby solving another problem for both Koi and keeper. For the beginners I would explain that maintaining an open hole in ice is vital to the fish, who could otherwise suffocate in oxygen-depleted conditions.

Running round with cans of hot-water every morning to make a hole is quite unnecessary if a pump is kept in operation, which is the safest and cheapest way to keep pond water in a healthy condition, so you know it makes sense.

Marine

angels, idols and algae . . .

This is my second letter to you. My first letter described my system which is a centralised filter tank. In the filter I was considering a delicate fish. Either a Moorish Idol or a Regal Angel, the water conditions are ammonia nil, nitrite nil, nitrate 10ppm, pH 8·0 and SG 1·023. Would these conditions be suitable? Please could you give me some tips on feeding these fish and their care?

I have a healthy growth of a green moss type algae. Would this choke *Caulerpa algae*? In my last letter you told me my lighting was strong enough to grow this plant. Can you tell me a source where I can buy some plant please?

Moorish Idol and Regal Angel

Both species should be treated as soon as you obtain them to rid them of the endo- and ectoparasites which both species are rather prone to. Failure to rid them of these parasites will result in their refusing food or eating in a desultory fashion and slowly losing weight due to the burden of endoparasites. Due to your admirably low nitrate reading (no doubt due to the algal growth and regular partial water changes), both species should flourish in your tank.

Caulerpa **algae spp**

Owing to the very rapid rate of growth of most *Caulerpa* species, I think you will find that these higher algae are untroubled by the thread algae. You will almost certainly find that, in order to support the growth of both species of algae, you will have to enhance the fertility of your seawater with a good algal fertilizer.

fish with crabs and shrimps . . .

I have a small 24 in. × 12 in. × 15 in. tank set up with a Boxing Shrimp, Dancing Shrimp and Arrow Crab. What small fishes would you recommend for this tank?

Due to the fact that you give no indication of the type of filtration, rockwork, corals, etc., it is rather difficult to answer this one. What is certain however is that the tank is very small at only 15½ Imperial gallons to be pressed into service as a marine aquarium of any type at all!

Assuming that this tank uses undergravel filtration and possesses a reasonable amount of rockwork and coral—living or otherwise, the actual net-capacity is probably no more than 12 gallons. Now, working on the *maximum* stocking capacity of 1 inch of fish to each 2 gallons of seawater, (—and 1 inch to each 4 gallons would be safer in view of the tank's small size), you have room for 6 inches of fish which need to be gentle and quiet species with no pronounced territory—defending traits. An example of such a collection might be a male/female pair of seahorses, and a small Emerald/orange Filefish (*Oxymonacanthus Longirostris*)—though all these fishes measured nose to tail-tip should only add up to a total of 6 inches.

criticisms and recommendations . . .

I have been keeping marines for just over one year, with moderate success. At the moment I have a 48 in. × 15 in. × 12 in. set-up.

It is filtered by all-over undergravel plates powered by two power heads, an external power filter and a 15 in. skimmer. The lighting consists of two 3 ft. 30 watt "Northlight" tubes and one 3 ft. 30 watt "Gro-Lux".

Stocking consists of: 2 African Clown 2½ in. and 1½ in.; 1 Cream Angel 3½ in.; 1 Blue Damsel 2 in.; 1 Malu Anemone; 2 Sand Anemone.

I am considering setting up another tank 53 in. × 15 in. × 12 in. The questions which I have are as follows:

1. Are there any constructive criticisms you could make on my existing system?

2. Would four more African Clowns 2 in. in size and 1 Malu Anemone overstock the system?

3. I am planning to use the reverse-flow system in my new set-up. Please advise on what size of power filter and other criteria involved in such a system.

A young Majestic Surgeon, *Acanthurus bleekeri*, would be a suitable addition to most tanks

1. *Criticisms:* None—your set-up sounds fine. I am a little surprised that you purchased a protein-skimmer (unless for use as an ozonisation chamber), since I have always found that, once the cockle-shell/coral sand filter-bed had matured bacterially, there was never any proteinacious residue to skim.

2. *Stocking:* If your two African clownfish are not fighting then they are almost certainly a sexed pair. The larger fish will be the female and the smaller one the male. It would be a great shame in my view to disturb their wedded bliss by introducing more fish of the same species and would probably now lead to serious fighting. Why don't you consider a Surgeon/Tang/Butterflyfish/Angelfish/Batfish/Wrasse purchase instead? If you do buy a Butterfly fish it had better be a Chelmon or Forcipiger species in view of the presence of the anemones.

3. *Reverse-flow:* A 53 in. × 15 in. × 12 in. tank would have a gross capacity of 34½ Imp. gallons (155 litres) but once the aquarium contained an adequate depth filterbed (average 3 in. depth *minimum*), and some rockwork, etc., its nett capacity of seawater would be of the order of 26 Imp. gallons (118 litres). You will need to turn this water through the filter-bed at least twice each hour and three passes per hour would be better still. Thus you need a power-filter having an hourly turnover rate of 50 to 75 galls/hr. (= 225 to 350 litres/hr.).

G.C.

Discus

ulcers . . .

I wonder if I could trouble you for advice on some young discus I have.

I purchased four young brown discus about three months ago. At that time they would have been the size of a 5p piece. They are kept in a community tank. I know that this isn't ideal—but at present I only have one tank—36 in. × 12 in. × 15 in. with neons, glowlights and two pairs of Emperor Tetras.

I change approx. 1/6th of the water weekly—replacing it with fresh tapwater. The local water has a pH of around 6 (at least in the tank it has) and is soft; very soft for Carbonate hardness and soft for General hardness.

The fish have settled in and eat very well—although only flake food. However, they increased in size, are active and always swim with fins erect.

About a month ago I noticed on one of the discus a small pale mark in the middle of the body. I thought at first it had been fighting and had been bitten or bumped against a rock. Within a few days this has progressed to an obvious ulcer.

The fish is healthy otherwise, although it occasionally darkens. As the fish has grown, so has the ulcer. I would say it extends through the thickness of the fish's skin. The edges of the ulcer are clean—there is no inflammation or fungus. There does, however, appear to be an edge of dead tissue around the ulcer.

Shortly after this appeared another 'spot' on the same side of its body near the base of the dorsal fin. This was more like a small pustule and remained like this until the past few days and this has now broken open and revealed a small ulcer. Furthermore, the 5th and 6th spine of the anal fin seem to be affected.

One of the other discus shows a small mark, on the base of his/her caudal peduncle. This has been present for almost 10 months.

I intend buying a 4 foot tank in the near future to have the discus separately but I wonder about the logic of continuing with these fish if they may be carrying something contagious.

I must say I have seen many types of ulcers in the skin in Discus but nothing like you describe. I have spent some considerable time trying to find something about it in some of my many books but, alas to no avail. The only way to make sure and put a name to this ailment would be to take a sample and have it examined under a microscope.

Obviously, the disease is contagious since a second Discus appears to suffer from the same ailment. I suggest that you either experiment with some of the new type of aids now available like *Furamor-P* (I have tested this new German aid and found it most effective). Or you can try something like *CQD*, which also works wonders.

I also would suggest that the next time you get Discus you start with a size somewhat larger. Although they always seem that much more expensive—they always are that much more healthy.

Finally, provide them with a more varied diet and not just a flake food. Discus are 'high protein' fish and must be fed accordingly; if they also take flake food that can only be of great benefit since they usually contain a supplement of vitamins and minerals, essential for the proper growth and well being of the fish.

E.S.

Company Profile

King British Aquarium Accessories Co. Ltd.

The retail shop is both spacious and attractive as this photograph shows

ALTHOUGH the majority of our readers will be familiar with the snappy catchphrase, "We are sprinkled all over the world" that has accompanied King British advertisements in recent times, relatively few may have a full appreciation of the extent of the organisation behind the slogan.

Keith Barraclough started in the aquatic business in his father's petshop back in 1952. After an enforced break for his National Service (1955-57), he made a fresh start in retailing and was soon on the way towards establishing the organisation which he now heads as Chief Executive.

In 1970, both the existing companies, King British Aquarium Accessories Co. Ltd. and Keith Barraclough, Aquarist Ltd., were incorporated. Although the latter name still stands (it is the Holding Company for all the 'KB' activities), the importing and wholesale "arm" of the organisation now trades as Barraclough's Fish & Aquarium Supplies which operates largely in the North of England and supplies over 300 outlets. Heading this side of the business as Operations Director is Paul Barraclough, Keith's son, aided by Michael Cole (Sales Manager) and Keith's daughter, Dawn (Buyer and Cash and Carry Manageress).

Barraclough's Fish & Aquarium Supplies is also responsible for handling all the livestock, totalling approximately 2·5 million fish per year. Average stocks at any one time stand at around 50,000 fish. As one would expect from a company whose Chief Executive is President of O.F.I. (Ornamental Fish International), all stocks undergo a period of quarantine or, to quote Keith Barraclough, "acclimatisation". A walk through this part of the premises vividly shows the ingenuity that has gone into devising a system that allows for an automatic 50% water change of all 240 tanks to be effected in 10 minutes, thus saving a great deal of effort and man-hours.

Every tank, including the 60 large ones in the retail shop, is filtered and then further purified by a King British Overhead Trickle Purifier (O.T.P.). There is even a modified O.T.P. in the coldwater section capable of processing 4½ tons of water per hour. The principle behind this *purification* system, which is often confused with *filtration*, is quite simple. By raising aquarium water via an airlift into a chamber above tank level, contaminated water is brought into direct contact with atmospheric air. At 20% oxygen concentration, air is much richer in this gas than water. As the water trickles over a bed of highly porous stone chips, it is purified by aerobic (oxygen-requiring) bacteria which, because of the high oxygen concentration, are claimed to be substantially more effective at their job. What the O.T.P. does not claim to be is a mechanical filter—it is a purifier.

The O.T.P., plus all the other types of aquarium equipment, foods and remedies are manufactured by King British Aquarium Accessories Ltd. led by Keith, Gordon Holmes (Technical Director) and Steve McKenny (Sales Manager).

The latest King British product to appear is Medicated Flake, the first flake of its kind in UK. This has an antibiotic added in the course of manufacture to combat a range of bacterial diseases, including Ulcer Disease in Goldfish. Because of its antibiotic content, this food is only available on prescription from a vet. On obtaining a prescription, 1 Kg tubs can then be bought direct from King British. (6 Kg tubs have been available since autumn 1984.) 25 gram packs can also be obtained from some vets (details from King British) and plans are already well advanced to increase the range which claims to be a major breakthrough in the treatment of fish diseases.

For full details of King British and Barraclough's Fish & Aquarium Supplies, contact Keith or his staff at Hayfield Mills, Haycliffe Lane, Bradford, BD5 9ET, West Yorkshire. Tel. No. Bradford 576241 (3 lines).

by
Roy Pinks

THE incredible antics of the NUM and the NCB continue to haunt the owners of tropicals, freshwater and marine alike, and the spectre of winter power cuts makes it worth considering the possibilities of temperate aquaria for the home. These occupy a position between coldwater and tropical, and for some reason have not caught on as they might. This article deals only with freshwater species, but marinists are probably aware anyway that there is plenty of scope for them in the 60-70°F. bracket, in which numerous saltwater species are happier than in warmer conditions.

The temperate tank may be defined as one which is unheated, but situated in the home. Its temperature range would probably encompass 55-65°F., though in many cases there would be higher upper limits. Stability of temperature would be greater in blocks of flats or terraces than in detached or semis, as a general tendency, but local conditions in all cases are the deciding factors. On the face of it many aquarists are a little afraid of the unheated tank because they think that anything which is obviously not coldwater must have a heater in its vicinity if it is to survive. They admit to a few species which are recognised as "midway fish", but tend to dismiss them as being unattractive and not worth bothering with. To be fair, it must be accepted that coldwater and temperate fish do not usually have the sparkle or the colour range of tropicals, but there are exceptions even here, and those who have seen bitterling and sunfish at their best will certainly wish to contest the issue. The greatest challenge with temperate fish is that of treating them on the basis of one species to a tank. This should put the enthusiast on his mettle, as he will know that this technique is likely to produce first class fish and striking visual impact.

The species usually recommended are White Cloud Mountain Minnows (*Tanichthys albonubes*) and the Golden Medaka (*Oryzias latipes*). The former is well known as the Poor Man's Neon, and truly glows at an early stage in its life. The Medaka is less common and resembles a slender Golden Orfe, though having somewhat pinker tones. Both are easy to keep, having no dietary fads, and will live together in harmony. *Vallisneria* and *Myriophyllum*, starkly contrasting one another, will prove satisfactory in the temperate tank, and most of the normally available range of aquarium plants will survive, though some will prove superior if the local water chemistry happens to suit them. To make up for the lack of suitable species, I would suggest that the tank lighting be enhanced: the accent on this makes quite a difference.

Thus far, nothing I have said is in any way contentious, but when I look through much of the literature in search of recommended temperature ranges I am struck by the constant repetition of the formula "75-80°F.", which suggests that anything much upwards or downwards would lead to trouble. Perhaps, because we all seek the easy way, we set our thermostats according to this dictum and shovel in the fish irrespective of their optimum needs. On the whole I think we probably pamper our fish, and a figure nearer 70°F. might well, in the long run, prove suitable for more species than we suppose. I can recall my earliest essays with tropicals, when there was no electricity and gas was expensive to harness to small tanks. Hopelessly inefficient heating scarcely raised the water temperature at all, and for weeks on end my fish survived in the region of 40°F. and even bred. This absurd state of affairs was acceptable to the old common or garden guppy, but I fear that its modern counterpart would not find such conditions tolerable All the same there is little doubt that a slowly dropping temperature can be accepted by a wide range of fish, but it has never been recorded which species will tolerate what, and what the penalties might be.

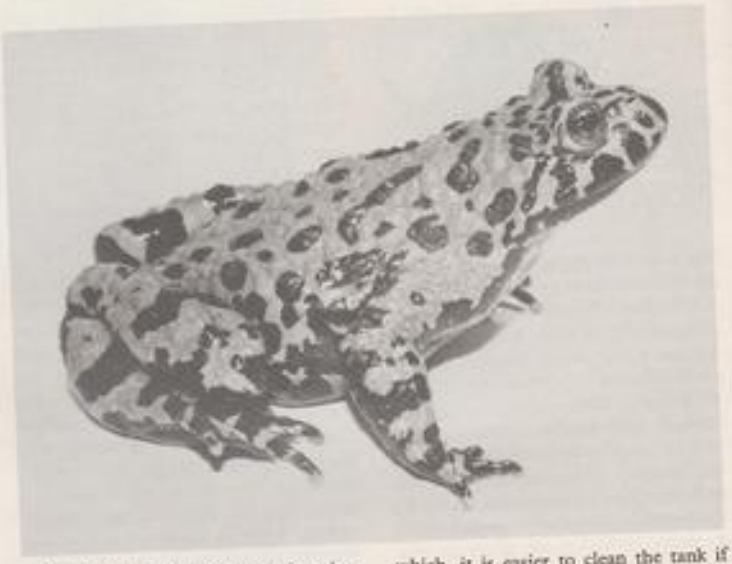
Generally the point of intolerance would be that at which individual species ceased to feed. However, this might need qualification. If a normally heated tank gradually cooled down due to power failure, most fish would probably cease to feed at about 65°F. But if individual species had been cooled gradually to that point, it is likely that feeding would continue at a degree or so lower. A further loss in cooling would be colour and vitality, and breeding would also be suspended. For how long these losses would continue is also uncertain, as adaptation to natural variations is in the nature of most living things, with considerable emphasis on the need to perpetuate the species.

Scientific exercises aimed at answering some of these questions probably have little commercial significance, hence they have not been encouraged, but to the fishkeeper the data to be gained from such would be much more than purely academic. The question of temperature tolerence is not just an idle one. Before the Great Freeze we would have doubted our ability to survive it—the temperatures in many places were ludicrously low. Yet many folk honestly believe that their homes have to be heated to 75°F. for them to be healthy to live in. We all seem to have adapted upwards in terms of heating, but the time may come when we shall have to consider the reverse tendency quite seriously. It would be interesting to hear from any sources how lower temperatures have been accepted by fish, and I shall be pleased to enlarge on the subject if any information does, in fact, become available.

THE ORIENTAL FIRE-BELLIED TOAD

by Chris Mattison

UNTIL a few years ago, the Oriental Fire-bellied Toad had been seen by only a very small number of vivarium enthusiasts. However, it has recently been imported in quite large numbers and there should be no trouble obtaining specimens from those pet shops which keep some of the more 'exotic' animals. It is the most brilliantly coloured of all the Fire-bellied Toads, of which there are four species in total (*Bombina bombina*, *B. variegata*, *B. maxima* and *B. orientalis*), and hails from South-east Asia. Most imported specimens come from China. An average-sized example measures about 4-5 cm from snout to vent, and is rather plump. The back, and the upper parts of the limbs, are covered in warts, and the pupils are shaped like inverted tear-drops. In colour, this toad is almost unbelievably gaudy, the back being bright green with black spots, whilst the underside is scarlet, again with black markings. The purpose of this coloration is two-fold: when at rest amongst aquatic vegetation the green and black dorsal surface serves to camouflage the toad (cryptic coloration), but if threatened or disturbed the toad arches its back displaying the bright ventral surface which startles its aggressor (aposematic coloration). In addition, the bright colours are associated with poisonous or distasteful prey (the wasp is another example) and this will also deter the predator. (Like most amphibians, the Fire-bellied Toads can produce toxic substances from glands in the skin, although these are not dangerous unless swallowed—after handling such animals it is advisable to wash the hands thoroughly.)

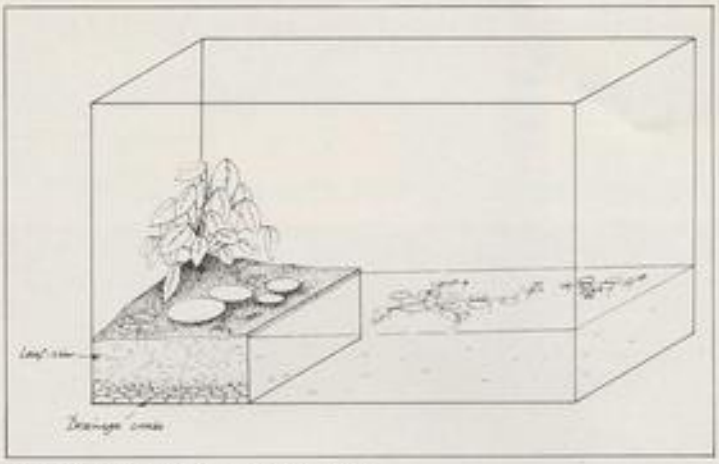


Care of these beautiful toads is quite easy and they should live for several years in captivity and may even breed. A medium-sized aquarium is the best means of housing them, and this should be filled to a depth of 2-3 inches with tap water. Roughly one-third of the area should be land, this being arranged by dividing the tank with a strip of glass and filling in with pebbles or compost, or by arranging flat rocks so that they are slightly above the water-level. A piece of bark or a broken clay plant-pot on the land area will act as a hideaway for the toads and help them to adapt to captivity.

Floating plants, such as Duckweed or *Salvinia* may be grown on the water, but rooted plants are unsuitable because they will quickly become disturbed as the toads move about (apart from which, it is easier to clean the tank if this part of it is kept free from any substrate). Because the toxins in the toads' skin may build up in the water, it is essential that they are kept very clean—the water should be siphoned out completely and replaced at least once every week.

Although these toads are not strictly tropical they should be given a minimum temperature of about 65°F, and care should be taken to see that this does not rise above 80°F. The tank should be well lit, either by natural light or by effective aquarium lighting.

Fire-bellies have hearty appetites and they will each eat several small insects, e.g. crickets, or a thumbnail-sized lump of *Tubifex* every day. Other foods which they will accept include earthworms and freshwater shrimps, *Gam-*



Suitable Vivarium for Fire-bellied Toads

marus. Unlike many toads they will feed under the water as well as on the land, and small fish would not be safe with them (even if they could withstand the constant disturbance). Similarly, smaller amphibians would soon disappear.

Breeding takes place at most times of the year, the only requirement being that both sexes are present and that an adequate diet is provided. A change of water appears to stimulate reproductive activity but this is not always necessary. The sexes may be told apart by the thicker fore-limbs of the male and the more rotund body of the female. These toads have a pelvic amplexus, which means that the male grasps the female immediately in front of her hind limbs. If she is not ready to spawn she makes repeated squeaking noises until released. A similar release call is made by males if they are grasped by mistake. If conditions are suitable (and if the correct partner has been selected) spawning takes place shortly after amplexus has begun. The eggs, usually about 50, but apparently up to 200, are laid singly and scattered over the bottom of the aquarium. If rocks or plants are present they may adhere to these. The eggs should be removed using a bulb pipette or a siphon, as they require clean conditions to develop successfully. They can be incubated in an aquarium containing 6-9 inches dechlorinated tap-water, taking care to remove any infertile or fungused eggs as soon as they are seen. The young tadpoles develop quite quickly and may be fed on lettuce which has been boiled for a minute or two to soften it, or on a good quality fish-flake. Provided that adequate food is given, and that the water is kept clean, for instance by a small box filter and/or periodic water changes of 25%, there is no reason why the majority of the larvae should not develop fully. At metamorphosis the young toads should be transferred to a tank arranged like that of the adults but with rather less water, and fed on small crickets or *Tubifex* or White-worm placed in a shallow dish on the land area. Growth is rapid and the toads can mature within one year of metamorphosis.

Captive bred animals are often less brightly coloured than wild-caught stock. The most natural way to correct this is to feed them plenty of small crustaceans, such as *Daphnia* or *Gammarus* during their first few months. Alternatively, their colouring may be enhanced by adding small quantities of colour-food to their diet.

In summary, this species fulfills all the requirements of captive amphibians. It is relatively inexpensive, easily maintained, and, given correct attention, will breed under quite simple aquarium conditions.

THE IN BETWEEN FISH

continued from page 19

Large *G. aymonieri* sometimes become quarrelsome among themselves. This, though, when several specimens are kept together. A single pair in a tank rarely, if ever, fall out and, in any case, their quarrels are not long-lasting or 'bloodthirsty'. It is not unknown, however, for well-grown *G. aymonieri* to swim up to a sluggish or stationary fish and attach itself to its side. This nasty habit can cause alarm if sore places occur on the victim's side. All the same, *G. aymonieri* has always behaved itself (when in my care) in any community tank housing a collection of small and fast-moving fishes such as tetras and barbs and the smaller livebearers. In brief, then, it is no more danger in the average community tank than is a cantankerous male swordtail or the untrustworthy opaline gourami.

Before bringing this article to a close, it is necessary to point out one or two distinctive characteristics of *G. aymonieri*. Firstly, it swims in darting movements—upwards or across the bottom. When swimming just above the compost it will soon sink down for a rest every so often as though completely exhausted by its exertions. The reason for this is easily explained. Although *G. aymonieri* is possessed of a swim-bladder, it is not a very effective one and does not lend the fish much buoyancy in the water. Next, the fish is exceedingly difficult to take in a net. It seems to enjoy teasing its pursuer by getting into awkward corners, burrowing into the substrate, or hiding in the roots of plants. So far as my knowledge extends, the fish has not bred in captivity (at least my memory-bank cannot recall any mention of its breeding in the aquarium literature which weighs down my shelving) and it lives a long time.

STARFISH

The Pentaceraster starfishes are the hardiest of the group and often among the cheapest. Unfortunately almost all of the knobbly-armed stars are active predators and a few are highly destructive to sessile invertebrates

by
Martyn Haywood

THE coral reefs of the world provide us with some of the most beautiful and bizarre animals in the world. A large proportion of these are echinoderms—sea lilies, brittle stars, starfishes, sea cucumbers and sea urchins—and fortunately for us, many are fairly easily maintained by aquarists. Most shops carry, or can obtain, a fairly wide variety of these animals but although a large number can be maintained with fishes they tend to be ignored by many marine fish-keepers.

In this brief article I intend giving a few guidelines, from personal experience, regarding the echinoderms that aquarists are likely to come across.

Sea lilies, also known as feather stars and more properly called crinoids, are among the most primitive creatures in the world, being largely unchanged from prehistoric times. They are mainly deep water animals and frequently appear upset by the comparatively high levels of light they are subjected to in the average home aquarium. There are two forms of crinoid one of which is fixed to rocks by a slightly flexible stalk. These are rarely obtained undamaged and are totally unsuited to tank life.

The other form has numerous finely branched arms sprouting from a comparatively small central disc and lives in caves and crevices in fairly shallow tropical reefs, emerging at nightfall to feed on plankton.

Continued on page 30

STARFISH

Continued from page 28

These are a much better bet for the home aquarium but even they rarely fare well. They have a high food requirement for a small animal and as they will not feed in bright light, keeping their arms tightly rolled, this is obviously a problem. They are also very sensitive to rapid changes in water quality, specific gravity and pH. I am sure I was not the first aquarist, and will not be the last, to have unpacked a crinoid into my tank only to find a few hours later a small mound of fragments as the last trace of the animal.

The proud new owner of a crinoid must take at least two hours slowly mixing his tank's water with that in which the animal was packed if it is to be safely acclimatised to its new home. Provided this degree of care is taken and a special point is made to feed very finely graded food after lights-out, a crinoid may last a few months—but do not expect great longevity.

In complete contrast I fnd sea-urchins to be one of the most interesting and simple groups of animals to maintain. Until I received one in a piece of living rock I had not found them particularly inspiring or desirable. Now, however, as I type this, that specimen has been in my tank for over two years and now has a test (shell) nearly three inches in diameter. I also have a pencil urchin which is faring equally well.

These animals are characterised by having an approximately spherical shell from which sprout a greater or lesser number of spines. These spines vary from very long and needle sharp to short and blunt. The mouth parts are on the lower side of the shell, waste being expelled from the top. Between the spines are situated the tube-feet with which the urchin can gain a stubborn foothold on whatever surface it moves.

When purchasing a sea-urchin it is well worth studying the animal for a time. A healthy urchin will be moving both its tube-feet and its spines. If the spines are lying flat, giving the urchin a somewhat thatched look, it should be given a wide berth as it has not long to live. It is also important that urchins are not lifted from the water. An air bubble may be trapped in the mouth-parts, known as the Aristotle's Lantern, and in this case decay soon sets in.

Urchins can be split into three groups, the longspined, shortspined and slate-pencil urchins. Of these the shortspined are generally the easiest although none poses serious problems. All are general purpose scavengers and will quickly deal with any excess green algae. While primarily herbivorous all appreciate a little meaty food in the form of mysis shrimp or similar and this should be dropped among the spines, to prevent any fishes present taking it. The urchin will use its tube-feet to transfer the food to its mouth.

While most urchins do not boast particularly spectacular colours, ranging from black, through shades of brown to pure white and combinations of these, there are exceptions. A particularly pretty reddish-pink shortspined species from the Indo-Pacific seems to have a bright future as an aquarium specimen. Incidentally, from my own observations of urchins ingesting tuffa rock and expelling small, almost spherical granules, they may play a significant role in the erosion of coral reefs.

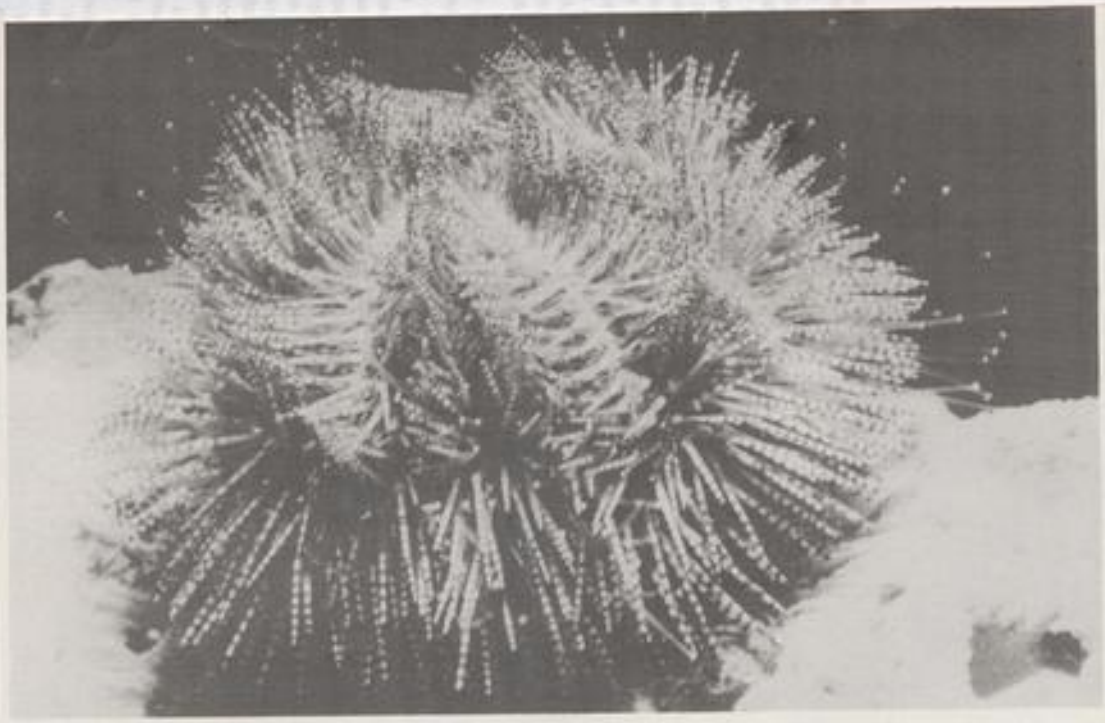
Starfishes, besides being one of the most commonly seen and easily recognised invertebrates, are in the main easily maintained. They are also among the most gaudily coloured animals in the sea. Although red and blue species are among the most common, others are occasionally available sporting every colour imaginable. They are also very variable in shape. They may have from four to over a dozen legs and vary in shape from typical five arms sunburst to the almost pentagonal biscuit stars.

Starfish, too, should be carefully examined before purchase as there are two common problems besetting these animals. The first may be imagined as the starfish equivalent of fin-rot in which the tips of one or more arm appears to be rotting away. In these cases amputation and sterilisation of the remaining stump offers the only, and at best, slight chance of saving the animal's life.

The other, less easily seen, malady involves a small boring mollusc, not unlike a miniature, greyish scallop. This bores through the starfish's skin and eventually punctures the internal water vascular system so causing the animal's death. This unpleasant shellfish generally appears on the underside of the arms, in sizes up to a quarter of an inch in diameter, and appears comparatively common on the blue starfish, *Linckia laevigata*.

Regarding feeding, most of the stubby or knobbly armed starfishes, such as the Protoreaster species, will fare quite happily on a diet of mussel, crab or fish strips. These should be placed under the animal to prevent theft by fishes or shrimps and crabs. The majority of other species perform a useful job scavenging small particles of food which have evaded the tank's other inhabitants.

While the brittle or serpent stars, which are very rapid movers on their long slim legs, may look delicate they are at least as hardy if not more so than the shorter armed species. The serpent stars are characterised by a very distinct central disc and, normally, five long, thin, and apparently segemented legs which they can stiffen to



This pink Sri Lankan sea-urchin is one of the more colourful species and like all its relatives can soon solve problems with excessive algae. Most species are harmless if handled with care but a few are dangerous to man

rigidity at will. They have a rather tedious habit of spending most of their time hidden in rock crevices but the first scent of food in the water will bring them scurrying from their hiding places.

A word of caution—do not keep a Coral Banded Shrimp, *Stenopus hispidus*, in a tank containing a number of these starfishes. I once saw one emerge from battle with a serpent star, sporting only two antenna, one claw and two legs—not a pretty sight. Also many of the shorter armed starfishes will feed on molluscs, such as a prized flame scallop. In its turn the Harlequin or Orchid Shrimp, *Hymenoceros elegans*, will generally only feed on the tubefeet of starfishes while the aptly named Bumblebee Shrimp takes only the tubefeet of sea-urchins.

Probably the most infamous species of starfish is the Crown of Thorns, a large dark species with a large number of heavily spiked arms. This species feeds, apparently exclusively, on coral polyps and was, only a few years ago, causing great damage to Australia's Great Barrier Reef. Fortunately the plague of these starfish seems to have abated and many devasted areas are quickly regenerating.

Sea-cucumbers have increased in popularity among aquarists in recent years with the regular importation of more colourful species from the East Indies and neighbouring areas. Most cucumbers have a short cylindrical or pear shaped body crowned by a rosette of feathery tentacles which serve to capture planktonic food.

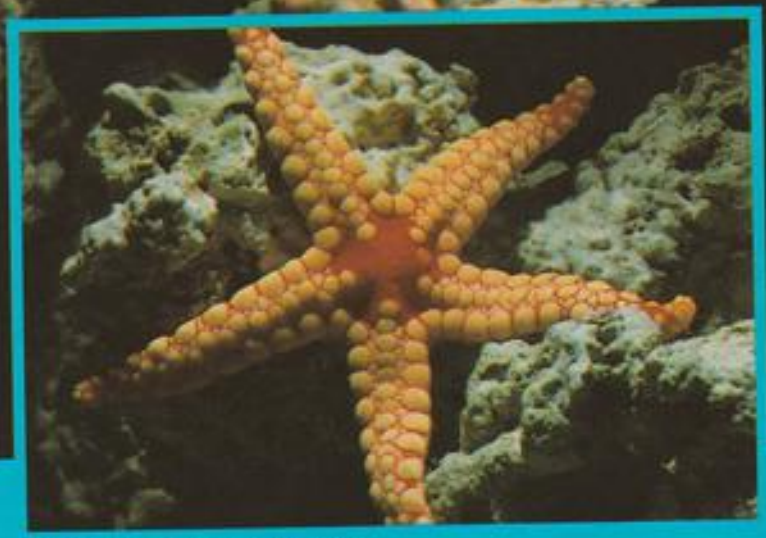
One particularly spectacular species is *Paracucumaria tricolor* from Singapore. Its body varies from pink through to purple-blue with five yellowish bands from which sprout the animal's tube-feet. The inch long tentacles are generally scarlet but may be orange or crimson. All cucumbers feed on particulate matter and their actual method of feeding verges on the comical. Each tentacle, in turn, folds inwards and is pushed into the mouth. It is then slowly removed, minus food, rather like a small boy sucking jam from his fingers.

Cucumbers invariably climb to a position with a good water flow and it is almost impossible to remove them from an inconvenient site without damaging the tube-feet. Fortunately these regrow quite quickly. If, however, a cucumber suffers a severe shock, such as an attack by fishes or sudden change in water chemistry, it has the un-nerving ability to eviscerate itself, throwing out a mass of intestines and other organs from the vent. This disgusting reaction is generally enough to disuade predators and in the wild the viscera regenerates rapidly and the animal is none the worse for the experience. This is not the case in tanks and an eviscerated cucumber rarely recovers so sudden changes in water quality must be avoided. Provided this proviso is met cucumbers generally prove among the hardiest of filter feeding invertebrates.

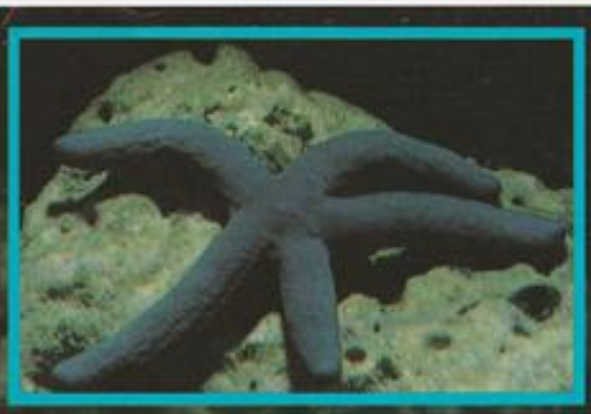
There are a number of rather drab, and often large, species which ingest detritus from the substrata but these are rarely imported and are of little interest to aquarists.

The relationship between anem-

Scarlet-tentacled Cucumaria species from Singapore are among the most colourful and regularly available sea-cucumbers. They are commonly called sea-apples to avoid confusion with their drabber relatives



One of the most distinctively coloured starfish is the orange and red Fromia monilis from Sri Lanka. It adapts easily to aquarium conditions and usually proves long lived



Linckia laevigata, looking as if made from children's plasticene, is one of the few blue invertebrates regularly available to hobbyists. It warrants a place in every invertebrate tank.

This brilliant red Ophidiaster starfish is one of the most vivid invertebrates Singapore has to offer. This harmless particle feeder virtually glows under Gro-lux lighting.

ones and marine clownfishes is well known. A less studied togetherness involves sea-cucumbers and fish of the Carapus family. Apart from one species which dwells in the body of pen shells, these fish have the unsavoury habit of living in the cloacal chamber of certain cucumbers. Here they apparently receive protection from predators as holothurians reputedly taste foul. Some species even go so far as to feed on the gonadal material of the cucumber obliging enough to play host.

None of these fish species, to the best of my knowledge, is attractive, having a vaguely eel-like appearance and being a uniform silver in colour. Not too surprisingly I have never heard of these fish being offered for sale and it is doubtful if they would make good aquarium inhabitants.

Having extolled the virtues of echinoderms we again find that in the oceans, where there is beauty there is also danger. Besides the well-known dangerous invertebrates such as Blue-ringed octopus, cone shells and jellyfishes, such as Sea-wasps and Portugese Man o'War, several echinoderms can also be dangerous to man.

Sea-urchins and sea-stars are equipped with small biting organs called pedicellariae which generally serve to keep the animal free from algae, small animals and detritus. In most species these organs are harmless but in some genera they are equipped with poison glands and in the Toxopneustes urchins a bite is potentially lethal. Among the starfishes the Crown of Thorns, *Acanthaster planci*, has a similar but not so toxic potential. Similarly, urchins with long needle-sharp spines can quite easily cause puncture wounds to careless fingers and these often turn septic. Therefore, it obviously pays to treat suspect echinoderms with respect. Given that the group as a whole will prove rewarding aquarium charges.

ON THE TEST BENCH

by Ian Sellick

TETRA

1984 has been a busy year for Tetra with several revised products and some completely new ones released on the U.K. market. To allow the aquarist to share in this success, a competition has been launched, the winner of which will be sent, with a companion, to Germany for a week, £250 spending money in pocket. A visit to Tetra's West Aquarium is included. Entry forms are available from stockists, and need two foil tops to comply with the rules. The simple aim is to make as many words as possible using the eight letters in 'TetraMin', words which must be in the concise *O.E.D.* That, in my reckoning, rules out 'Tetra' as an entry in the list!

Runners up will receive Tetra New Laborett kits. This new test kit is a smaller version of the Laborett that has been on the market for a number of years, but which is possibly beyond the needs of many aquarists. The colour-matching wheels did, however, make for accurate readings of the various colorimetric methods used.

The New Laborett measures permanent and temporary hardness, as well as pH and nitrite. The kit can only be fully used therefore by freshwater aquarists, although the pH and nitrite reagents work equally well in salt water. The tests are easily carried out in the usual square Tetra plastic vials included, a measuring syringe being one useful addition to the set for accurately aliquoting the aquarium water under test. Comparison is made with printed colour charts, as in the separate Tetra test kits.

A useful feature (although one might hope that all serious aquarists do this anyway) is the inclusion of record sheets so that you can plot the obtained analytical results in graph form to monitor the performance of the aquaria tested for these parameters.

At about 35p or so a complete test, the kit is reasonably good value for money, although it will be better value for the marine aquarist to still buy separate test kits. However, the all-in price of £12·50 should render it attractive to a number of fishkeepers' Christmas trees this year.

Tetra's new product is an Ammonia Test Kit, priced at £4·50. Performing some 30 tests, this kit will be most

useful to the marine aquarist for monitoring levels of ammonia before they are converted to nitrite by biological action. Both ammonia and nitrite are toxic to aquatic life; ammonia may cause stress before any reading shows up on your nitrite test-kit. Indeed, if there is an unsuspected breakdown of your biological filtration, an ammonia reading that doesn't subside quickly and show up as a subsequent nitrite reading may be a useful indicator of this.

In freshwater, ammonia follows the same route, but in acid conditions is present as the ionised form NH_4^+, not as free ammonia, and is less of a problem. However, much tap water is slightly alkaline, and many popular fishes, such as those from the Rift Valley are kept in deliberately alkaline conditions, so again, this test kit will help.

Tetra suggest that the kit be used to test garden ponds in summer as these, too, often are alkaline. In the cases I've investigated, this alkalinity itself is often a greater problem than any other factor, and can give some quite staggering pH readings as plants and algae actively remove CO_2 from the water, depositing calcium and turning the water into a substantially caustic solution. Certainly, under these circumstances, monitor ammonia, as under these stressful conditions it is wholly toxic, but first check pH and get it back towards neutral!

This test kit is a useful addition to Tetra's range.

NEW TECHNOLOGY AMMONIA TEST KIT

The instruction leaflet supplied with this test looks a little daunting at first sight, but a careful read through soon explains why it includes a table of figures and formulae for you to use. Because the test measures total ammonia, this does not tell us how toxic the water is likely to be without knowing how much of the ammonia present is in the unionised form (NH_3). As the amount of this is dependent on both pH and temperature, New Technology's table gives a method of estimating how much toxic ammonia is present when you know total ammonia content.

For example, at 75°F, a change in pH from 7·8 to 8·3 will roughly treble the amount of NH_3 present. If the temperature drops to 71°F at pH 8·3 still, NH_3 will drop by over 10%.

In order to use this test kit properly, therefore, you should maintain the sample under test at a constant, accurately measured temperature, and you must have a pH test kit, or preferably meter, handy, to enable you to calculate the level of NH_3. To give another example at 75°F. From pH

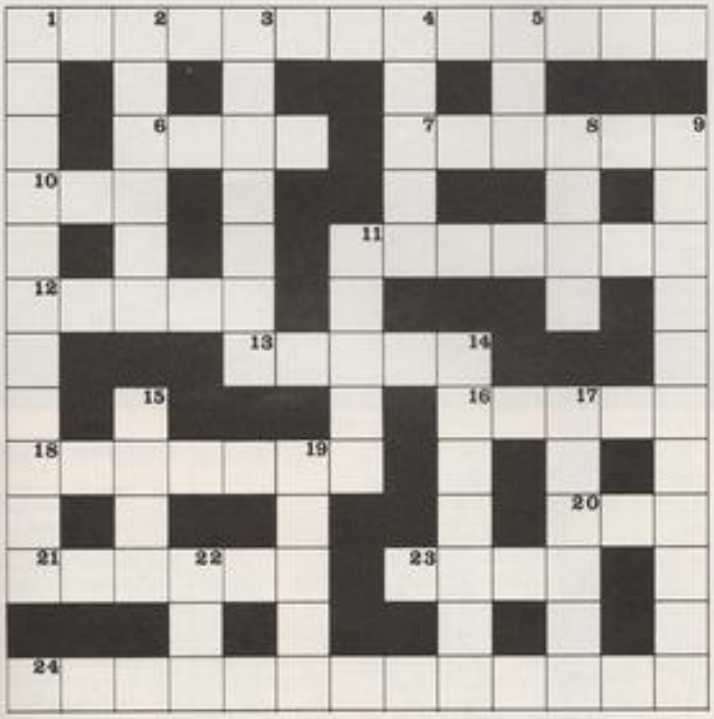
8·1 to pH 8·2, the amount of NH_3 changes from 6·21% to 7·69% of the total present. If your pH test kit is incapable of reading accurately to 0·1 of a unit, you could have problems deciding how valid your ammonia reading is too.

The test is easy to perform, but frankly difficult to read. A volume of water sample (5ml) is taken and 5 drops of one then 8 drops of the second supplied reagent added. This is mixed gently and left for 3 minutes. Then a comparison tube is prepared with the same volume of clear tap water to which is added, dropwise, a pale yellow colour standard. When the comparison tube colour is the same as the sample tube, simply multiply drops taken to achieve this by 0·1 to obtain ppm total ammonia. All very well in theory, but I found in practice the yellow colour generated by both the sample and the standard to be extremely faint, and difficult to see in any but the best lighting conditions. Indoors by artificial light, especially tungsten or warm fluorescents, makes the task well-nigh impossible. Outside during the day or under 'natural' lighting, the colour can be discerned. No doubt a little practise helps.

That the test is sensitive to ammonia was easily demonstrated by spiking a sample with a small trace. Accuracy has not been determined; however, especially in seawater or alkaline freshwater, where 10% of the total ammonia is present as NH_3 at 77°F and pH 8·3, I would be inclined to regard the mere presence of ammonia in the test as a sign that something needs doing to your water.

CROSSWORD

by Isis



CLUES

Across:

1. Tennis flasher illuminating aquatics (7, 6)
6. Small illuminating fish? (4)
7. Butch, as of eggs (6)
10. Water-lily leaf (3)
11. The highest (7)
12. In taxonomy, level of eg Perciformes (5)
13. Backwards clever Scot F (5)
16. Alternative (5)
18. Imperial water measure aplenty (7)
20. Starfish have five (3)
21. Small River (6)
23. Fish sperm (4)
24. The Cesorhinids (7, 6)

Down:

1. Most speciose Tanganyikan cichlid genus (11)
2. Leaf-fish (6)
3. Baby pike (4, 3)
4. Dashboard (5)
5. Without one, you're broke! (3)
8. It flies! (4)
9. Characin genus sounds like half-weight! (11)
11. Shortened finger-fishes (5)
14. Gadids (7)
15. Stigma (4)
17. Keeps a tank warm (6)
19. In taxonomy, word for the name given (5)
22. As in some corals (*Acropora*), type of deer (3)

Solution on page 48.

THE PEARL CATFISH
SOME NOTES ON BREEDING

by Frank Garside

THIS fish, commonly referred to as the 'Pearl Catfish', is a member of the Bagridae, and native to Indonesia, Java etc. There appears to have been some earlier confusion about the identity of this fish, as fish which fit the description have been referred to in the literature as *Pimelodella gracilis*. Classification errors of this nature are perpetuated by the current practice in the trade of referring to the related *Mystus microcanthus* as the 'two-spot pink pim'.

As far as can be ascertained *Mystus armatus* has not been bred previously in captivity, therefore this is probably the only authenticated eye-witness account of spawning and subsequent rearing of this fish.

Mystus armatus reaches a length of 6-7 in. (18 cm.) and is a uniform pearly grey in coloration, with a darker triangular spot on the caudal peduncle. The leading rays of the dorsal fin are black. The male is slimmer than the female but of similar coloration. The fish is nocturnal and predatory in habit, but totally ignores other fish which are not small enough to be swallowed. The fish has a strongly developed territorial instinct, defending its hiding place against intruders of any size.

From time to time occasional specimens of *Mystus armatus* have been offered for sale in the 'Rogues Gallery' departments of our local aquarist shop, together with the usual other miscreants and ill-advised purchases such as Zebra Cichlids (convicts), Marbled Cichlids (oscars) etc.

The writer's first experience of the fish was in 1980 when a single specimen of some 5 in. was bought from a local dealer. As there wasn't a great deal of tank space available at the time, the creature was put into a heavily-planted three-foot tank which held half-a-dozen small Tiger Barbs. The safety of the catfish was a cause of some slight concern as the Tiger Barbs would doubtless be attracted to the catfish's nasal appendages like bees to a honey-pot, and it was resolved to move the fish to more permanent and safer quarters as soon as practicable.

A day later it became painfully obvious that any humanitarian concern for the catfish's welfare was sadly misplaced. The boisterous Barbs had disappeared and the Pearl Catfish had a well-fed and satisfied look.

The present fish were lent to the writer by an aquarist friend, Neil Chapman, who had had them for some time. There were four adult fish of 4½-5 in. and the three females appeared to be full of eggs.

The breeding aquarium

The catfish were placed in a three-foot aquarium which was heavily planted with Indian fern, also floating in a three-inch layer. The tank also contained a quantity of natural bogwood, recently dug out of a local peat bog. As a consequence of this the water was amber in colour and had a slightly acidic reaction, (6·8) in contrast to the local tap water which although very soft (3-4 GH) has a pH of between 7·2 and 7·6.

As there was no pre-existent information in the literature, and personal experience was limited to its epicurean taste for Tiger Barbs, this was only intended to be a temporary arrangement. The prevailing temperature was 74-76°F and lighting was reduced to a single 40w bulb, some 6 in. above the surface. These twilight conditions seemed to give the fish a sense of security and they eventually emerged during the late evening and started to feed heavily on pieces of ox-heart.

Having no idea of how to stimulate the fish into spawning, a 25% water change in the late evening was decided upon as as good a start as any. This approach has never failed for the writer with Barbs or Characins, therefore four gallons of water were syphoned out at 10 p.m. on 25/6/84 and replaced with fresh tap-water at about 52°F. The tank temperature dropped to 70°F; and the influx of fresh-water precipitated great activity on the part of the catfish which started to go up and down the rear glass as if preparing a spawning site.

The spawning

At 5 a.m. the following day (26/6/84) the male fish was displaying, with widespread fins, to the three females, which were huddled together looking totally unimpressed. It was obviously unwise to disturb the fish by removing the surplus females and in any case it wasn't known whether the fish would spawn on a prepared site or communally. Observations were made from a discreet distance. The aquarium was in such a position as to catch the early morning sunlight and the fish could be clearly seen without switching on the overhead lighting. After a few minutes of side-by-side wriggling there was a locking of the ventral fins, glowlight fashion, and a roll which put the female in an inverted position. A cloud of several hundreds of eggs, clear amber and circa 1 mm. diameter were released. The adult fish made no attempt to either collect

the eggs, an impossible task anyway, or to eat them. The eggs had a similar density to that of water and drifted until adhering to the plants or bogwood.

After two hours, during which this operation was repeated several times, the adults were removed. Many thousands of eggs were seen.

On one piece of bogwood for example, five hundred eggs were counted covering a surface area of no more than one hundred square inches. Rather surprisingly, even with the egg distribution at this density, in no instance were two eggs touching.

Many infertile eggs were expected, and this proved to be the case. Within twelve hours almost every visible egg was white and the whole business looked like being a failure. Maybe the use of Methylene Blue as a prophylactic would have obviated this wastage, or maybe there were too many females.

The water was tested: pH was 6·8 (using bromothymal blue) hardness 4° (GH) 74°F neither filtration nor aeration was employed.

Hatching

The remaining viable eggs started to hatch after 24 hours, but hatching was still incomplete after 40 hours. The fry were minute (c. 2mm.) and similar to the typical Fry of small Characins or Barbs. Three days after hatching (1st July) Fry were free-swimming at 2·5 mm. On the 2nd July the Fry developed the fascinating habit of swimming in an inverted position just below the surface and on 4th July, with an average length of c.10 mm, the Fry were seen to be breathing atmospheric air every 15-20 seconds using auxiliary breathing apparatus. This practice discontinued after four weeks and didn't seem to be related to water conditions.

Rearing the Fry

When hatching commenced, liquifry (red) was added and after three days hard-boiled egg yolk and brime shrimp were used. After a week the fish had grown so much that chopped *Tubifex*, Grated Beef Heart, Raw Liver and Cod Roe were given. They were fed every two hours, 6 a.m.-12 midnight, and 10% of the water changed daily, to prevent the water becoming too acidified with the fishes' copious excreta.

The growth rate of these Fry was undoubtedly the fastest experienced by the writer. Two weeks from spawning the average length was over 15 mm. At three weeks several Fry were 25 mm. At six weeks the largest youngster has a body length of 40 mm. (nearly 2 in.). A counting exercise showed over one hundred survivors.

Sport

It has been of special interest that one Fry has been a total matt black since hatching. This fish is the largest and most voracious but lives apart from the other Fry. No reason is known nor theory propounded for this unsocial behaviour unless this is nature's way of ensuring that as far as possible any deviant from normal has a minimal chance of survival.

Mr David Sands showed the writer a wild-caught *Corydoras paleatus*, which although albinoid, had some mottling of black on the caudal fin and head which had enabled its survival in the wild.

A similar point is made in Darwin's 'Origin of Species' ie, that although sports and mutations do occur (or else we wouldn't have fancy goldfish, angels and albino *C. aeneus* etc) nature abhors change.

General habits

At five weeks a strong territorial instinct manifested itself and the fish remained hidden most of the day. Growth rate has reduced and some reluctance to feed noticed.*

Future plans

Mr Sands has provided the writer with information that may indicate that Mystus Catfish feed their young with a body 'slime' secreted by the parent fish. It is proposed to attempt another spawning using a pair of fish and to leave them with the eggs and Fry to verify or disprove this.

The Black sport has been removed to another aquarium together with some of its siblings and it is hoped in the future to try to 'fix' the black coloration to develop a black pearl.

Acknowledgement

The writer is indebted to Mr David Sands of Dee-Bee Aquarium World, Hesketh Bank for giving freely his invaluable help and advice, and for verifying the species as *Mystus armatus* (Day 1865).

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* The reluctance to feed persisted until all the Fry were moved (at 8 weeks) to a tank containing some *Corydoras paleatus*, and illuminated by "Gro-Lux" immediately the Fry began to eat anything and everything again!

SPOTLIGHT

The Common Frog

by L. E. Perkins

FOR many aquarists their first contact with water, as the habitat of interesting life-forms, involved the common frog or its spawn which was collected in their youth from the wild and brought home in order to study its development. Of recent years such childhood delights have been denied the young for numerous reasons, not the least of which has been the disappearance of so many natural ponds with consequent drastic diminution in the number of frogs to be found in the countryside.

The scarcity of frogs reached an alarming peak with the imminent possibility of their figuring on the list of endangered native species along with the natterjack toad and the crested newt, but recent surveys have shown that frogs are prospering again having sought garden pools for spawning sites in lieu of farm ponds and natural water holes.

A nationwide awareness of the threatened danger to this popular amphibian has induced many garden pond owners to actively encourage frogs to avail themselves of their gardens' facilities. This is good news and should be applauded but there lurks a number of flaws in this development stemming from borth ignorance and misdirected overcare.

Common frogs in amplexus under water

The general pattern of the frog's life cycle is familiar to the majority of people and so far as the pond owner is concerned commences with the appearance of frogs in the pool as winter relinquishes its freezing grip, and the subsequent croaking of the males with the attendant active free-for-all love-in which concludes with the coupling of the sexes and mass deposition of spawn in the familiar gelatinous masses. By this time the pond fish are shedding their winter torpidity and foraging for food along with numerous other aquatic denizens which all combine to pose the first threat to the new ranid generation.

Leaving their jelloid capsules, the tiny tadpoles at length become free-swimming and attach themselves to algal growth on the submerged plants and around the pond's ege. The aquatic carnivores continue to deplete their numbers and are joined, by the time the tadpoles are swimming about questing for meatier sustenance, by newts which have entered the pond to breed. Observing this one can begin to appreciate the need for such prolific depositions of frogs' eggs but the slaughter is by no means ended.

With the appearance of the hindlegs and then the forelegs, the tadpoles begin to assume a frog-like appearance until, with the absorption of the tail, a tiny but perfect replica of the frog as we know it, eschews the world of water and endeavours to make a land fall and to secrete itself among the garden foliage. By this time their parents, which lost all interest in them immediately spawning had finished, have dispersed and the froglets are on their own with far less than a fifty-fifty chance of surviving to maturity, a state not reached until the third or fourth year of their existence.

As the miniscule frogs scramble from the water they are met by waiting blackbirds and thrushes which pick them off with the greatest of ease for consumption on the spot or to carry away to their fledglings; for by now it is June and the world of nature is throbbing with new life and hungry mouths agape for food abound.

For those young frogs which survive the exodus from water, the world is peopled with predators of many kinds against which the frogs are defenceless, relying only upon remaining motionless or resorting to hopping flight, depending upon circumstances. Hedgehogs, grass snakes, herons and other birds, domestic cats, etc., will pose a threat enduring throughout their lives. However, predation from some natural foes is reduced within the garden environment, in many cases because of its urban situation, and to increase the chances of better survival there are ways in which we can help.

While a 100% survival success is not only impossible but impractical on the grounds of too much competition for too little food, decimation is acceptable rather than annihilation and the aim should be to assist a moderate rate of survival in the early stages of froghood when the froglets' rapid departure from the water is vital for they soon drown if not able to get ashore. So, ensure the presence of rafts (floating plants) to afford resting sites and see that overhanging vegetation exists to enable them to climb onto land. Where part of the pond, usually the shallow regions, appears to be the favourite locality for going ashore, cover it with a 'lid' of close mesh chicken wire or the like, bent around the edges to form a shallow dome so that it is clear of the water surface/ground and this will serve very well as a protection from birds.

While tending the pond's edging one is sure to encounter tiny froglets lately ashore from the water and trying to disperse and they can be helped in this endeavour by catching them and releasing them at a distance, separately, under hedges and shrubs.

It may be thought, at the time of spawning, that it is a good idea to scoop up the odd mass of spawn and to rehouse it in a 'furnished' tub for greater safety from fish and other aquatic predators. This is not a practical enterprise for any but the dedicated frog watcher, for the tadpoles, when emerged and free-swimming, will soon need feeding when their diet requires protein and, later, removing daily as they complete their metamorphosis. For inexplicable reasons (not altogether connected with dietry deficiences), full development becomes arrested in many of the tadpoles, some remaining in larval limbo until the following year at least and sometimes for longer.

It is fair to say that the majority of people like rather than dislike frogs. And why not? Their vices are non-existent and their general disposition and behaviour attractive to say nothing of their beneficial proclivities in the garden. That they grasp at passing fish when amorously motivated during early spring may be true on a very limited scale but other than that it could be said that the common frog is blameless. If he has elected, in desperation, to improve his survival chances by using our gardens and pools, why not make him welcome and help where we can?

PRESS RELEASE

KEITH Barraclough Aquarist Limited, one of the UK's leading aquatic companies, announce the formation of a new group division: Barraclough's Fish and Aquarium Supplies, which will control the cash and carry outlet, pet store delivery service and the retail shop at the Bradford headquarters.

Paul Barraclough, operations director, will be responsible for the overall activity of the wholesale administration. Dawn Barraclough, buyer and cash and carry manageress, is in charge of purchasing and the company's van delivery service to their 300 plus customers in the North of England.

The third member of the management team is Michael Cole, sales manager, who is responsible for all livestock policies and van telephone sales.

The rationalisation brings together parts of the KBAL (the holding company) and King British (manufacturing and branded products) operations to streamline group activities and provide an even better service and selection for their customers.

Recent expansion of the cash and carry outlet and increased business in the delivery service and retail shop areas has enabled the new division to action plans and further widen the scope of the group's operations in this rapidly growing market.

The announcement coincided with the group's annual open days on 21st and 22nd October, which attracted more than 1,200 visitors from the trade and general public.

Paul Barraclough has been working full time with the family business since 1972 and has experience in all departments of the organisation.

His sister, Dawn, joined the company in 1979 and has gained a wide knowledge and product experience in the wholesaling and distribution of new division's 2,500 stock lines.

Michael Cole has been with Barraclough's since 1969, during which time he has been extremely involved in all aspects of fish handling and his experience will be invaluable to ensure the smooth transition of the new operation.

Commenting on these latest developments, Keith Barraclough, chief executive and founder of the group said: "When Gordon Holmes and I started the organisation in 1965, we knew the importance of forward planning and careful financial management. This latest move is part of an overall move to rationalise our business and provide an even better service to our growing range of customers".

Barraclough's Fish and Aquarium Supplies, Hayfield Mills, Haycliffe Lane, Bradford, West Yorkshire BD5 9ET. Telephone: 0274 576241.

For further information please contact: Keith Barraclough 0274 576241 or Bob Rushton 01-404 5575.

BOOK REVIEW

Catfishes of the World. Volume 4

There is no doubt in my mind that Volume 4 of Catfishes of the World is David Sands' most accomplished work to date. A massive 282 pages and some 180 full colour photographs, many by the world's greatest fish photographers, together with numerous line drawings of exceptional quality from ichthyological works of this and the last century encompass the families *Aspredinidae*, *Doradidae* and *Loricariidae*.

The *Loricariidae* being the second largest family of catfishes from South America has priority within this volume. What we as hobbyists know as a 'plec.', whiptail 'cat', or sucker 'cat' has been elaborately expounded upon and the immense variation between one species and the next is depicted by stunning photographs of some exceptional specimens. What we know as a 'plec' turns out to be one of a hundred *Hypostomus* species or one of 60 *Ancistrus* species. Specific identification is very difficult, unless locality information is available, though generic identification is made simple by the use of easy to follow keys and explanatory notes. The whiptail catfishes are illustrated with an outstanding number of unique photographs, many genera being monotypic (only one species within its genera), showing the remarkable diversity of colour, shape and form. Intermediary genera between the two extremes are represented by such well known genera as *Otocinclus*, *Hypoptopoma*, *Panaque* and *Hemiancistrus* while lesser known genera as *Isorineloricaria*, *Ricola*, *Brochiloricaria* and *Parierhina* are also figured for identification purposes.

A complete list of all the valid genera and species has been included primarily for ichthyologists, for which this volume will become a 'bible', though it is invaluable to aquarists providing an insight into the complexity, diversity and study of this family. Credit must go to the author for seeking extremely useful information regarding feeding and breeding behaviour of Loricariids within their natural habitat which can only encourage adventurous breeders to take

up the challenge. Indeed, many of the spawnings and fry of Loricariids and Aspredinids were a direct result of breeding successes achieved by the author's specimens. Not only does he write about them but he breeds them too!

By contrast, the *Aspredinidae* (Banjo Catfish) and the *Doradidae* (Talking Catfish) sections appear to be 'thin on the ground' but after reading these chapters one realises they are by no means inferior to the Loricariids. Previously, nothing or little information was available on these two families though one cannot understand why as both are almost as complex and varied in species as the *Loricaridae*. Examples of the commonly imported Banjo catfishes are shown with unique breeding 'shots' of *Platystacus cotylephorus* and their fry. The Doradids are diverse in terms of size and are therefore divided into large and small sections with many representatives of both groups shown. Close-up photographs of the vicious looking scutes make us aware of the dangers when handling these species. Recent discoveries such as that of the emmission of a toxic fluid from a gland at the base of the pectoral fin of many dorads can be seen in detail and shows us some of the fascinating aspects of keeping our catfishes.

Catfishes of the World, Volume 4 is a must for all aquarists with an interest in this group of fishes. The retail price of £18 may appear high, but once you open the cover and sample the delights of the presentation and content you soon realise every penny was well spent. Once again available in loose-leaf form I can not envisage the possibility of supplements as this work is so thorough and correct even though I have been told that several have already been drafted.

Published by Dunsure Enterprises, 18 Station Road, Dunure, Ayr, Scotland and *distributed by* Dee Bee Books, 116 Hesketh Lane, Tarleton, Nr. Preston, Lancs.

NEXT MONTH

Coldwater Issue

COLOUR IN THE GARDEN POND
(Colour feature)

PLANTS FOR COLDWATER AQUARIA

FANCY GOLDFISH FOR THE AQUARIUM

SPOTLIGHT: THE ROUND-TAILED PARADISE FISH

WHAT IS YOUR OPINION?

by B. Whiteside.
B.A., A.C.P.

'Photographs by the Author'

WELCOME TO THE issue of *The Aquarist & Pondkeeper* that marks my 21st anniversary as a monthly contributor. The enthusiastic, young student of the early Sixties—has turned into the middle-aged, cynical teacher of the mid Eighties.

On several occasions I've mentioned a 12-year old aquarist, Master Gavin Meek, who is a pupil at the school in which I teach. Recently I gave him some Indian fern, Java moss, Malayan sand snails and an unwanted heater/stat. Gavin had just set up a 48 in. tank in his bedroom—to augment his downstairs community tank. A couple of days later elder sister April arrived in school one morning and told me of an amazing incident the previous night; and later in the morning Gavin appeared to tell me the tale.

The previous night the family had been watching television downstairs when they heard a peculiar crack—which they thought was just background noise on the television programme. They were wrong. The rear pane of glass in the four-foot upstairs tank had broken—and water, fish, etc. were on the move. (I assume that Gavin's second-hand tank had possibly had its rear glass panel replaced quite recently prior to his buying it; and that the replacement glass was not heavy enough.)

What was the outcome? Many gallons of water flooded the Meek household: it literally flowed down the stairs and soaked numbers of carpets on the way. It came through the ceiling. Water built up behind the downstairs wallpaper and formed large bulges—and when Gavin's elder brother, Drew, stuck a pin in the wallpaper, water sprayed out. The water caused the lights to fuse, and the Meeks were left in darkness—although, luckily, the power points (13-amp plugs) remained on—so the downstairs tank stayed warm. As soon as the accident occurred, Gavin removed his shoes and socks and rolled up his trouser legs—and waded into his bedroom to fish for his fish. Fortunately he managed to save most of the fish—with only five exceptions—and placed them in the downstairs tank. Gavin's mother was sensible enough to realise that the accident was not Gavin's fault. He has been starring in a school play for the past couple of days so I've been unable to find out what's happening now in the Meek household. I've had a few wet carpets myself, over the years, and I keep six tanks upstairs in bedrooms, but luckily I've managed to avoid a major disaster such as Gavin's. Have any other readers suffered disasterous flooding from cracked tanks or leaking tanks or siphons/filters emptying tanks onto carpets? If so, please send me a few lines about your disaster—and how other family members reacted.

Mr. Kevin Appleton, who lives at 37 Eastern Avenue, Thorpe-St-Andrew, Norwich, Norfolk, sent me Christmas greetings and wrote: "Having been involved with aquatic societies for many years, I, like many others, have experienced problems finding different programme ideas to satisfy members each month. It is for this reason that I have now developed a slide-hire service which may be of interest to your readers. Slides are grouped into programmes which include: general freshwater tropical fishes—two programmes; koi and ponds—two programmes; goldfish including fancy varieties, pond plants etc., marine tropical fishes—two programmes; marine invertebrates—two programmes; native marines; vivariums; tableaux; catfish and oddballs; importing; trout-farming and wholesaleing; killifish; and zoos.

"A small charge will have to be made to cover expenses, postage and eventual replacement, and upon receipt of a s.a.e. I would be pleased to forward details to anybody who might be interested.

"It is my intention to continue to improve and enlarge these programmes; and I should be pleased to hear from anyone with slides available." Mr. Appleton's telephone number is 0603-31964, if you wish to contact him.

Photograph 1 shows some of my maturing angelfish. Please drop me a line if you have bred angels recently.

Mrs. Cheryl V. Kerr resides at 83 Dunlop Road, Lochside, Dumfries, and she writes: "I have just finished reading your article in the October 1984 issue—about your wanting to hear from people who've kept honey gouramies. I wish to tell you about mine. I purchased a pair about seven months ago. After weeks of haggling with my local pet shop, Carlisle Aquatics, Eddie, the proprietor, tried to put me off them as he said they were very shy and had no colour; but I had read about them in my books and was determined, so I persevered and he got me a pair in specially. I put them in my husband's 48 in. community tank and they did very well.

"However, I purchased and set up my own 36 in. tank in June last. I put in my pair of honey gouramies, a pair of keyhole dwarf cichlids, a pair of rams, three angelfish, one black shark, one silver shark, one pair of dwarf gouramies—which we bred ourselves—and three *Corydoras* catfish. Just over a month ago the honey gouramies were in true breeding colours, and the male was blowing bubbles; so I decided to try them on their own in an 18 in. tank. Immediately they made a nest, and the female spawned.

Angel Fish

"The babies are doing well and will be four weeks old on Tuesday. We do not like the brine shrimp hatcher; and so before they were free-swimming I put in some Interpet Liquifry No. 1 liquid food, and after a couple of days started them on TetraMin Baby Food E. I hope this letter is of interest to you."

Please let me know how the babies developed, Mrs. Kerr.

Mrs. Jane Meredith wrote this letter some time ago from 18 Cranleigh Road, Portchester, Fareham, Hants. "I have written to you before about breeding my dwarf gouramies. I find your column very interesting and enlightening—I only wish the magazine were weekly instead of monthly. I am a fanatical breeder and breed every fish I can lay my hands on; but my space is limited, and with so many young to raise I am never able to stock all the fish I want to breed; so I was interested in your column and the remarks made.

"I use ordinary box filters or corner filters in all my tanks. I find them very easy to look after and very efficient and with so many tanks I need something that I can just glance at through the glass to see if it needs cleaning, without having to dismantle it—like most internal filters."

From number 14 The Avenue, Bognor Regis, Sussex, came a letter written by Mr. T. Flack. He wrote: "I returned to the hobby eight months ago when I set up a 36 in. × 12 in. × 15 in. tropical community tank. I last had a tank about ten years ago. I am constantly worried by the emphasis put on partial water changes every few weeks. I don't remember its being mentioned before. In the past eight months I have changed some water only twice to pacify my guilt feelings.

"During that time my red flame tetras have spawned, my swordtails have produced young and a pair of leopard danios seem so besotted with each other that spawning is a regular occurrence. I assume that these activities are signs of healthy fish in a healthy tank. Have I somehow achieved a balanced set-up, am I just fortunate, or will my reluctance to change water eventually catch up with me?"

If it works, Mr. Flack, I see nothing wrong with it. Occasional partial water changes probably benefit the fish—so fit in the odd change when time permits. I must admit that my tanks don't often get any of the water removed; but it's easy to see how fish react when fresh water is poured into a tank: the fish liven up and the colours brighten up.

Mr. R. M. P. Wheeler's address is 205 Peterborough Road, Carshalton, Surrey, and he writes: "Re Mr. Love's letter in the August 1984 issue concerning the Oxydator, I believe you will find the item first advertised on page 9 of October 1982 *Aquarist* also in 'Press Release' p. 58 of the November 1982 issue. It has been advertised in every issue from then on, I think. The early advert claimed it replaces 'air-stones, biological filters, etc.' I have used the Oxydator for some 18 months; I have tried it in several tanks. Some had under-gravel or power/air filters. In one of my piranha tanks, before using an Oxydator, I had a power filter. It cleaned the tank and kept a low NO2—nitrite—level, ·05−. After trying the Oxydator only, i.e. no fiter, within three days the NO2 was ·5+. I returned to the previous power filter. The only notable point was that the fish did not show too much discomfort. I believe this was due to the dissolved oxygen from the Oxydator—although a high NO2 level is dangerous to the fish.

"I have tried a mixed tropical tank, also a coldwater set-up, with the same results. It is an aid to a fish set-up but not a panacea to replace biological filters, etc. I phoned the Highgate Aquarist, the U.K. distributor, regarding my findings; the answer did not impress me. They said I should use the filtering systems as normal as well as the Oxydator—but that is not what the advertisement said . . ."

I hope you have enjoyed my 21st anniversary issue. 21 years is a long time. Perhaps it's time I took a rest: school life has got very hectic too.

I was saddened to read, in the December 1984 issue, of the death of fellow-contributor Mr. Frank W. Orme. I did not know Mr. Orme but occasionally read his interesting column. It's sad to note the decrease in contributions from elderly contributors. I suppose it merely indicates the passage of time!

For a future feature please send your opinions on: (a) breeding unusual livebearers; (b) cultivating live foods; (c) koi in winter; and (d) cultivating Amazon sword species in tropical tanks. I hope you'll send me a few lines. Goodbye until our next meeting.

CICHLIDS: EGGS & BEHAVIOUR

by Ian C. Sellick

The principal aim of all animals (and plants) is to reproduce themselves and thus perpetuate their kind. In order to do this, the animals must survive from the time they came into being by the fertilisation of an egg from their mother until they are mature enough to reproduce. All behaviour is aimed at making this happen: fish, and cichlids in particular, are no exception, and have developed some interesting repertoires to enable them to get through life and breed successfully.

Each species has a unique set of problems to overcome, and consequently each behaves somewhat differently. The reason why there are so many species of cichlids engaged in going from egg to breeding is outside the scope of this article, but the fact that there are so many provides us, the aquarist, with a beautiful pageant of exciting fish to study and observe.

Unlike fish such as barbs and characins that, with notable exceptions, scatter eggs willy-nilly and trust to enough fry escaping the attentions of predators to allow the population to survive, all cichlids protect their eggs in some way. If you are going to protect your eggs, the first consequence is that you need not produce so many relative to your body size. If you are going to produce fewer eggs, you can make each egg larger, and consequently have larger and more developed fry on hatching. Not only does this line of reasoning have energetic consequences, it can have behavioural ones too. As each egg represents a large investment, it must be protected by the appropriate behaviour.

In cichlids, egg-care behaviour is always extensive and ranges from defence of a small area in which the eggs are laid and guarded, through varying degrees of egg care within this area, and finally to the point where the eggs are removed from the spawning area in one of two ways; mouthbrooding or spawning on a movable substrate. In general, there is a good relationship between egg size and egg numbers for both sub-

Cichlasoma severum: **pair spawning on hard substrate. Spawn care is typically a joint effort between male and female**

strate spawners and mouthbrooders. The smaller the number of eggs, the larger the eggs tend to be. The differences in egg size are not so noticeable in substrate spawners, but in mouthbrooders size ranges from 'normal' 2-3 mm long eggs to 7 mm monsters. As larger eggs tend to take longer to hatch and develop, this also has effects on behaviour. Of course, we cannot say that any of these features is the one that developed first, evolution or larger eggs, smaller egg number, and modification of behaviour must have all happened simultaneously for the fish to have survived.

Among the South American cichlids, *Cichla ocellaris* would seem to be one of the most primitive. It is a large predatory fish reaching some 60 cm in length. Although not frequently kept in captivity, it is an important fish for sport fishery and has caused problems on being introduced to various areas of the world (Puerto Rico, Panama). Some 10,000 eggs are laid on a hard substrate with an even division of parental care. Most of the largest *Cichlasoma* also lay several thousand eggs on a hard substrate, and so does the oscar, *Astronotus*. *Cichla* and *Astronotus* have very little difference between male and female, whereas some species of *Cichlasoma* have considerable sexual dimorphism.

Usually, this illustrates some role specialisation. Males perform territory guard duty while females tend the eggs closely, fanning and cleaning them. If the male is to guard the territory and the female the eggs, it makes sense for the primary defender to be as large and boldly coloured as possible as this display is the first line of defence. Actual physical aggression, should it be necessary, will be helped by being as large as possible. An almost incidental, but very important aspect of this is that when the female does not have to grow so large, she can invest more of her energy income from food in actual egg production.

This pattern is modified to a greater or lesser extent according to circumstances; different substrates may be preferred, and even different types of eggs laid. For example, *Cichlasoma nicaraguense* which mostly occurs in rivers, lays non-adhesive eggs that can roll and tumble in a pit guarded by the parents, and will thus be kept clean by the water flow without the absolute necessity for parental attention.

All the *Tilapia* of Africa, and many of the acaras of the Americas, as well as those specialists in other fields, *Uaru*, angels and discus are also typical substrate spawners, dividing egg care between male and female, and following this line of the greater the sexual dimorphism, the less the male has to do with actual egg care.

Among the dwarf cichlids of South America, there is an interesting extension of this. In some species of *Apistogramma*, there is a considerable and very dramatic sexual dimorphism. Males are not only very much larger than females, but are so completely different, it is sometimes difficult to equate male and female as the same species. Here, the male defending an area for the female is not quite the same, as males gradually acquire harems of females, all of whom are kept in a greatly extended territory. In this situation, the male's function is solely to guard this large area and fertilise the eggs, the actual care of the eggs (and later the fry) is the virtual sole province of the female. Females will in fact actively evict males from their sub-territory within the larger one.

Discus eggs viewed from behind the substrate with an attentive parent. Parental roles are divided 50 : 50 and there is no sexual dimorphism

This harem arrangement gets over one of the problems of being a very small fish that can physically only lay a small number of eggs. With several females spawning all the time with the most successful male, the output of fry is actually much greater than could be achieved by a single pair, and greater is the chance of the species' population continuing against the rather high predation pressure of the Amazonian river system.

Males being big, bright and flamboyantly attired and coloured not only helps in territory defence, but also in advertising for females to join the harem. Bigger, active, more colourful males are also more likely to attract mates in the 1:1 situation of the more normally pairing substrate spawners. This then, is another case of many factors evolving of necessity simultaneously, with the concomitant improvement in the fish's 'lot' as each small change happens.

In the mouthbrooders, there is a separate set of priorities. In the more 'primitive' mouthbrooders, such as the genera *Sarotherodon* and *Oreochromis*, the eggs laid are still small and large in number. Females are mostly drably coloured, in the case of *Oreochromis mossambicus* plain grey. Males of most tilapine mouthbrooders build nests, scraped in the mud or in the gravel of the river or lake bed, sometimes constructed so that the nest stands proud of the substrate. Males display on or over their nests to attract a female or females who lay eggs in batches which are fertilised by the male, then the eggs are immediately picked up by the female (or male in certain species). The eggs are brooded for a relatively short period of time (about 10-14 days) as the fry by this stage need to be out and feeding having absorbed their small yolk-sacs.

In the *Haplochromis* derived mouthbrooders, males sometimes build nests, although these are sometimes solely used for display and not for spawning

in. There is, however, a move away from permanent structures and territories like this. This is partly due to the fact that with the progressively smaller number of eggs, spawning takes less time, and the substrate can become less important. In the mbuna, males have more or less transitory territories to which females are attracted by the male's colours and behaviour, spawn, and pick up the eggs immediately, fertilisation occurring in the mouth. Females then depart the immediate area, hiding in rocky crevices until the eggs hatch. The young fish are released some 21 days later.

This dependence on a territory does vary from mbuna species to species, some have developed secondary functions for territory defence, such as preserving a source of food. Spawning like this, the eggs barely touch the substrate before they are picked up, and this has led some species to become totally independent on the substrate. There are midwater spawning *Cyrtocara* in Lake Malawi, but the best known are the curious little *Cyprichromis* in Lake Tanganyika.

Tropheus species, the ultimate mouthbrooders according to most opinions, are also fish that do not use the substrate, apart from as a reference point. The eggs are actually laid and picked up in midwater alongside the substrate. Fertilisation occurs in the mouth of the female brooding these very large eggs, small in number.

So there is a whole spectrum of mouthbrooding from very substrate and territory dependent spawning, to total independence from the substrate. It is interesting that there are other mouthbrooders, particularly in South America and West Africa, where fish are only half way along the road to full mouthbrooding, or so it would seem. These are fish of the genera *Geophagus*, *Gymnogeophagus* and *Aequidens* that spawn in 'normal' substrate-spawner fashion, but then pick up the eggs at various times after spawning.

It is interesting to note that the species that guard the eggs on the substrate longest (such as *Geophagus jurupari*) are the least sexually dimorphic, both parents guarding the eggs until both parents pick them up well after 24 hours post-spawning. *Geophagus steindachneri* (and probably its near relative *G. crassilabris* as well) picks up the eggs immediately after spawning. Here there is a very considerable sexual dimorphism, and the female only broods the eggs. The eggs are larger too, not much, but noticeably so. These species are converging on the *Haplochromis* pattern, therefore.

This overview of what cichlids do with their eggs is only one part of the behavioural repertoire that cichlids show. I hope it gives some insight into the 'whys' behind their behaviour.

BOOK REVIEW

'FISHKEEPER'S GUIDE' series published by Salamander Books Ltd., 27 Old Grosvenor Street, WC1N 3AF, each at £3·95: *Garden Ponds* by David Papworth; *Coldwater Fishes* by Dick Mills; *Community Fishes* by Dick Mills; *The Tropical Aquarium* by Dick Mills.

The first striking impression of these neat hard-cover books is that of their unusual format of 4¾ in. width by 8¾ in. All are very fully illustrated with colour photographs and colour diagrams.

Garden Ponds covers the subject from installation (with reference to all types of construction) through planting, stocking with fish, other livestock, pests, diseases, to pool upkeep. A diary completes the chapters and affords advice on care during each of the four seasons.

Coldwater Fishes. A comprehensive coverage of fish varieties to be kept in ponds and aquaria including such less familiar species as the Pirate Perch (*Aphredoderus sayanus*), the Topmouth gudgeon (*Pseudorasbora parva*) and the Red Shiner (*Notropis lutrensis*). The coverage includes advice on aquarium selection and on equipping and furnishing a tank, aquarium plants and water requirements, ponds, pond plants, filters, fountains, feeding, maintenance, fish anatomy, diseases, breeding. These aspects are dealt with in a clear and concise fashion with photos and explicit diagrams. Final chapters illustrate and describe goldfish and koi varieties with other coldwater species.

The Tropical Aquarium. The layout of this book is especially pleasing and its step-by-step instructions on setting up a tropical aquarium are most appealing and practical with first class photographs and drawings which will ensure that the newcomer to the hobby will set up his first aquarium with the minimum of difficulty. There are chapters on plants, feeding, maintenance, breeding and diseases. The second part of the book is devoted to colour photographs and descriptions of 50 species of popular aquarium fishes.

Community Fishes. As the author points out, with such a myriad of colourful fish species available from the tropical regions of the world, the beginner may be excused for unwisely assembling a collection of fishes for his aquarium on the strength of their attractiveness and without regard to their respective dispositions and behavioural patterns. This book sets out to categorise aquarium fishes as surface swimmers, midwater fishes and bottom-dwelling species and to indicate which species are compatible with which. As well as chapters on heating, lighting, furnishing, filtration, plants and maintenance, there is an illustrated chapter on 60 species of 'community' fish and another on breeding aquarium fishes.

Here we have four handy-sized books attractively laid out with concise but comprehensive information and excellent illustrations at a very reasonable price. There has long been a great need for moderately priced books of good quality on the basics of fishkeeping and the volumes reviewed here go much of the way towards filling that need.

L. E. PERKINS

CROSSWORD SOLUTION

Across:
1. Lantern Fishes
6. Neon
7. Clutch
10. Pad
11. Maximum
12. Order
13. Canty (reversed – ynnac)
16. Other
18. Gallons
20. Arm
21. Stream
23. Mist
24. Basking sharks

Down:
1. *Lamprologus*
2. Nandid
3. Euro fry
4. Facia
5. Sou
8. Time
9. *Hemigrammus*
11. Motor
14. Codfish
15. Slur
17. Heater
19. Nomen
22. Ilk

A-Z of the Aquarium

Serranidae

THE Serranidae constitute a large Family of numerous genera made up of about 370 species. Common names for this group are Sea Basses or Sea Perches. In one way or another, both these labels are misleading since neither can be regarded as applicable to all 370 species.

For example, there are some Groupers which can reportedly grow to 3 metres in length and 400 Kilograms in weight, with apparently smooth skin and fleshy lips. These features make them very "un-perchlike" other than in their predatory habits (there are some unconfirmed reports of large Groupers, e.g. *Promicrops lanceolatus*, actually swallowing divers) and generalized Perciform morphological characteristics (e.g. dorsal fin divided into two parts; caudal fin with 17 or fewer rays).

***Serranus hepatus*, the Brown Comber**

At the other extreme, as it were, are the delicate-looking and beautiful *Anthias* species, including *A. squamipinnis*, sometimes referred to as the Wreckfish (although this name is also shared by other Serranids, such as *Polyprion americanum*).

Another subgroup within the Serranidae is referred to as the Combers and includes genera such as *Serranus* and *Centropristis*. Yet, another subgroup is known as the Hamlets (genus *Hypoplectrus*).

In the final analysis, very few Serranids are actually known as Sea Basses or Perches. Among the Sea Basses, are the Bass itself, *Dicentrarchus labrax*, and the Spotted Bass, *D. punctatus*, while one of the few species commonly regarded as a Sea Perch is *Epinephelus guaza*, the Dusky Perch which, in any case, is better known as one of the Groupers.

These examples help to illustrate how diversified the Serranids are. Despite this, as well as their widespread distribution in most tropical and temperate seas (a few species are even found in freshwater), all possess several features in common: three spines on the gill cover, one in the pelvic fin (plus five soft rays) and three in the anal. In addition, the lateral line is both continuous and complete.

One of the most fascinating characteristics of many of the Serranidae is their ability to change sex or to be both male and female at the same time (functional hermaphroditism). Where a change is involved, individuals are female first and male later (protogynous hermaphroditism).

Topminnows

THE term Topminnow has been applied in, at least, two different ways by different authors over the years. Some, like J. R. Norman in "A History of Fishes" (3rd edition by P. H. Greenwood, published by Benn, 1975), use it to cover all those fishes embraced by the general labels "Toothcarp" or "Cyprinodont". In other books, e.g. "Biology of Fishes" by C. E. Bond (published by Saunders, 1979), the term is used in referring only to those fish which belong to the Family Cyprinodontidae, commonly known as Killifish.

We, therefore, find that a member of the Cyprinodontidae, *Aplocheilichthys johnstoni*, is a Topminnow according to both "classifications" while another, *Poeciliopsis occidentalis* (the Gila Topminnow—a member of the Poeciliidae), is regarded as such only in the former.

Up to recently, everyone seemed to agree that *all* Topminnows belonged to the Suborder Cyprinodontoidei. This agreement was based on the combined occurrence of a number of anatomical features, such as the possession of a single dorsal fin, the absence of spines in the fins, the marked tendency of the lateral line to be particularly well developed in the head region, and the possession of paired narial openings (nostrils).

Although common names are often deservedly criticised for causing more confusion than they actually solve, the term Topminnow can be regarded, in some ways, as an exception to this "rule". The reason for saying this is that this common name suggests that there is a similarity between the Cyprinodontidae and the Poeciliidae in a way that the scientific labels, perhaps, fail to do.

Recent research by Lynne Parenti suggests that the traditional difference between Killifish and Livebearers (egglaying v. livebearing) is not quite as significant as hitherto believed. She, therefore, proposes new usage for several terms based on what appears to be pretty sound evidence. If this re-classification becomes widely accepted, (time will tell) we, as aquarists, may well need to reassess our views and prejudices. It will not be easy but it may well be "correct".

For full details of Lynne Parenti's findings, see Bulletin of the American Museum of Natural History, Vol. 168, Art. 4, 1981. A summary of this major work also appeared in *Aquarist & Pondkeeper* in June 1984.

***Xenotoca variata* (a Goodeid) is a Toothcarp. Therefore, according to Norman, it is a Topminnow. According to Bond, it is not**

Starfishes

The term Starfish is a rather loose one in that it does not tell us precisely which organism is being referred to.

The most obvious thing that all "Stars" have in common is their overall shape, although some, like those of the genus *Culcita*, have such short arms that they resemble an angular disc more closely than they do a star. On a more biological basis, all Stars are members of the Phylum Echinodermata and are, therefore, related to the Sea Urchins and Sea Cucumbers (see A—Z, February, 1984).

An eight-armed Atlantic Asteroid Starfish

The looseness in terminology referred to above is reflected in the fact that animals belonging to three Classes of Echinoderm are known as Stars.

(i) Asteroidea—
Commonly known as Starfish or Sea Stars.

(ii) Ophiuroidea—
Basket, Serpent and Brittle Stars.

(iii) Crinoidea—
Some known as Sea Lilies, others as Comatulids or Feather Stars.

All three types can be kept in marine aquaria with a greater or lesser degree of difficulty. The easiest, as a rule, (and, consequently, the types most commonly seen) are some species of the Class Asteroidea. Occasionally, Ophiuroids also become available while Crinoids only rarely find their way into the hobby. When they do, these filter feeders invariably prove difficult to maintain in peak condition for any length of time.

The Asteroidea are all free-living Stars found in a wide variety of marine habitats. They are all radially symmetrical, based on a central disc which bears projections known as rays or arms. Asteroids differ from all other

Underside of Asteroid showing continuity between disc and arms

arm-bearing Echinoderms in that the arms are not sharply demarcated from the disc. Instead, they "grade" into it.

Perhaps the most famous of all the Asteroids is the Crown of Thorns, *Acanthaster planci*, which is periodically responsible for the large-scale denudation of coral reefs.

The Ophiuroidea are superficially similar to the Asteroidea but can easily be distinguished from them by the possession of highly mobile arms which are sharply demarcated from the central disc.

The Crinoidea form the most ancient Class of Echinoderms and can be distinguished from all other Stars in the possession of a stalk (which may be very reduced in the Cromatulids).

Toxotidae

If you look at a body of water from above (but at an angle), the fish, rocks and plants that you see are not really where you see them. The reason for this is that the density of the medium *in* which the fish, rocks and plants are being viewed (water) is considerably higher than that of the medium *from* which they are being viewed (air).

This difference in densities causes the light rays passing from one medium to the other to be bent (refracted), bringing about an apparent shift in the positions of objects. Native river tribes, who depend to a greater or lesser extent on their success at spear fishing from canoes, have mastered the technique of accurate "differential" orientation and have, therefore, become effective aerial hunters of sub-aquatic prey.

If you reverse the situation so that we are dealing with an underwater predator which catches a fair percentage of its food from above the water surface, we begin to gain an appreciation of the sophisticated hunting technique which has evolved in the Toxotidae, the Archer Fishes.

Unlike other fish that employ aerial vision, e.g. *Anableps* (A—Z, May, 1984), the Toxotidae do not have specially modified eye lenses for the job. Instead, they have "normal" fish eye lenses but have evolved an ability to estimate positions and distances above water. The degree of accuracy that they possess appears, however, to be somewhat less acute than is often reported.

Nevertheless, it is accurate enough—Archerfish would not be Archerfish otherwise. If an insect is spotted on a leaf or branch above water level, the fish (often in shoals) will approach slowly and, once within striking distance, will attempt to shoot down the insect by directing small, strong jets of water at it. Some reports say that the strength of these jets, which are generated by means of the specially modified jaw apparatus, is sufficient to cause a stinging sensation on human skin.

There is only a single genus in the Toxotidae, *Toxotes*, with four species. Only two of these, *T. jaculator* and *T. chatareus*, are usually seen in the hobby. Both require brackish, tropical conditions and plenty of swimming space.

***Toxotes jaculator* patrolling just below the water surface**

Tomorrow's AQUARIST

FIND-THE-FISH REMINDER

Just a reminder that we should receive your entries for this exciting competition sponsored by *King British Aquarium Accessories Co. Ltd.* by 14th of this month at the latest. Keep your ideas coming—there is over £100 in prizes to be won! For full details of the competition and how to enter, see last month's issue of the *Aquarist & Pondkeeper*.

Good luck!

★★★★★★★★★★★★

INTRODUCING LEE HOLDEN

Name: **LEE A. HOLDEN**
Age: 11 years (Born: 2.3.73)
Society: Darwen Aquarist Society
Society Address: The Secretary,
27 Nancy Street,
Darwen,
Lancashire.

Lee with the trophies he won at the 1984 Yorkshire Aquarist Festival

Lee started keeping fish, as so many other people have over the years, by winning a Goldfish at a fairground in 1981. Again, like so many fishkeepers who come into the hobby via this route, Lee met (to his great dismay) with very little initial success. But, despite the fact that he was only nine at the time, he would not accept failure. Therefore, he persuaded his parents to buy him a tank with some Goldfish.

Lee's parents, John and Margaret, were not fishkeepers at the time so they sensibly sought advice rather than plunge in without adequate preparation. The advice they received was well founded and they eventually opted for a decent-sized tank (3 ft.) and a collection of tropical, rather than coldwater, fish to begin with.

This was in December 1981. By late summer 1982, Lee had joined Darwen A.S., after visiting the Club several times with some of his schoolfriends who were already members. Things went well for him and his enthusiasm soon rubbed off on his parents and his younger sister, Sandra (aged 5). In December of the same year, the whole family joined Darwen A.S.

In January 1983, Lee entered his first Table Show with a Flying Fox (*Epalzeorhynchus kallopterus*) that had been bought for him as a birthday present in March of the previous year. To his delight, he won 1st prize in his class. This was just what he needed. In March of the same year, he again won a first at an Inter-Club Show in St. Helens.

Lee's enthusiasm and ability did not go unnoticed and Darwen's Show Secretary, Dave Milner, undertook to take him to as many Open Shows in the F.N.A.S. League as possible. The first Open Show he entered was in Blackburn in May 1983. Unfortunately, he did not win anything there. Typically, though, he bounced back at Lytham in July by winning another first and, in so doing, taking his first-ever trophy. This was followed by further successes in other Open Shows. By the end of the 1983/84 season, he had won 9 firsts, 17 seconds and 13 thirds.

Moving on to new challenges, Lee graduated to the major Festivals, contributing to the Darwen A.S. tableau at the Yorkshire Aquarist Festival where, in 1983, he picked up a first in his Class for Aquatic Paintings. He then went on last year to win the first, second *and* third in Aquatic Paintings and yet another first for his Flying Fox.

The story for the British Aquarist Festival is equally spectacular with a first in 1983 in Aquatic Handicrafts and first and third in the same Class in 1984 and a further first in Aquatic Paintings.

Lee's deep involvement in fishkeeping has led to the whole family being "hooked" and now, even Sandra, at five years of age, has won numerous prizes.

Lee quotes as his next targets (other than to have renewed success at this year's Open Shows) hat-tricks in Aquatic Paintings and Handicraft, firsts at Y.A.F. and B.A.F. and the attainment of a Breeders Award Certificate from the F.N.A.S. We wish him well!

COLDWATER JOTTINGS

by Stephen Smith

(Publicity Officer for A.M.G.K.)

I AM very honoured to be invited by the Editor to continue this column, following the death of our fishkeeping colleague Frank Orme, who will be sadly missed. Frank was a friend and an inspiration to many fishkeepers, myself included; and his enthusiasm and dedication to the hobby will undoubtedly continue to serve as an inspiration to us all throughout the future.

The hobby of fishkeeping is apparently the third most popular hobby in the country—after, I was surprised to hear, stamp collecting and golf. As in all hobbies, there is often a conflict of opinion; none more so than in coldwater fishkeeping. Often, a method or principle which one fishkeeper holds dear will cause another to hold up his hands in horror, and this should be a healthy sign. My comment is this: fishkeeping is a matter of enjoyment—your enjoyment. The best method for you to use is the one which suits you, works for you, and with which you are happy. Of course, the only way to learn and improve is by listening to the other person's point of view. You may well find the very solution to a problem you've been grappling with for ages. But remember there are no hard-and-fast rules in fishkeeping, and it would be a pity if the enjoyment of the hobby should be spoiled by unbending opinion and bickering. There is so much about the pleasurable pursuit of fishkeeping that is rewarding: both privately and in the company of fellow enthusiasts.

Why not let me know about your own interest in coldwater fishkeeping: how you became "hooked" and the methods which you have found work for you. Coldwater fishkeeping covers a broad range of varied interests: from goldfish breeding and rearing, through pondkeeping and water-gardens, to keeping and showing prize koi. I will endeavour through this column to reflect as many aspects as possible of the world of coldwater fishkeeping, from the people in the world of the hobby—yourselves.

Wintertime, for many (though not all) coldwater fishkeepers is very much a "close season"—a time to hibernate by reflecting on the successes and failures of the past season and to dream about the glories which the oncoming Spring must surely bring. As the snowdrops and crocuses start to wake us from our slumber, and life in the pond begins to stir, perhaps we should consider at this time of the year joining one of the several specialist coldwater societies around the country. Details of societies and meetings are published regularly in this magazine. If the secretaries of coldwater societies would like to send membership details to me, I would be pleased to pass this on to any interested reader who sends a stamped self-addressed envelope to me, care of the Editor.

A great deal of information on the hobby can be gained by enrolling as a member. Most societies produce some form of newsletter which itself makes the subscription worthwhile even if you are unable to attend meetings. I know of many people who are members of several clubs. Some of these they are actively involved, others not so much. Of course, the opportunity of meeting fellow coldwater enthusiasts opens up a whole new world of the hobby.

The vast majority of fishkeepers are friendly and informal, and are usually more than willing to pass on information to anyone who shares an interest in the popular pastime.

Winter is also the time when we bring our favourite fish indoors 'out of the cold'—especially if we don't own a fish-house. Personally, I prefer to do this to help bring my breeding pairs up to spawning condition for the following year.

Within weeks of installing my best Moors in indoor aquaria last November they gave me quite a surprise—there were eggs everywhere! Probably the change of water, or simply the increase in temperatures. Whatever it was, it certainly gave my fish "Spring fever". Anyway, I have subsequently set up further tanks to accommodate the fish from the eggs, and I made pretty sure that males and females were in distinctly separate aquaria!

A word of caution about keeping late/early spawnings. Winter is the worst time for fry to survive, so keep only a few (if any at all) and if you don't have central heating, apply a consistent gentle heat to see them through the cold nights (and days!). My advice would be though—and I've learned my lesson: "Don't let it happen again!"

Meet the Societies

ST. EDMUNDSBURY & DISTRICT AQUARIST SOCIETY

The St. E. & D.A.S. Badge

Marbled Angel

Following an advertisement in the "Bury St. Edmunds" press, 19 aquarists met on 10 October 1977 and formed the aptly-named St. Edmundsbury & District Aquarist Society. Monthly meetings were soon underway but with no real increase in membership for a time.

It was, therefore, decided to expand the Society's activities by meeting once a fortnight in members' homes and by applying for membership of the Eastern Federation of Aquarists. This was closely followed by affiliation to the F.B.A.S. and adoption of their Standards.

The combined effect of these measures was soon reflected in increased membership, involvement in a wider range of activities and the establishing of contact with other Societies.

In December 1980, the St. E. & D.A.S. entry for the F.B.A.S. Poster Design Competition was awarded First Prize. Shortly after this, one of the "Big Four" banks in Bury St. Edmunds asked the Society to take over the maintenance of a six-foot tank which they had on show at the branch. This is still being done on a rota basis and has attracted quite a few new members. Round about the same time, a library was set up and a new competition was organised in which members could have their tanks judged in their own homes.

1983 marked a further expansion in activities with the setting up of an exhibition of tanks and fish in one of the municipal buildings. The event attracted some 300 people. In 1984, the figure rose to around 500. On both occasions, the Society picked up new members.

1983 also saw the first Open Show, held under F.B.A.S. rules. This proved to be highly successful and laid the foundations for an even more successful Show in 1984.

Other activities run by the Society include Inter-Club quizzes (in conjunction with other E.F.A. Societies), Table Shows, coach trips to Fish Farms and to the major National Festivals, lectures by well-known speakers and a Christmas Party.

Meetings are held at The Newbury Community Centre, Howard Estate, Bury St. Edmunds, starting at 8.00 p.m.

Subscription rates: Single, £3·00; Family, £4·00; Juniors, £1·00.

Apply to: Mr. T. Brant, 2 Broom Lane, Lakenheath, Brandon, Suffolk. Tel. Brandon 860398.

SKELMERSDALE & DISTRICT AQUARIST SOCIETY

The S. & D.A.S. Emblem

Male Paradise Fish displaying

Skelmersdale & District Aquarist Society was formed in 1977 by a small nucleus of six enthusiastic aquarists to cater for all aspects of the aquarium hobby, from tropical freshwater to marines.

Like many other Societies, the early days brought their inevitable share of teething problems, not least of which was the unavailability of a regular venue for meetings. Happily, this and other difficulties were duly resolved with the formation of a hardworking committee and things have steadily expanded and improved since then.

Meetings now take place twice monthly (every second and fourth Wednesdays) at the Skelmersdale Labour Club, Westgate, Skelmersdale, starting at around 8.00 p.m. An added bonus from the Society's viewpoint is that each member also joins the Labour Club, thus being eligible to participate in all its social activities.

Recently, S. & D.A.S. accepted an invitation to join an Association with two other Clubs, St. Helens A.S. and Sandgrounder's A.S. The resulting organisation has become known as the 'Triple S', in recognition of the first letter of the names of all three Societies.

By pooling certain resources, joint activities can be organised which, not only widen the circle of contacts and experiences, but also make it possible for the Societies to finance activities which would otherwise be out of the reach of each individual Society.

For example, S. & D.A.S. now attempts to co-ordinate its Christmas Social with those of the other 'Triple S' members. The same goes for other social nights throughout the year. Coach trips and fees for visiting lecturers are also shared. Mutual benefits are so advantageous that 'Triple S' would be happy to receive an approach from any other Society in the area interested in joining.

Besides running three-way Bench Shows and other activities with the other two 'Triple S' Clubs, S. & D.A.S. also has its own programme of Table Shows, auctions, quizzes and lectures. It also possesses its own library of aquatic books and is planning to run its first Open Show in 1985 under F.N.A.S. rules (to which the Society is affiliated).

Subscription rates: Single, £1·50; Family, £2·50; Juniors and O.A.P's, 75p.

Apply to: Mr. G. Martin (Secretary), 10 The Winsters, New Church Farm, Skelmersdale, Lancs., WN8 8NG. Tel. Skem. 21610 (after 6.00 p.m.).

NEWS... From Aquarists' Societies

Monthly reports from Secretaries of aquarists societies for inclusion on this page should reach the Editor by 3rd of the month preceding the month of publication.

North Avon A.S. held their A.G.M. in October, which resulted in slight changes in the make-up of the committee. Mr. C. Spence remains as Chairman, and Mr. R. Cummins as Secretary, but the position of Vice Chairman is now held by Mr. J. Hughes, and Treasurer by Mrs. I. Hughes. The Society's annual cups were awarded by the outgoing committee prior to the election of officers. The Highest Points (table shown) Cup was won by Mr. P. Long; the Suhada Senior Cup was presented to Mrs. Southwick; the Suhada Junior Cup to Master Matthew Round, and the James Webb Cup to Mr. G. Churchill. Congratulations are extended to these members on their achievements. North Avon A.S. would also like to congratulate *Aquarist and Pondkeeper* on its 60th anniversary, and express the hope that it will continue to flourish for many years to come.

If you would like to extend your interest and knowledge in the many aspects of the aquarist hobby, why not come along and meet us at any of our meetings, held on the third Monday in each month at Hasham Folk Centre, High Street, Hasham, Bristol or enquire of the Secretary, R. W. Cummins, 1 St. Annes Close, Cadbury Heath, Warmley, Bristol BS15 5EH.

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AT the Annual General Meeting of the **Darlington & District A.S.** the following officers were elected: Chairman, Mr. K. Brewer; Vice Chairman, Mr. M. Burn; Secretary, Mr. K. Rodway.

Would you please address any correspondence to the following address: 35 Geneva Road, Darlington, Co. Durham. Telephone: 0325 487581.

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THE meetings of the **Goldfish Society of Great Britain** will be held at the Central Club YWCA, Great Russell Street, London WC1B 3LR, 2.30 p.m.: 19th January; 16th March A.G.M.; 20th July; 16th November.

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SPEAKING to **Bristol A.S.** Dr. P. Miller described the biology of the methods by which Carp became aware of sounds and mentioned experiments which tended to show that in many cases, when offered the choice, Carp chose to live in a temperature higher than that of their previous environment.

Table Show Results: Comets: 1 and 3, C. Hayes; 2 and 4, P. Norman. Bristol Shubunkins (bred 1984): 1, 2, 3 and 4, R. Lormand. Biggest baby (bred 1984): J. Day.

Bristol A.S., which caters for all aspects of the coldwater side of the hobby meets on the second Tuesday at St. Ambrose Church Hall, Stretford Road, Whitehall at 7.30. Visitors or problems are welcomed. Details from T. C. Harper, 11 Bridge Walk, Bristol BS7 0LE. (0272-699131).

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THE following appointments were made at the recent A.G.M. of **Huddersfield Tropical Fish Society:** Chairman, Jim Duckett. Show Secretary, Mrs. Pam Town, 197 Abbey Road, Shepley, Huddersfield (Tel: 0484 607640). Secretary, Edward Cheetham, 102 Huddersfield Road (Tel: Brighouse 0484 607640).

Our open show date for 1985 is 8th September at Slaithwaite Hall.

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RESULTS of the **Dorchester A.S.** open show (formerly the Dorchester Tropical Fish Society), were as follows: Best Fish in Show and Best Tropical: R. F. Adams (Salisbury). F.B.A.S. Championship Trophy (Class Dc): C. Amey (Dorchester). Best Coldwater: R. Fitzgerald (Dorchester). Best Livebearer: D. and P. Lambert (South East A.S.), and finally, but not least, Highest Pointed Visiting Society Silver Salver, was won by Salisbury D.A.S. Individual class winners were: Ba: D. Higbee; B: Mrs. D. Cruickshank (South East A.S.); Ca: R. F. Adams (Salisbury); Cb: C. Amey (Dorchester); C: D. Higbee; Da: D. Cox (Yeovil); D: R. F. Adams; Db: C. Amey; Dc: C. Amey; Ea: R. Paull (Dorchester); E: S. McLeod (Salisbury); F: D. S. Langdon (Yeovil); Ga: S. McLeod; G: R. F. Adams; H: T. A. Cruickshank (South East A.S.); I: M. Puckett (Taunton); K: F. Cox (Bournemouth); L: D. Young (Dorchester); Ma: F. Cox; M: D. Cox; Nb-m: F. Cox; No-t: D. and P. Lambert (South East A.S.); O: D. Young; P: D. Cox; Q: C. Amey; R: F. Cox; S: D. Cox; T: D. and P. Lambert; U: R. F. Adams; V: R. Fitzgerald (Dorchester); W: R. Cooper (Taunton); Xb-m: H. Miller (Chard); Xo-t: R. F. Adams.

The Society wishes to thank all those who helped to make the show possible, and in particular the following: B. P. Nutrition (U.K.) Ltd.; Algarde; Acuvel International Ltd; Fantasy & Pet Products Ltd; R. C. Hagen (U.K.) Ltd.; Interpet Ltd; Phillips Yeast Products Ltd; Magnet Pet Foods Ltd.; Tetramin (U.K.) Ltd; Thomas's (Petcare); Waterlife Research Industries Ltd; and Eric Woods (Rosewood) Ltd., for their generous help and support.

Readers will note that the new name of the Society is now the Dorchester Aquarist Society. Meetings as usual are held on the Fourth Wednesday of each month at the George Hotel, Trinity Street, Dorchester.

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Dunfermline and District A.S. held their 14th annual open show in the Nethertown Institute. Exhibitors, representing 28 societies, travelled as far as Peterhead and Peebles to enter a total of 577 entries, the highest entry at an open show this year.

It took 11 judges, comprising some of the top Scottish experts all afternoon to judge the high stadard of fish, entered in 51 classes.

Dunfermline members won 18 firsts, 17 seconds, 14 thirds and 12 trophies, including the Best Exhibitor Trophy and, with a record 102 points, the Shield for the Society with the highest points.

Trophy winners: Livebearer: J. Mitchell (Kirkcaldy); Characin: D. Dobbie (Dunfermline); Barb: H. Hoey (Dunfermline); Cichlid: G. Talbot (Forfar); Danio or Minnow: J. Wells (Dunfermline).

Catfish: H. Bowie (Edinburgh Pondkeepers); Loach: R. Colnart (Cowie); Egglaying Toothcarp: R. Farquhar (Aberdeen); Anabantid: Mr and Mrs J. Wright (Edinburgh); Siamese Fighter: A. Little (Kirkcaldy).

Silverside: K. Johnston (Dunfermline); Shark: J. Wells (Dunfermline); Rasbora: J. Wells (Dunfermline); A.O.S. Egglayers: D. Dobbie (Dunfermline); Pair: I. Henry (Dunfermline).

Breeders (Livebearers): R. MacIntosh (Muirhouse); Breeders (Egglayers): P. and J. Wilson (Grangemouth); Coldwater: M Colnart (Cowie); Plants: N. Hearty (Livingston); Furnished Jar: H. Hoey (Dunfermline).

Best Fish in Show—G. Talbot (Forfar).

Guppies: J. Wells (Dunfermline). Platies: P. Henry (Dunfermline). Mollies: J. Mitchell (Kirkcaldy). Swordtails: I. Hill (Lanarkshire). A.O.S. Livebearers: B. McFarquhar (Aberdeen). Characins "A": H. Hoey (Dunfermline). Characins "B": D. Dobbie (Dunfermline). Characins "C": P. Henry (Dunfermline). Barbus tetrazona: S. Hamilton (Independent). Barbs "A": H. Hoey (Dunfermline). Barbs "B": S. Graham (Muirhouse). Small Cichlids: G. Talbot (Forfar). Rift Valley Cichlids: G. McNeil (Dunfermline). Large Cichlids: H. Johnston (Peterhead). Tropical Minnows: M. Marley (Whitburn). Danios: J. Wells (Dunfermline). Catfish "A": J. Fettes (Aberdeen). Catfish "B": H. Bowie (Edinburgh Pondkeepers). Loaches: M. Colnart (Cowie). Egglaying Toothcarp: R. McFarquhar (Aberdeen). Colisa Species: C. Henry (Dunfermline). Trichogaster species: J. and M. Gilchrist (Stirling). AOV Anabantid: Mrs and Mrs J. Wright (Edinburgh). Siamese Fighters: A. Little (Kirkcaldy). Silversides: K. Johnston (Dunfermline). Sharks: J. Wells (Dunfermline). Rasboras: J. Wells (Dunfermline). AOS Egglayers: D. Dobbie (Dunfermline). Pairs, Guppies: J. Wells (Dunfermline). Pairs, Platies: Ramsay (Scottish). Pairs, Mollies: T. Ramsay (Scottish). Pairs, Swordtails: J. Wells (Dunfermline). Pairs, AOS Livebearers: D. Meredith (Kirkcaldy). Pairs, Egglayers: I. Henry (Dunfermline). Breeders Guppies: R. Turnbull (SMTAS). Breeders Platies: H. Shields (SLAG). Breeders Mollies: R. MacIntosh. Breeders Swordtails: T. Grieve (SMTAS). Breeders AOS Life: R. MacIntosh (Muirhouse). Breeders Egglayers "D" J. Davidson (Dalkeith). Breeders Egglayers "C": McFarquhar (Aberdeen). Breeders Egglayers "B": J. McCormack (Cowie). Breeders Egglayers "A": R. and J. Wilson (Grangemouth). Breeders Coldwater: M. Colnart (Cowie). Shubunkins: Mrs B. Murray (Cowie). Common Goldfish & Comet: Mrs Colnart (Cowie). A. V. Double Tailed Goldfish: M. Thomson (Ochils). AOV Coldwater: M. Colnart (Cowie). Plants: N. Hearty (Livingston). Furnished Jar: H. Hoey (Dunfermline). Any unidentified Species: G. McNeil (Dunfermline).

Society with highest aggregate of prize cards: Dunfermline. Dunfermline member with highest aggregate of prize cards: John Wells. Individual with highest aggregate of prize cards: John Wells.

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FURTHER to an extra ordinary meeting of the **Alfreton & District A.S.** held on 1st October, the following officials were elected: President, Mr. Stanley Hill. Chairman, Mr. Stanley Leivers. Treasurer, Mr. Brian Hickling. Assistant Secretary, Mr. Frank Martin. Secretary/Show Secretary, Mr. Malcolm Darrington, 48 Pennine Avenue, Riddings, Derbyshire.

Meetings of the society are held on the 1st Monday of each month at Alfreton Hall, Alfreton, Derbyshire.

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Wolverhampton A.S. open show held on 23rd September. Once again we would like to thank everyone who helped to make the show a success, the judges and all the societies who entered. We meet on the first Saturday of each month at the "Stamford Arms," Bristol, St. Penn Fields, Wolverhampton. Further information can be gained by ringing Wolverhampton 750144.

Best in Show: F. S. D. Whitehouse, *Gasteropelecus levesilensis*. Best Society: Leicester ADAS. Best Individual: F. S. D. Whitehouse. Judged to F.B.A.S. rules.

Furnished Aquarium: R. Palmer. Large Barbs: J. T. F. Mayle. Small Barbs: F. S. D. Whitehouse. Characins: C. Wainwright. Characins: C. Wainwright. Characins: J. Richards. Angels: C. Smith. Dwarf Cichlids: Mr. and Mrs. Harrison. Rift Valley Cichlids: G. Eccles. A.O.S. Cichlids: F. S. D. Whitehouse. Anabantid: R. Sheffield. Betta Splendens: G. Woolley. Killiefish: Mrs. M. Hall. Small Catfish: A. and R. Potts. Corydoras: J. and J. Davies. Brochis: J. Richards. Rasboras: Paul Johnson. Danio: Brockhouse family. Loaches: J.E.D. Labeo: Mr. and Mrs. L. Purks. A.O.S. Tropical Egglayer: E. Broderick Male Guppy: Colin Hall. Female Guppy: W. Crampton. Swordtail: Mr. G. Edwards. Platy: Mr. and Mrs. A. Crampton. Molly: A. Finnigan. A.O.S. Tropical (Livebearers): J. and J. Davies. Junior Egglayer: D. Brockhouse. Pairs (Egglayer): R. Sheffield

Junior (Livebearer): A. Clouds. Pairs (Livebearer): J. Griffiths. Single Tail Goldfish: Mr. and Mrs. Littlewood. Twin Tail Goldfish: Mr. and Mrs. Littlewood. A.O.S. Coldwater: R. Jayes. Breeders (Egglayers): D. R. Kilworth. Breeders (Livebearer): J. T. F. Mayle. Plants: J.E.D.

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Paisley & District A.S. held its last meeting on 2nd October in Paisley Museum and Art Galleries. This was an inter-club night involving Greenock and Helensburgh Societies who brought 15 and 9 members each. With 35 Paisley members and a large number of visitors the total attendance was in excess of 80. The guest speaker for the evening was Mr. John Wells from Dunfermline who gave a talk on 'Hints and Tips on Showing Your Fish.' He was ably assisted by his wife, Jean, who judged the ordinary club table show while John judged the inter-club table show which was 'Catfish,' with results as follows: First Awards Catfish 'A': D. O. Carr (Greenock). Catfish 'B': I. Lindsay (Paisley). The ordinary club table show First Award results (Characins) were as follows: Senior: I. Lindsay; Junior: D. Hunter. The treasurer, D. Mackay, conducted a small mini-auction and Mr. Wells presented award cards to the winners.

The pointages for the first round of the inter-club table show are as follows: Greenock: 8 points; Paisley: 4 points; Helensburgh: Nil. Members of all three Societies are looking forward to the next rounds of this new competition which will take place in the next few months.

Anyone interested in obtaining further information about the Club should contact the Secretary, Mrs. E. Lindsay, 71 Wright Street, Renfrew. Phone: 041-889 5772.

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RESULTS of **Sunderland A.S.** open show held on Sunday 30th September 1984, at Pennywell Community Centre. First award winners: Class B: J. Priestley; Ba: W. Grant; C: J. Alexander; Ca: M. Bunn; Cb: G. Errington; D: J. Gardener; Da: D. Morgan; Db: S. King; De: G. Errington; E: R. and S. Brown; Ea: R. and C. Hargreaves; F: T. Waller; G: R. Corner; H: R. Kirkup; J: H. Hargreaves; K: S. King; L: W. A. Grant; La: Mr. Moses; M: D. Morgan; Ma: S. King; N-ben: D. Morgan; N.O.-T: A. Waller; O: G. Watson; P: J. Tinling; Q: R. S. Brown; R: M. Conway; S: A. Waller; T: A. Waller; U: R. Bell; V: J. Harris; W: S. Kelly; Wa: L. Hindle; X.b-m: R. Brogden; X.O-T: A. Waller. Best Fish in Show, Barbus similaratus owned by Mr. J. Priestley (Stanley A.S.). Best Exhibitor: Mr. A. Waller (Southend A.S.). Entries 261.

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Edinburgh Aquarium and Pondkeepers open show winners: Reekie Trophy for Livebearers: D. Meredith (Kirkaldy). Paterson Trophy for Characins: J. Leslie (Kirkaldy). Henderson Trophy for Barbs: Shirley Graham (Muirhouse). G. and T. Forsyth Trophy for Cichlids: G. Talbot (Forfar). S. and M. Salesrooms Trophy for Anabantids: F. McKenzie (Cowie). The Aquariums Trophy for Catfish: Bruce Milne (Forfar). E.A.P. Club Trophy for Rasboras: J. Wells (Dunfermline). Elaine and Kevin Trophy for Best Shark and Loach: J. Pennycuick (Newbattle Pegasus Disco Trophy for Best Pair: R. MacIntosh (Muirhouse). E.A.P. Trophy, Breeders Livebearers: T. Greive (S.M.T.). Tower Trophy, Breeders Egglayers: M. and S. Poulton (S.M.T.). Pete and Sylvia Trophy, Best Coldwater: M. Coltart (Cowie). Scott and Thompson Trophy, Best Plant: N. R. Hearty (Livingston). E.A.P. Trophy Best Junior: B. J. Poulton (S.M.T.). Top pointed E.A.P. Member Trophy: H. Bowie. Best Fish in Show, City Limit Video Trophy: D. Meredith, Kirkaldy Aquarist Society.

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Edinburgh A.S. s.g.m. and election of office bearers was held in the club rooms on 25th September at which the following were elected: President, J. Wright; Secretary, J. Milligan; Asst. Secretary, Liz Wright; Treasurer, H. Kerr; Asst. Treasurer, J. Wright; P.A.O., J. Ballantyne; Asst. P.A.O., N. Ballantyne; Librarian, P. Cook; Club Shop, S. Kemp; Show Manager, J. Irish; Asst. show manager M. Hayward.

First award winners in the Open Show. Common Goldfish: M. Coltart (Cowie). Shubunkins: K. Johnston (Dunfermline). Veiltails: M. Thomson (Ochil). Twintails: K. Johnston (Dunfermline). Dorsalless: K. Johnson (Dunfermline). A.O.S. Coldwater: M. Coltart (Cowie). Guppy Male: J. Wells (Dunfermline A.S.). Mollies: S. Kemp (Edinburgh). Platies: J. Wells (Dunfermline). Swordtails: J. Wells (Dunfermline). A.O.S. Livebearers: H. Shields (SLAG). Barbs (A): H. A. Hoey (Dunfermline). Barbs (B): S. Graham (Muirhouse). Characins (A): J. Leslie (Kirkcaldy). Characins (B): P. A. Sutherland (Livingston). Characins (C): R. Turnbull (S.M.T.A.S.). Rasboras: J. Wells (Dunfermline). Danios & TRO: Mimosws: J. Wells (Dunfermline). Egglaying Tooth Carps: R. Ainslie (Kirkcaldy). Siamese Fighters: G. Talbot (Forfar). Trichogaster Species: D. Crawford (Kirkcaldy). Colisa Species: J. Davidson (Dalkeith). A.O.S. Anabantids: H. Hoey (Dunfermline). Small Cichlids: G. Talbot (Forfar). Large Cichlids: H. Johnston (Peterhead). Angels: P. Sutherland (Livingston). Rift Valley Cichlids: L. Davidson (Edinburgh). Catfish (A): J. P. Wilson (Grangemouth). Synodontis Species: I. Lindsay (Paisley). Sharks: G. Talbot (Forfar). Loaches: H. Hoey (Dunfermline). A.O.S. Egglayers: D. Dobbie (Dunfermline). Pairs (Livebearers): G. Kane (Kirkcaldy). Pairs (Egglayers): P. Meldrum (Livingston). Aquarium Plants: T. Ramsay (Scottish). Breeders Guppies: R. Coltart (Cowie). Breeders Mollies: G. Kane (Kirkcaldy). Breeders (Swordtails): J. Wright (Edinburgh). Breeders (Platies): H. Shields (SLAG). Breeders A.O.S. (Livebearers): R. MacIntosh (Muirhouse). Breeders (Egglayers A): J. Davidson (Dalkeith). Breeders (Egglayers B): G. Kane (Kirkcaldy). Breeders (Egglayers C): M. S. Poulton (S.M.T.). Breeders (Egglayers D): G. Kane (Kirkcaldy). Breeders Experimental: H. Dixon (Falkirk). Unidentified Species: G. McNeil (Dunfermline).

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AT the Annual General Meeting of the **Romford and Beaconstree A.S.**, held at St. Augustine's Church Hall, Birbeck Road, Rush Green, Romford, Essex, the following Committee were elected: Chairman, Mr. C. Wiseman; Secretary, Mr. S. Carter; Treasurer, Mr. G. Stapleton; Show Secretary, Mr. B. Brown; Asst. Show Secretary, Mrs. D. Godfrey; Programme Officer, Mr. S. Wright; P.R.O., Mrs. D. Wiseman; Social Secretary, Mrs. R. Stannard; Junior Member, Mr. J. Wiseman; Lay Member, Mr. V. Wren.

The society meets on alternate Thursdays and new members or visitors are always welcome.

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Ellesmere Port open show was held on 16th September. First award winners:

Guppies: P. K. Holden (Blackpool). Platies: Mr. and Mrs. Baldwin (Sandgrounders) Section winners. Swordtails: Mr. and Mrs. Marshall (Merseyside). Mollies: K. Brunt (Potteries Fish Club). A.O.V. Livebearers: R. I. Payne (Merseyside). Anabantids (small): M. Hughes (Ellesmere Port). Anabantids (large): Mr. and Mrs. Baldin (Sandgrounders). Fighters: P. Jones (Wrexham) Section winner. Characins (small): Mr. and Mrs. Robinson (Skegness). Characins (large): K. Brunt (Blackpool) Section winner. Cichlids (small): D. Price (Ellesmere Port). Cichlids (large): Mrs. Atkins (Sandgrounders) Section winner. Angels: Mr. and Mrs. Evans (Blackpool). Rift Valley Cichlids (small): Mr. and Mrs. J. Williams (Ellesmere Port). Rift Valley Cichlids (large): Mr. and Mrs. Goddard (Macclesfield) Section winners. Barbs (small): M. K. Rathbone (Potteries Fish Club) Section winner. Barbs (large): Mr. and Mrs. Baldwin (Sandgrounders). Minnows: Mr. and Mrs. Baldwin (Sandgrounders). Danios: A. M. Redman (Blackpool). Rasboras: Mr. and Mrs. Marshall (Merseyside) Section winners. Sharks: Mr. and Mrs. Baldwin (Sandgrounders) Section winners. Foxes: D. Price (Ellesmere Port). Loaches, Botia: Mr. and Mrs. Marshall (Merseyside). Corydoras, Brochis: Mr. and Mrs. Marshall (Merseyside) Section winners. A.O.V. Catfish: Mr. and Mrs. Baldwin (Sandgrounders). Killifish: R. I. Payne (Merseyside). A.O.V. Tropical: R. I. Payne (Merseyside). Breeders (Egglayers): R. MacDonald (Macclesfield) Section winner. Breeders (Livebearers): Mr. and Mrs. Marshall (Merseyside). Pairs (Egglayers): Mr. and Mrs. Baldwin (Sandgrounders) Section winners. Pairs (Livebearers): Mr. and Mrs. Smith (Blackburn). Egglayer (Junior): G. Wood (Ellesmere Port). Livebearers (Junior): G. Williams (Ellesmere Port) Section winners. Common Goldfish: Mr. and Mrs. Bibby (Sandgrounders). Shubunkins: N. Woodward (Merseyside). A.O.V. Fancy Goldfish: N. Woodward (Merseyside). A.O.V. Coldwater: Mr. and Mrs. Goddard (Macclesfield).

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RESULTS of **Preston & District A.S.** Second Annual open show held at Preston North End Supporters Club on 2nd September.

Best in Show: Mr. and Mrs. Goddard (Macclesfield). Guppies: K. Hunter (Workington). Platies: Mr. and Mrs. Baldwin (Sandgrounders). Swordtails: F. and S. Spencer (Preston). Mollies: Mr. and Mrs. McDonald (Merseyside). A.O.V. Livebearers: R. I. Payne (Merseyside). Small Anabantids up to 8 cms: R. Whittaker (Sandgrounders). Large Anabantids over 8 cms: M. and D. Hartley (Sandgrounders). Fighters: R. I. Payne (Merseyside). Old World Dwarf Cichlids up to 10 cms: A. Milligan (Preston). Old World Large Cichlids over 10 cms: Mr. and Mrs. Goddard (Macclesfield). New World Dwarf Cichlids up to 10 cms: J. and S. Cresswell (Preston). New World Large Cichlids over 10 cms: M. and D. Hartley (Sandgrounders). Angels: M. and D. Hartley (Sandgrounders). Discus: P. Kelly (Preston). Small Barbs up to 7.5 cms: R. J. Stephens (Blackburn). Large Barbs over 7.5 cms: Mr. and Mrs. Baldwin (Sandgrounders). Small Characins up to 7.5 cms: Mr. and Mrs. Baldwin (Sandgrounders). Large Characins over 7.5 cms: D. T. Milner (Darwen). Rasboras: D. T. Milner (Darwen). Danios: Mr. and Mrs. Smith (Blackburn). Minnows: M. and K. Rathbone (P.T.F.C.). Corydoras and Brochis: K. Brunt (P.T.F.C.). A.O.V. Catfish: M. and D. Hartley (Sandgrounders). Sharks: Mr. and Mrs. Baldwin (Sandgrounders). Foxes: Mr. and Mrs. Mulla (Merseyside). Loaches and Botias: Mr. and Mrs. Marshall (Merseyside). Toothcarps (Top Spawning): Mr. Drake (Atherton N.W.). Toothcarps (Bottom Spawning): Don Parkinson (St. Helens). Pairs (Egglayers up to 7.5 cms.): Mr. and Mrs. Baldwin (Sandgrounders). Pairs (Egglayers over 7.5 cms.): J. and S. Cresswell (Preston). Pairs (Livebearers): Mr. and Mrs. Marshall (Merseyside). Breeders (Egglayers 1): J. T. Morris (Sandgrounders). Breeders (Egglayers 2): Mr. Drake (Atherton N.W.). Breeders (Egglayers 3): Mr. and Mrs. Baldwin (Sandgrounders). Breeders (Egglayers 4): D. Pluck (Preston). Breeders (Livebearers 3): D. T. Milner (Darwen). Breeders (Livebearers 4): Mr. and Mrs. Marshall (Merseyside). A.O.V. Tropicals: Mr. and Mrs. Hands (Accrington). Common Goldfish and Comets: Mr. and Mrs. Bibby (Sandgrounders). Shubunkins: S. Walsh (Accrington). Moors: D. T. Milner (Darwen). A.O.V. Fancy Goldfish: Mr. and Mrs. Bibby (Sandgrounders). A.O.V. Coldwater: S. Walsh (Accrington).

Preston and District A.S. would like to thank all who participated in making the open show such a successful day.

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HAREWOOD House near Harrogate in Yorkshire was once again the venue for the 8th Annual National open show for the **Yorkshire Koi Society.**

It attracted thousands of visitors which was further enhanced by a Traction Engine rally held in the grounds of Harewood House on the same day.

Many Koi were entered in both the individual and dealers classes with John Cowell, of 'Quality Koi', taking the Lion's share of the trophies in the dealers class including the Grand Champion, and customers taking trophies in the individual class including runner-up to the Grand Champion with Koi sold by 'Quality Koi'.

Results as follows: Individual class: Best in size 14 in.-18 in.: Shows, David Wilson. Best in size 14 in.-18 in.: Tancho, David Wilson. Best in size 18 in.-22 in.: Sanke, Bill Houghton. Best over all: Showa, David Wilson. Best over all: Sanke, Bill Houghton. Runner-up to Grand Champion: Showa, David Wilson. (All Koi supplied by 'Quality Koi').

Dealers class: Best Kohaku: 'Quality Koi'. Best Kin-Ki-Utsuri/Hikari Utsuri: 'Quality Koi'. Best Showa: 'Quality Koi'. Best Ai Goromo/Koromo, Asagi, Shusui: 'Quality Koi'. Grand Champion: Kohaku, 'Quality Koi'.