

The NEW

AQUARIST & PONDKEEPER

MAY 1996

£2.25

The Better Fishkeeping Magazine



INSIDE

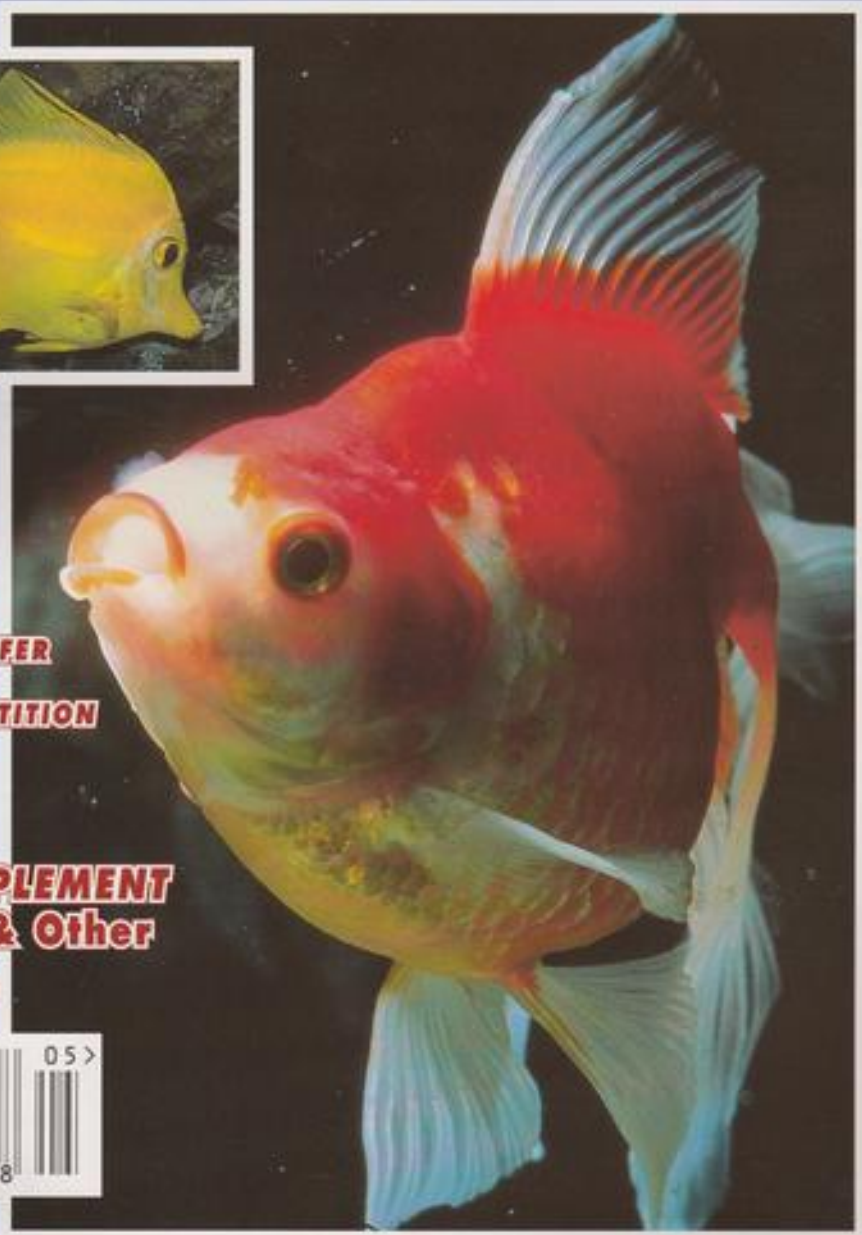
**AQUARIAN
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PLUS

**FREE SUPPLEMENT
Goldfish & Other
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MAY 1996 VOL 61 NO 2

AQUARIST PONDKEEPER

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Wellesley Road,
Ashford, Kent TN24 8ET

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SUBSCRIPTIONS/
ADVERTISING AND
PRODUCTION/
CLASSIFIEDS &
BUYERS GUIDE/
ACCOUNTS
01233 636149

FAX NUMBER
01233 631239

SUBSCRIPTIONS
Rates on application.
All subscriptions payable
in advance to:
MJ Publications Limited,
Caxton House,
Wellesley Road,
Ashford, Kent
TN24 8ET

Litho origination by
Ashford Composition Ltd.,
Ashford, Kent
Colour reproduction by Ashford
Scanning Ltd., Ashford, Kent
Printed by Headley Brothers
Limited, Ashford, Kent

Distributed to the
Newstrade by:
UMD Ltd., Tabernacls Street,
London EC2A 4BN

ISSN 0003-7273

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Comment

It's been a bleak time recently. One way or another, Events occurred which just threw up the unexpected, the inevitable and the alarming — and we're not just talking BSE or CJD here.

Neither the theft of a car, followed by a family bereavement, is exactly conducive to producing a hobby magazine, both of these events following on a contributor's last minute panic when a floppy disk jammed in a word-processor! Looking back, there was not much that could have been done to avoid any of these setbacks — apart from not huddling from bed nor attempting to do anything practical. (Yes, the car was alarmed and one does not expect floppy disks to stick; sadly, ill health coupled with advancing age is something that has its own predictability.)

Can any, or all, of these carry a relevant message for us at our enjoyment level of fishkeeping? Obviously we are not advocating doing nothing at all in case anything should go wrong; rather, our attitude should be to do all we can to minimise disasters should they occur by taking every reasonable precaution.

Being in complete control over conditions in our aquariums the onus falls upon us for the total well-being of our captive fishes. Do as much advance work as is needed when taking on any new item of interest, be it fish, equipment, striking out with a new pond or changing codes. Understanding that every action taken will result in a corresponding reaction will go a long way to avoiding setbacks in the future. Obtaining quality information, reliable equipment and healthy stock — in that order too — should be three good principles to follow.

It cannot be a coincidence that we were given twice as much equipment to absorb information with than we have to deliver it — using eyes and ears more than the mouth is usually far more beneficial! However, there is one obvious exception to this set of rules — by all means absorb all the visual information on hand in this issue of A&P, but for goodness sake, don't neglect to tell your friends about it too!

So most of you spotted our deliberate April Fool's new product — Heronstop (aka Green Water!) — but we definitely didn't intend you to search for an article that wasn't there! We apologise to Trevor Gray for the omission of his colourful(!) article and hope to bring it to you in the not too distant future.

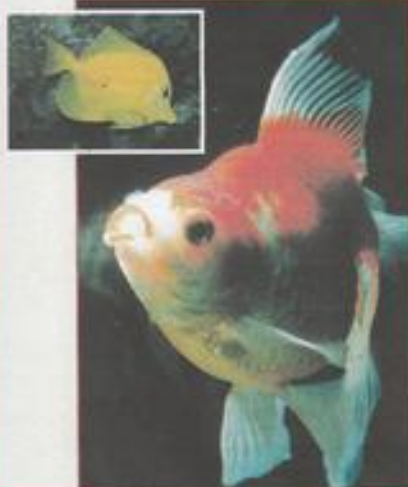
Sid Phillips

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COVER PICTURES

MAIN PICTURE: M.P. & C. PIEDNOIR
INSET PICTURE: NICK DAKIN



The quite superior expression on this fish's face is fully justified as it surely reflects the feelings of this superb Goldfish as it contemplates the many hundreds of years *Carassius auratus* has been an aquarium favourite, bringing so much pleasure to so many people worldwide.

The Yellow Tang, *Zebrafish flavescens*, is an ideal subject for inclusion in the Reverse-Flow marine aquarium.

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Growing Tips

BY BARRY R JAMES

The Art of Aquarium Decoration

In the 35 years or so that I have been involved in the aquarium world, I have seldom been impressed by the layout of hobbyists' aquariums. It is quite obvious that little planning or forethought had gone into their creation. There are certain guidelines which must be followed and I will elaborate on these later, but basically it is the aquarist's own creation and, as such, will be judged by others as an expression of his or her artistry. Without doubt, setting up an aquarium or "aquascaping" as it is known in the aquarium world is an art form, which in my opinion, ranks with sculpture and painting in its complexity and freedom of expression. However it is not, unlike traditional art, a static creation. The setting up and initial planting is only the beginning of a cycle of growth and maturity and a certain vision and knowledge is required to envisage the final completed work, which may only be apparent after some months or even years.

There is on the market a software programme for landscaping the garden. Published under the auspices of BBC Gardener's World it is on CD Rom. This programme has the ability to predict and display the growth of trees and shrubs in the future. When working with this programme I have often been staggered on projecting a plan say five years into the future to discover that that tiny little conifer has now swamped the garden!

Somebody some day will write a programme for aquascaping aquaria which will contain similar surprises for the aquarium designer. For the moment though we can only be guided by our present knowledge and that which we can obtain through reference to aquatic literature.

Before attempting anything a rough sketch plan of the intended scheme should be drawn to scale. The next operation is to assemble the hard materials to be used for the 'furniture.' This would include the gravels, rocks, bogwood, cans of expanded polystyrene, resin pastes and artifacts such as 'Similawood.' An important part of the planning is to decide in advance how equipment such as heaters, internal filters and pipes should be disguised. In addition, background pictures should be firmly affixed to the rear glass. This is best achieved by using adhesives rather than sellotape, which has a disconcerting habit of drying out and coming loose after quite a short period of time.

If you are a serious plant grower undergravel heater cables need to be fixed to the bottom glass and beneficial additional substrates such as Everite No 1 should be put in place. The next phase is the installation of the equipment. Heaters, filters and CO₂ diffusers must all be positioned and held in place by suckers. I prefer to fix suckers in place permanently by using Dow Corning rather than rely purely

A to Z of plants

Cardamine

This is a large genus containing some 160 species many of which are bog plants. At least three are capable of growing submerged for long periods and therefore may be regarded as aquatic. They are distributed throughout the temperate regions with some being found at altitude in the tropics.



PHOTO: MP. & C. PEDGLEY

Cardamine lyrata Bunge
1835

Common Name: Japanese Cress

Description: A pretty herbaceous plant of dainty habit which emerged grows prostrate with alternate leaves born on thin stems. The stems turn upwards when flowering and are pinnate with large terminal lobes. The small white flowers are born in clusters. When growing underwater the leaves are light-green born on long petioles and

are roundish or slightly kidney shaped. The stems grow upwards towards the surface.

Cultivation: This species is happiest when growing in cooler tanks with a temperature range of 15-20°C. Cardamine needs a brightly lit situation but is otherwise undemanding.

Propagation: By stem cuttings

Note: Two other species, *C. prorepens* and *C. variabilis*, are known to be suitable but are not in cultivation. *C. rotundifolia* (American Cress) is a plant of weak, prostrate habit, rooting freely at the nodes. It bears alternate deep-green rounded leaves. It grows well in an unheated aquarium. A native of North America it has not been imported into Europe for many years.

on the suction action. The back glass is disguised and the background rocks are best held in position using expanded polystyrene spray. This material sets immediately and can then be "worked" by careful manipulation with a miniature gas blowtorch to achieve the best effect. The pre-washed gravel is now added. At least 3in deep at the back sloping to 1 1/2in at the front is needed.

Now the terraces can be installed to maintain the gravel levels. Rocks, large pebbles, bogwood, "Similastone" or "Similastone" can all be used for this purpose. I glue small splinters of rock or pebbles in the gaps between the terracing material to prevent the spilling of the gravel. "Plastic Padding" I have found is best for this purpose because of the speed at which it sets. The next

operation is to fill the tank with about 9in of water and install the plants. The advantage of planting with a reasonable depth of water in the tank is that the plants will take up their natural positions (not just lay on the gravel) and you can get a rough idea of how things are progressing as you go along. I will deal with this operation next month.

Editor's Note: Here seems to be a good place to mention something a reader contacted us about. Apparently, the use of aquarium sealant may not make a too permanent job of fixing pieces of rock together to form aquarium decorations. It may be that Barry's Plastic Padding could be a better alternative. Any observations by readers on this subject would be very welcome.

REVERSE-FLO

As we discovered last month, reverse-flow filtration offers the marine fishkeeper increased opportunities over the downflow method and consequently the choices for livestock are broadened immensely. For the first time a selection of invertebrates can be recommended without hesitation. However, a word of warning at this point, invertebrates, and particularly sessile

NICK DAKIN SUGGESTS FISH AND INVERTEBRATES FOR LAST MONTH'S REVERSE-FLOW MARINE SYSTEM.

• PHOTOGRAPHS BY THE AUTHOR •

invertebrates, are very sensitive and the newcomer to the hobby would be well advised to keep a fish-only tank for about 12 months in order that valuable experience be gained with species that are far more forgiving when it comes to varying water parameters. After this period, the hobbyist will be much more familiar with water testing, feeding, lighting and other areas of good aquarium husbandry which are so crucial

The Strawberry Gramma (*Pseudochromis porphyreus*)

Size: 2.2in (wild) 2.75in (aquarium)



The Strawberry Gramma (*Pseudochromis porphyreus*)

Whilst this beautiful cerise coloured fish may not be the most demanding of species as far as water quality is concerned, it is aggressive and requires that its tankmates are chosen with great care. Slow-moving or timid species are to be avoided if they are not to receive the unwanted attentions of the territorial Strawberry Gramma. Disease resistance is high and most specimens adapt to aquarium life very swiftly. Also worth considering are the Flash-Back Gramma (*Pseudochromis diadema*) and The False Gramma (*Pseudochromis paccagnellae*).

FEEDING: The Strawberry Gramma will accept most marine fare, including flake, as long as the pieces are small enough.

The Longnosed Hawkfish (*Oxycirrhites typus*)

Size: 4in (wild & aquarium)

All hawkfishes are efficient predators,

with the larger species ambushing smaller fish. No such fears with the Long-Nosed Hawkfish as it preys on shrimps and other similar crustacea. Whilst shrimps that perform a parasite removing service are generally left alone, this species has been known to take Dancing Shrimps and Cleaner Shrimps on occasions. Lack of a swim bladder means that hawkfish spend much of their time inactive and perched on suitable vantage points (usually gorgonians). This

lack of movement does not necessarily diminish their desirability as an interesting shape and colourful appearance more than make up for it. In common with others of the same family, the Long-Nosed Hawkfish

requires excellent water quality at all times.

FEEDING: Live river and brineshrimp are particularly relished, although other meaty marine fare will be taken. Experiment to establish a

favourite diet.

The Yellow Tang (see front cover for photograph) (*Zebrasoma flavescens*)

Size: 8in (wild) 4-6in (aquarium)

One of the most popular marine fish in the hobby, The Yellow Tang is also possibly one of the most abused. Owing to its ultimate size, a tank of at least 4ft is required, with excellent water quality, plenty of swimming space and some established micro and macro algae on which to graze. Failure to provide these things will result in the fish contracting a potentially fatal disease, or wasting away. The reverse-flow system as described last month would suit the Yellow Tang, after it had been allowed to mature over a period of four-six months. It should not be regarded as an initial introduction.

FEEDING: Most tangs will accept brineshrimp and other small morsels but being predominantly herbivores

The Longnosed Hawkfish (*Oxycirrhites typus*)



W L LIVESTOCK

to the well-being of invertebrates. Having said that, reverse-flow filtration is ideal for a fish-only tank and can easily be converted to house invertebrates at a later date as long as the tank has not been the subject of copper-based medications.

THE FISH-ONLY AQUARIUM

Many newcomers to the hobby often

feel that it is almost obligatory to start with anything that lives in salt water. Fish, invertebrates, algae; all are introduced in an uncontrolled mix guaranteed to end in disaster in the majority of cases. The fish-only aquarium, however, can be just as attractive and certainly much more controllable.

All the species covered in livestock for the downflow system are particularly

relevant here (A&P March 1996), but several more demanding fish can be added to the list at this point.

NEXT MONTH:

I WILL BE CONTINUING MY SERIES WITH A LOOK AT TRICKLE FILTRATION

they demand regular quantities of green foods. Marine algae is ideal (e.g. *Caulerpa* sp.) but can be depleted very quickly. Blanched lettuce or spinach leaves make a good alternative. The leaves must be lightly blanched to destroy their cellulose covering which would otherwise make them indigestible.

THE MIXED AQUARIUM

Should the aquarist wish to progress onto a mixed fish/invertebrate set-up from a fish-only tank several items will require attention.

(A) Fish stocking levels will generally have to be drastically reduced. Invertebrates are very sensitive to the toxic waste of fish and too many sharing the same tank is an unhealthy mix. My own formula devised some ten years ago has proved very successful: 1in of fish for every six gallons of water nett, after one year. This may seem low but it does give a margin of safety whilst ensuring the best possible chances of success with invertebrates.

(B) Fish should be compatible with invertebrates. It is no good introducing specimens that are either going to eat invertebrates, or fall victim to invertebrates themselves! Always check on the suitability of a species before purchasing. It is worth noting that all fish mentioned so far in this series are compatible with invertebrates (although Yellow Tangs usually require extra space).

(C) If copper medications have been used to control fish diseases, then the substrate, tufa rock and water must be changed. Copper is highly toxic to all

invertebrates, even in very low concentrations, and unfortunately it binds to the calcium carbonates found in all calcareous materials only to be released at a later date. Equally, copper cannot be used to treat fish diseases in a mixed aquarium; a point to bear in mind when considering fish with a low resistance to various ailments.

(D) Whether copper has been used or not, a large water change will be in order to freshen the tank. Seventy five per cent would not be too much.

(E) It is essential that low nitrates and phosphates are maintained; below 10ppm total NO₂ in the case of nitrates and less than 0.05 where phosphates are concerned.

(F) Many sessile invertebrates are light-loving owing to a symbiotic algae within their tissues called zooxanthellae. If the algae dies, then the coral either suffers badly or also dies. Therefore, provision must be made to increase lighting to sufficiently intense levels (more of which when the series reaches trickle filtration).

SUITABLE INVERTEBRATE CLAMS (*Tridacna* sp.)

These bivalve molluscs are widely available and relatively reliable to keep. The zooxanthellae within the fleshy mantle gives them

Tridacna sp.

their colour and patterning, which on occasions can be simply stunning and therefore command very high prices.

FEEDING: This is usually unnecessary, as their symbiotic algae supplies much of their nutrition. Juices from foods given to fish sharing the same tank are filtered from the water and help to supplement the diet.

SOFT CORALS

(*Sarcophyton* sp. and *Sinularia* sp.)

The majority of soft corals make ideal specimens, at all levels of the hobby. Besides the requirements of clean water and reasonably lighting, soft corals largely take care of themselves. They look impressive and grow at a steady rate. A good collection of different species can make any mixed aquarium a joy to behold.

FEEDING: Direct feeding is not required. There will be far more invertebrates to explore in two months time.



TOMORROW'S AQUARIST

BY GINA SANDFORD



Summer is coming — so they tell me! With the thought of warm humid weather approaching my thoughts usually turn towards what is going to emerge from the darkness of my garden pond. This structure is basically a fibre-glass pond that used to be in my greenhouse. One year, in a reshuffle, it was moved outside and placed in the corner of the garden. It wasn't meant to remain there, after all, this was the coldest, darkest corner — you know the sort, the one where the snow lies longest.

The reshuffle took a little longer than anticipated and, by the time the pond should have been reinstated, it was full of rainwater and proving to be a good source of *Daphnia* to feed the fish so I slung in a handful of pond weed, *Elodea crista*, and reconciled myself to a greenhouse without a pond. Soon newts arrived, and dragonflies, damselflies, the odd frog and toad and field mice. I found a dead mouse in the pond and arranged a 'get-out' branch so that anything else that fell in would be able to clamber out.

The pond has now been there ten years and I've back-filled the gap between the wall and the pond with soil and a moss-covered large beech branch hides the front. It is still fish-less but by no means life-less. Friends have donated bits of plants and it is now showing a healthy growth of Water Forget-Me-Nots, *Ranunculus*, *Potamogeton*, Water Mint, Parrot's Feather and good old pondweed. The newts lay their eggs in the pondweed, and come up to rest on the floating vegetation. Frogs lurk among the Forget-Me-Nots and toads hunt slugs and bugs from the shelter of the

The delicate flower of our native Water-lily, *Nymphaeodes peltata*.
PHOTO: M. SANDFORD

hollows in the beech branch.

Last year a friend came to visit and recalled my similar pond at our old house and the beautiful little yellow water lily that had flourished there. I bemoaned that fact that the roots I had brought with me had died off. Two weeks later the friend returned with a plastic bag of leaves, stems and a root. He had been cleaning out his patio pond and thought I could find a home for it. It was *Nymphaeodes peltata*, a water lily native to the British Isles, but more importantly, it was a piece from the stock I had given him years ago — thank heavens I did.

One plus one equals too many to count!

One of the other pleasures of summer is breeding anabantids. Many Gouramis are very accommodating fish, their ability to breathe air means that we don't necessarily have to have a filter on the tank to give water movement and thus better oxygenation but, if we are going to attempt to keep them this way we need a will of iron.

Some of the best spawnings I have had with Opaline, Leeri Gouramis and Siamese Fighters, have been during the height of summer with the fish housed in tanks in the greenhouse. I used a



24x12x12in tank with a sand substrate and plenty of well-established plants — the type of plant didn't matter, what was important was that they were growing well. Due to the vagaries of the English weather, however, I add a heater/stat just for safety although it is rarely on as the temperature is, on average, maintained at 24-28°C, by the warmth of the sun; even overnight (I use a min/max thermometer to check this) it only drops a couple of degrees. Into this environment I placed a pair of fish and only a pair of fish — no catfish to clear up the remains of food or control the algae (the plants were doing this), or characins to add colour — just the single pair of Gouramis.

Well-fed on live foods (from the garden pond!) it was only a matter of days before a bubble nest frothed on the surface and the male became resplendent in breeding colours as he chivvied the female into position beneath the nest. She relented and he wrapped himself around her body; they trembled together and she released a few eggs that sank slowly in the water. The male released his hold to retrieve the eggs in his mouth

and blow them up into the safety of the nest. Repeatedly they embraced and released until the female was spent and she went in search of sanctuary, leaving the male to guard the eggs under the nest. At this point I would carefully remove the female to recover in another tank. Although there was sufficient plant cover for her to avoid the male's advances, it would be easier to take her out now than after the eggs hatched. The male watched over the brood for about four days. I say about because it varied from pair to pair, some males gave up after 24 hours while others would gently keep placing fry back into the nest for up to a week.

There is a cardinal rule when breeding anabantids that the air space just above the water surface must be kept very warm and, therefore humid, so that when they fry come up to breathe they will not be chilled and die. Herein lies my reason for preferring to breed my Gouramis in the summer months — it is warm and therefore very easy to keep that air space at the right humidity. If the cover glass is not replaced completely, or is knocked slightly, there is less

likelihood of a cold draught killing the fry. It also makes providing live foods easier. I can hatch my brine shrimp anywhere, and not in the confines of the warm fish house, therefore I can hatch more of it and, provided I have enough growing on space, raise more fry at any one time.

For those of you with a little less space, Siamese Fighters can also be bred this way but for this you will need one male and two females because the male can be

The spawning embrace of the Siamese Fighter, *Betta splendens*.
PHOTO: M. SANDFORD

quite merciless if a female is not quite ready to breed. By using two or even three females he has to divide his attentions and this gives each female a better chance of survival. The tank can be smaller, an 18x10x10in is sufficient but it should be well planted, again to provide hiding places for the female. In all other respects this are the same.



Tetra COMPETITION

Tetra Pond Floating Food Sticks — a definite winner with your fish and a possible winner for you!

TetraPond Floating Food Sticks have always been good for your pond fish. They are a highly digestible nutritional food especially developed to provide a complete balanced diet. They are also enriched with Vitamin C to improve the health and vitality of your fish.

Due to the latest state of the art production techniques, they gradually soften on the surface of the water and are quickly consumed. This ensures there is very little waste which could promote algae growth, or clog up pumps and filters.

But now however it is not just your fish who can benefit from TetraPond Floating Food Sticks because if you purchase the Special Promotional 100g Tubs (r.r.p. £2.55) you will find a complimentary Scratchcard tucked inside.

There are £1.5 million worth of prizes to be won and every card is a potential winner. It is also very easy to play. All you have to do is scratch off three of the silver fish and if you



reveal three identical symbols you are a winner.

The major prize is a £3,000 holiday voucher and there are runners up prizes of books by garden expert Dr. D. Hessayon (£4.99) and £1 National Garden Gift Tokens. If you are not fortunate enough to be a winner you can still obtain a £1 National Garden Gift Token by sending a 24 or 36 exposure colourprint film to the TetraPond Scratchcard Offer address. (Full competition details are on the Scratchcard).

We have 12 of the Promotional Tubs to give away to readers of *Aquarist* and *Pondkeeper*. Simply write the answers to the following three questions on the back of a sealed down envelope or a postcard, put on your own address and send to: Dept SC, Tetra Competition, PO Box 2182, Bournemouth BH2 5ZA, to arrive no later than Friday June 7th 1996. The first 12 correct entries to be drawn will each receive the 100g Tubs with a Scratchcard inside.

- 1 What is the best time of year to introduce plants to either new or established ponds?
- 2 In a garden pond how many square inches of water

surface should you allow for each inch of fish length (excluding tail fins) — 16, 24 or 30?

- 3 *Nuphar* or *Nymphaea* are more commonly known as what?

CATFISH CORNER



Most aquarists keep a few catfish in their tanks to eat up any food which has fallen into the gravel beyond the reach of other fish. These usually belong to the family Callichthyidae which includes the ever popular genus *Corydoras*. Indeed it is estimated that as many as 400,000 *Corydoras* are exported from their native habitats each year, which makes them one of the most popular fish of all time. Unfortunately, it also tends to obscure the fact that Catfish are far more than just *Corydoras*.

There are well over 1,000 species of catfish already described by science and within the order of Siluriformes, to which all catfish belong, there are in excess of 2,000 species. This huge group of bony fish contains about 31 families all of which have Weberian ossicles (also known as the Weberian apparatus) derived from the first four vertebrae. This forms a link between the inner ear and the swimbladder and aids in detecting sound and other vibrations. This structure is also found in fish belonging to the order Cypriniformes which includes the Carps and Characins.

DEREK LAMBERT LOOKS BEYOND CORYDORAS AND FINDS A DIVERSITY OF OTHER CATFISH.

Catfish are found throughout the world occupying just about every ecological niche possible. They range in size from 1in miniatures up to monsters that are measured in yards rather than feet. In recent times there has been something of a fad in the hobby to keep some of the very large species of catfish as pets. Most notable of these has been *Piractocephalus Arniellopterus*, The Redtail Catfish. When these were initially imported it was known that they could grow in excess of 6ft long in the wild, but people assumed their growth rate would be reduced in captivity and they would only reach 2ft or maybe 3ft long. Unfortunately this has not proven the case and it is now known Redtail Catfish will continue to grow until any tank they

ABOVE
Red-tailed Catfish, *Piractocephalus Arniellopterus*.
PHOTO: G. WIGZOS

are kept in is too small for them. Most public aquaria are being offered on average one of these fish a month. All have outgrown the available accommodation. Unless you can fit a 12x8x8ft aquarium in your house do not even attempt to keep one of these fish, it would be cruel to do so. Personally I think the trade in these fish should be stopped now: voluntarily by the trade refusing to supply them or, if common sense fails, then by a government ban.

Contrary to popular belief not all catfish are active only during the night. Some are nocturnal but many others are active during the day, whilst others are primarily only active at dawn and dusk. A knowledge of when each species is active will help you when working out your feeding schedule. It is all very well feeding your fish three times a day, but if all those feeds are given during the day your nocturnal catfish will starve to death. Since it is very difficult to see

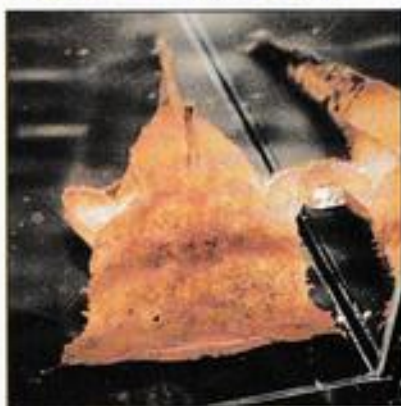


ABOVE
Who could mix up this brown mottled catfish, *Hypostomus plecostomus* ...
PHOTO: MP & C. PEDROZ

RIGHT
... with this voracious Frogmouth Catfish, *Claeoa claeoa*?
PHOTO: ACP LIBRARY

when an armoured catfish is losing weight, it is quite possible for your fish to have died before you realise there is a problem. Essentially the only way to be sure is to examine the soft underbelly. If it is concave then the fish needs more food, a convex underbelly indicates the fish is well fed. This is something to look at when buying these fish in an aquarium shop. Most newly imported catfish need feeding up but if they have become too emaciated they will die shortly after purchase.

Within the huge range of catfish



species you will find predators as well as vegetarians, many fish which feed on specialised foods or others which are just plain pigs and will eat everything! One of the commonest mistakes aquarists make concerning catfish is to

assume they eat all the leftovers. It is true to say many species will grub around the substrate looking for tasty morsels of food, but even these should be specifically fed. For bottom dwelling species tablet foods are particularly good because they fall straight to the bottom and the catfish can eat them before some of the nourishment has had a chance to leach out into the water. Nocturnal fish should have food put in the aquarium a little while after the lights have been turned out, not just before. This is because the other fish in the aquarium will still be active at this time and will eat most of the food put in for the nocturnal catfish. What I do is creep back in the room 10 minutes after the lights have been turned out, using a torch to light my way and feed my catfish then. This way I often see them out and about eating when the other fish are asleep.

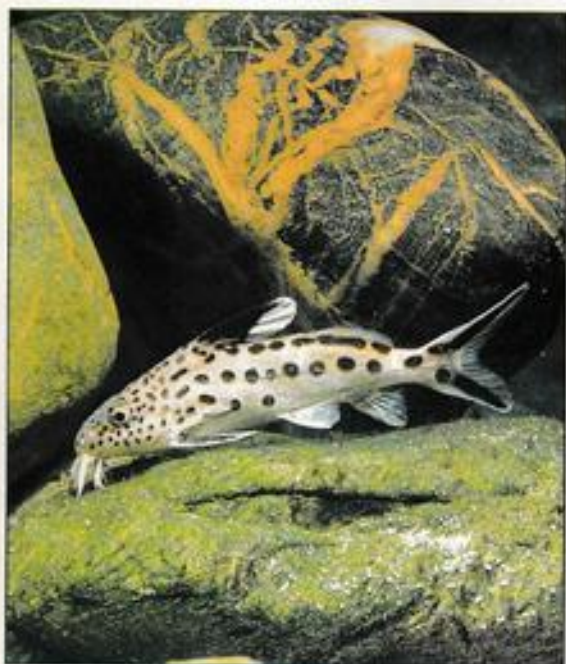
Before you buy any catfish a knowledge of what it eats is of great importance. Some species which look very similar have very different dietary requirements. An aquarist once came to me with a problem in his community aquarium. All his fish were disappearing one by one. Lately it was becoming worse with two fish vanishing over night. When I quizzed him on what fish were in the tank he ran through the usual list of normal community fish and added on the end "and a brown mottled catfish which I think is a *Plecostomus*". When I finally got to see the *Plecostomus* it turned out to be a *Claeoa claeoa*! This is a nocturnal predatory catfish growing to some 8in in length and it was this fish which was eating all the others. So a knowledge of exactly what you are buying is vital. Most aquatic shops have the fish clearly labelled but sometimes mistakes can happen.

Surprisingly few catfish species are bred in captivity with any regularity. It is dangerous to generalise too much about catfish breeding because similar looking species may breed very differently, even if they belong to the same family. A classic example of this are the genera *Otocinclus* and *Hypoptopoma*. Both have similar body shapes and feed in much the same way, but *Otocinclus* lay adhesive eggs on plant leaves and do not care for them, whereas *Hypoptopoma* spawn in



The diminutive *Parotocinclus maculicauda*
PHOTO: MP & C. PEDROZ

TROPICAL *Catfish Corner*



caves and the male guards the eggs until they hatch.

Many catfish care for their eggs in one way or another. Some build a bubble nest amongst plants or under a piece of wood. This includes the genus *Haplosteurum* (see Janet Marshall's article in this issue). Other species which care for their eggs include

members of the genus *Hexammatichthys* which are thought to be mouthbrooders and the rather bizarre *Platystracus* in which once spawning is complete the eggs adhere to the female's soft abdomen skin. Another very unusual reproductive strategy is exhibited by three species of *Synodontis* (*S. multipunctatus*, *S. petricola* and *S. variegatus*). These lay their eggs in a mouthbrooding Cichlid's nest as the Cichlids are spawning. The Catfish eggs are then taken into the Cichlid's mouth and incubated there.

I hope this article has opened your eyes a little to the wide variety of catfish available in the hobby, beyond just the *Corydoras* which are so popular. The diversity within the group in body form, dietary requirements, behaviour and size is tremendous. Many make great additions to a community aquarium as part of the "clean up crew" but others are real pets in themselves.

This *Synodontis multipunctatus* has Cuckoo-like breeding habits.
PHOTO: MR. S. C. REDDICE

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LANKA LABYRINTHS

PART 2: COMBTAILS AND KRETSERIS



F

or my four day trip to the south, Dhanapalla and I left at

7am and picked up Dinesh, Rohan's

DAVID ARMITAGE, TRAVELLING WITH DINESH GABADAGE, MAKES A LAST ATTEMPT TO BAG HIS PREY.

• PHOTOGRAPHS BY THE AUTHOR •

second assistant enroute. By 7.30am we were in Galle for breakfast and then we headed inland on minor roads to the remnant of the

TROPICAL *Lanka Labyrinths*



PREVIOUS PAGE
Stony stream at Udagama.

ABOVE
Belontia signata.

ABOVE RIGHT
Malpulutta kretseri female.

RIGHT
Malpulutta kretseri male.



Fact Box

BELONTIA SIGNATA

Belontia is distinguished by a two filament pelvic. Two varieties have been described, one from the uplands is high-backed with no blue colouration, the other from the lowlands is slender, brighter with blue tail colouration, a blue pectoral spot, elongated pelvic filaments and extended combs to the tail. It is one of the 10 commonest Sri Lankan fish, an adaptable habitat generalist, a good aggressive coloniser which allows it to compete with other fish. In nature it feeds on flying and terrestrial insects. Opinions on spawning differ. Some describe a scattered nest, other large bubbles which run together to form an air-pocket, others describe the eggs being collected together in a clump. Spawning can produce several hundred eggs which hatch after just over a day and produce large, dark fry which swim free after four days, feed immediately on brine-shrimp larvae and can be left with their parents for several weeks while they develop a dorsal spot which females may retain.

Kottawa forest. Here we found a stream as it trickled through marshland and eventually broadened out into a deeply shaded rivulet with some thigh-deep pools. In one of these, Dinesh caught

our first labyrinth of the trip, a Combtail. Sure that it was the right habitat, he was determined to use the purse-seine to trawl under a deep overhang with tangles of roots. He thrust one end into my hands and, as we waded toward deeper water, I realised that I would have to discard my waders and carried on with my underpants tucked into my shirt, a stirring sight! Eventually we caught just one, 1cm *M. kretseri* and despite repeated attempts caught no more.

We fished two other streams or the same stream in two other places as we descended to the edge of fields and with the usual audience, caught *P. cupanus* both in shaded areas at the edge of paddy field and as the stream crossed the field in full sun along with *Clanwa punctata* hiding amongst tall grasses.

As the light failed, we found our resthouse between Udagama and Hinduma. The water had to be pumped from the stream to the header tank and meanwhile Dinesh disappeared, returning to announce that he had found another nice habitat. This was under the steep slope beneath the resthouse and we caught *C. punctata*. Dinesh and Dhanapahla preferred to bath here but I returned to the resthouse to use the

shower.

The next morning at 8am, we continued on, taking the road between Nakiyadema and Udagama, which we turned off, along a dirt track which led

Fact Box

MALPULUTTA KRETSERI

This is a forest specialist with a shrinking habitat. It is now confined to forest pockets in the SW of the island but was once found in the NW province. There are red and blue races which occur side by side and a smaller blue strain from Kuruwita. In the aquarium it is somewhat delicate and prone to jumping out. Spawning takes place at all levels in the water, under leaves or in floating tubes, in coconut shells or plant pots. The female initiates spawning, turning dark and pecking at the male's flank. After the embrace, the female picks up the sinking white eggs, which turn amber, from the male's anal and they both pick up eggs which have fallen. They take two days to hatch and as long as six days to free-swim, resulting in up to 150 (more usually 30-60) young.

TROPICAL *Lanka Labyrinths*

HABITAT 9 Udugama
pH 6.5/28°C

Belontia signata
Channa orientalis
Nemacheilus notostigmata
Rasbora daniconius

HABITAT 10 Matugama
pH 6.0/26°C

Aploccheilichthys werneri
Malpulutta kretseri
Mystus vittatus
Ompok bimaculatus
Rasbora daniconius
Rasbora vaterifolius

uphill to forestry land, picking up five young 'volunteers' en-route. We parked near the forester's hut, just on the other side of a bridge and he eventually joined us after his strenuous uphill bicycle ride. As we prepared our fishing equipment, I asked how far it was to the habitat. 'Only 250 yards' — came the answer. That may have been true but we then trekked at least a mile up the stony stream, accompanied by a local dog and then cut across fields for a further two miles or so, arriving at a small house beside some King Coconut trees. After trekking all this way in my waders, I was exhausted and nothing could have tasted as good as that cool drink of King Coconut. Nevertheless, the stony stream had proved a rich source of superbly coloured *Belontia* and some juvenile *C. orientalis*, hiding under stones, roots or branches. Everyone leant a hand catching fish and while I was intent looking at some *Utricularia*, growing on rocks in the swift current, one of the boys found a *Cryptocaryon*. By a convoluted route we arrived back at the small house by the bridge where I looked forward to a rest. However, it was far too early for that and we strode up the road into the forest and then dived off through the trees, to find the source of the increasingly noisy waterfall. I declined Dinesh's kind invitation to climb to the top and instead stood with my head under one mini-torrent, to prepare me from the formidable return ascent to the road.

I joined everyone in a swim back at the bridge and then was surprised to see Dinesh approaching with three bundles, wrapped in leaves. This was our lunch of curry and rice, prepared by the lady who lived by the bridge and was followed by a jack fruit which we divided between us, the kids and not forgetting the dog.

Next we sped off for a *M. kretseri* habitat first discovered by Rodney Jonklaas with Roban, near a plantation of tea, rubber and coffee, close to Akuressa. However, we failed to find it, despite a trek across marshy paddy fields, with



plenty of *Pseudosphromenus capensis*, into a forest remnant which proved alive with leeches and modified the usual mirth at my ridiculous waders which repelled them. There was extensive cultivation in the area and it may be that the habitat has disappeared for good.

We then made a mammoth drive, in the failing light, all the way along the coast to Hambotota where we found the resthouse overlooking the beach. While Dinesh and Dhanapala went out frog-hunting by torchlight, I drank the last bottle of Lion beer on the veranda, enjoying the look of shock on the face of the German archaeologists as they realised the supply had dried after a prolonged brewery strike in Colombo.

After a restless night, listening to the Snakeheads jumping in their bags, we departed in the morning for a drive around the Bundula sanctuary. Once again, the 4WD proved its worth as we crawled around the bush watching the large families of Langurs and Macaques, the Painted Storks and Little Green Bee-Eaters and the lucky glimpse of Spotted Deer and Jackal. The Buffalo here were truly wild in comparison with the domesticated versions which were a

common site in the paddy fields, surrounded by cattle egrets. Of particular note was the bizarre bill of the Greater Thick-knee, a relative of our threatened Stone-curlew.

This area is renowned for its 'curd' — a sort of buffalo yoghurt which is eaten with sweet syrup and we stopped for a sample, which was admittedly very cooling, before our drive back down the

ABOVE
Remnant of forest near Matugama.

RIGHT
The habitat of *M. kretseri*, tracked down at last!

coast to Kalutara. We eventually found a slightly run-down lodging on the beach. Nevertheless the staff managed to find me a bottle of '3 Coins' beer which refreshed me as I aired the increasing number of bags of live labyrinths and Snakeheads.

Without breakfast, we headed off in the direction of Matugama, my last chance of a *M. kretseri* habitat. We stopped by a roadside stall and Dinesh peered into the far distance. 'This is it', he announced, pointing at a forest remnant in the distance and strode off at high speed, followed by a pair of stumbling waders. Fortunately, this time, as we were on the flat, I was able to keep up. We followed the line of a small stream until Dinesh climbed in where the branches nearly closed in overhead. After fishing under a particularly

promising looking overhang, he moved away, out of sight downstream, and I pushed my net into a tangle of branches, near the bank in shallow water. There was something different in the net. I stooped over in the gloom and removed my steamed and besplashed glasses to try to focus: 'Dinesh', I called, 'I think I've caught a *kreiser*'. And so I had. With Dinesh's help it was secured, as was

another tiny individual, in the same place and further down the stream, Dinesh caught another two, including a superb, adult male. Also in abundance were beautiful reddish *Rasbora waterflaris*, another endemic. As we packed up to go, Dinesh pointed out where the stream became deeper and wider and said he had never found *M. kreiseri* beyond that point.

This was a fitting climax to my first short stay in this part of the Indian sub-continent and we celebrated with a belated but extensive Moslem breakfast. I can't quite explain why I have this compulsion for 'fish tourism'. Friends say that it's because I am deranged (which is probably true) but I get huge satisfaction from seeing the fish in their natural habitat. But also a great part of the experience is meeting people with similar enthusiasms and realising that there is concern for the fish in their country of origin. Many thanks to all mentioned in this article whose expertise made my trip so memorable.

• For further information on *Labyrinthfish* send an SAE to AAGB, c/o 19 Clifton Crescent, Spothrough, Dewcastle DN5 7PE.



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 Pethiyagoda, R. 1994. Threats to indigenous freshwater fishes of Sri Lanka and remarks on their conservation. *Hydrobiologia* 285, 189-201.

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Don't forget your name, age, address and if you belong to a local Society.



OUR DAY OUT by Graham from Kamagato

Last weekend our family went out to some aquatic shops. They all had a good selection of fish some I had not seen before. Mum liked one of the catfish in the first shop. It was black and red and I think it was a Bumblebee catfish. Dad told us that as it had a very wide mouth, it could eat some of our smaller fish, so we did not buy it. I liked the next shop the best as each tank had a little map on it to show where the fish came from. It also showed how big they grew to and if they were suitable for a community tank. We bought some more Danios for my tank and Dad bought some Corydoras for the tank in the front room.

The third shop we went into had more outdoor fish and ponds than aquarium fish. This was fun as we stopped for a cake and drink and the tables were on little islands between three large ponds. The fish often came up to the top as if to say 'hello' whilst we ate. There was a little waterfall which was very pretty. Different types of plants grew around the ponds and some on the edge were growing into the water. Mum said that it would look very colourful in the summer.

I had a great day out and learnt a lot about different fish and where they come from. My tank is doing well but after my trip around the shops I am going to change part of it to give different levels for the fish and more hiding places. The man in the second shop told me that the more hiding places there are in the tank the less the fish will hide as they will feel safer. My light is on a timer switch and was on for ten hours a day. I am going to change this to four and a half hours in the morning and four and a half hours from tea-time. This way I will be able to see more of them but there should still be enough light for good plant growth.

Thank you for that, Graham, unfortunately you forgot to send your address. Please write to me again and tell me who you are and where you live so I can send you your prize.

WORD SEARCH

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

WORDS TO FIND

CLOWN LOACH	TIGER BARB
ANGELFISH	KRIBENSIS
ZEBRA DANIO	NEON TETRA
GOLDFISH	GUPPY
SWORDTAIL	

JOKER TIME



- Q. Which Danio can roar?
A. A Leopard Danio
- Q. What is yellow and dangerous?
A. Shark infested custard
- Q. Which Guppy helps in hot weather?
A. A Fantail
- Q. How would you describe a net?
A. A set of holes held together by string
- Q. Which Danio helps you cross the road?
A. A Zebra Danio
- Q. Which Guppy is useful in the garden?

- A. A Spade-tail
- Q. What did the lone Porpoise say when he met a group of Porpoises?
A. 'O.K. Now back to school'

How do you other Juniors light your tanks? Have you had a good day out recently that you could tell us about? Did something funny happen whilst you were out? Maybe you have recently had a club event that you could tell us about? Remember, those lovely people at John Allan Aquariums are giving a prize for the best received — SO DON'T DELAY — DO IT TODAY!

Please write to: Jackie's Juniors, c/o MJ Publications Ltd, Caxton House, Wellesley Road, Ashford, Kent TN24 5ET.



frogs & friends

By BOB and VAL DAVIES



Berber Skink, an attractive, easy and relatively inexpensive species.

PHOTO: BOB & VAL DAVIES

Frequent imports

The Berber Skink (*Eumeces schneideri*) is often to be seen in reptile outlets. This attractive species is not difficult to keep if obtained in good condition. Hailing from North Africa to Central Asia they need a hot, dry vivarium. Daytime temperatures should rise to 35°C (95°F) dropping to 18-20°C (64-68°F) at night. As with other lizards a thermal gradient is recommended i.e. a hot spot at one end of the vivarium with a cooler area at the other end. Full-spectrum lighting is needed with this species. As they often burrow some 10cm (4in) of coarse sand (not builder's sand) substrate is a must. Any rocks used for decoration must be firmly bedded in the sand. Provide a water bowl and give the vivarium a light spray in the morning.

Adults grow to 45cm (18in), males are aggressive and will fight each other. Feeding presents no problems as Berber Skinks tend to be omnivorous, however too much protein in the form of dog or cat food should be avoided and a vitamin/calcium supplement provided. Females lay five to 20 eggs in damp sand approximately six weeks after mating. They will usually guard the eggs until they hatch (between 56-65 days). It is better to remove the eggs for incubation to prevent accidental damage or to avoid desiccation. Wild-caught adults will sometimes bite, but captive-bred young soon become tame and feed from fingers.

Introduced species

The Atlas of Amphibians and Reptiles in Britain gives brief details of 10 species which have been introduced into this

country at various times, either accidentally or deliberately. The fortunes of these introduced animals have varied — some

seem to have survived for long periods others may last for a shorter time before dying out. In many cases details are somewhat vague. Certainly colonies of Alpine Newts (*Triturus alpestris*) are known to be surviving. This is a hardy species and should be able to cope with our winters. Although native



Baby Snapper, a tough and voracious predator.

PHOTO: BOB & VAL DAVIES

to Jersey and Guernsey, the Green Lizard (*Lacerta viridis*) has not been permanently established on the mainland although introduced groups have tended to survive several years. Two colonies of Green Tree Frogs (*Hyla arborea*) are known to have become established but the last we heard was that they had been plundered and possibly no longer exist. Not being native species they have no protection against collection. Other species which are known or thought to exist are the Yellow-Bellied Toad and Fire-Bellied Toad (*Bombina variegata* and *B. bombina*), the Midwife Toad (*Alytes obstetricans*), the Dice Snake (*Natrix tessellatus*) and the Wall Lizard (*Podarcis muralis*). All of these are relatively hardy and could conceivably survive our climate but for some reason it is not so easy and many introductions have failed.

Dumped Terrapins, mainly Red-Ears, but occasionally Snapping Turtles, are a familiar tale — although breeding is not thought likely they can live for many years. Snapping Turtles are especially hardy, often to be seen in the wild moving about under the ice in winter. Snappers usually grow to 12in (30cm) but can attain lengths of 18in (45cm). They are quite voracious creatures and could play havoc with native animals.

The latest possibility (previously reported) is the American Bullfrog, tadpoles of which have been offered for sale with the advice that they will live in garden ponds. The thoughts of a colony of exotic herps in your garden may sound appealing but be warned! Such introductions are illegal and can carry a heavy penalty.

Cannibalism

With most species of livebearing reptiles it is usually advisable to remove the young as soon as possible after birth to prevent cannibalism or damage by the adults. Newborn

babies are, after all, small, moving edible objects and may be mistaken for food by a female which has probably not eaten for some time prior to parturition.

Our Barrel Skinks (*Chalcides sepsoides*) have bred on several occasions but apparently produced only two or three young at a time. As they are a secretive, fossorial species spending most of their

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Adult female Barrel Skink with juvenile survivor.

PHOTO: BOB & VAL DAVIES

time under the sand it can be difficult to keep an eye on things. When moving a piece of cork bark a female was observed giving birth. There were three babies, still with remnants of the birth sac adhering,

and one baby just emerging. The whole group disappeared into the sand within seconds. A later thorough search revealed only one baby. The group consists of three males and five females which had not been separated so the culprit was not known. On previous occasions some surviving babies have been seen with tails missing — this species will readily shed the tail if seized.

In future gravid females will be removed although it is possible that the female was responsible. With other livebearers, Slow worms (*Anguis fragilis*), Blue-Tongued Skinks (*Tiliqua* spp.) and certain Chameleon species no cannibalism has been experienced.

DIARY DATES

Sunday June 30 — Cumbrian Reptile Association Annual Fair. Held this year at Newton Rigg College, Penrith, Cumbria. 10.30am to 4.00pm. Signposted from Junction 40 M6.

Sunday July 14 — Birmingham Reptile, Amphibian and Tarantula Society, Annual Show, Colmers Farm Leisure Centre, Northfield, Birmingham. 11am to 5.00pm.

Saturday/Sunday August 3/4 — British Herpetological Society (N.W. Group) Reptile Rally at Wildfowl and Wetlands Trust, Martin Mere, Burscough, Lancs. 10.30am-4.00pm.

HERP FACT FILE — AMPLEXUS

The breeding habits of many species of frogs and toads are as yet unknown but in the commonest method of mating the male seizes the female in a grip known as amplexus which stimulates her to pass out her eggs which are then fertilised. To assist this process males of many species (mainly among those which breed in water) develop special nuptial pads — areas of rough skin or even spines which give a better grip on the female. These are usually on the feet but sometimes occur higher on the forelimbs or even on the chest according to species. In addition males, for example the Oriental Fire-Bellied Toad (*Bombina orientalis*), may exhibit more muscular forelimbs. The purpose of amplexus is to juxtapose the cloacae (vents) of each partner to prevent the seminal fluid from drifting away before fertilisation occurs. Females of explosive, seasonal breeders will often attract several males in which case the one in amplexus can possibly kick others away, although he might be displaced by a larger male — voice may play a part in this — a louder voice signifies a larger male and there is evidence to show that it is the larger males which tend to mate.

There are four main kinds of amplexus.

Axillary amplexus

This is the most familiar, as in our Common Frog (*Rana temporaria*) and Common Toad (*Bufo bufo*). The female is

gripped just behind her forelimbs. Most of the advanced frogs use this method but there are a few exceptions. It is quite efficient, in certain species the male positions his feet on either side of his cloaca which channels the seminal fluid downwards onto the emerging eggs.

Inguinal amplexus

The female is gripped around her 'waist' — the male may have to arch his body underneath the female. This method is used by the more primitive species especially totally aquatic species such as the Clawed Toads (*Xenopus*). However, a few of the more advanced species retain inguinal amplexus.

Cephalic amplexus

A rare method in which the male holds the female around the throat — the males turn the forelimbs inwards so that it is the outer surface which is in contact with the female. This type of amplexus has been observed in three members of the Arrowpoison family (*Dendrobatidae*) namely *Epipedobates tricolor*, *Phyllobates terribilis* and *Colostethus inguinaleis*. Other dendrobatids observed do not use amplexus — the females lay eggs which are then fertilised in situ as she moves away.

Adhesion

The normal clasping amplexus appears to have been modified in some stout,

short-limbed frogs such as the African Rain Frogs (*Brevipops*). The pair become attached by a glue-like secretion for the duration of the mating — a normal grip would be impossible in these species. The adhesion is thought to be so strong that damage would occur if they were forcibly separated.

Mating in water usually means that some eggs are unfertilised, this, and subsequent heavy predation, are compensated for by producing large numbers of eggs. The Giant African Bullfrogs (*Pyxicephalus*) mate in shallow water as the eggs emerge the female's body is arched to raise the pair above the water so that the seminal fluid makes better contact with the eggs.

In various *Dendrobatid* species a form of ritualised amplexus can be observed between members of the same sex. A calling male will seize an intruding male and attempt to press him down — because they are evenly matched a wrestling contest develops. Females also practise 'pressing'. The pressed female usually remains prone for a short time and then moves off. This behaviour is usually (but not always) seen when a male is calling.

Amplexus may last for anything from half an hour to several weeks. In some species females may be seized before they even reach the water and will carry the male around until breeding is completed.

THE EFFECTS OF TEMPERATURE ON FISHES

Most of us think we know all about the effects of heat and cold on fishes, but we don't. Scientists are continually learning about the thermal responses of fishes to temperature manipulation and, because this is a very active area of environmental science, I'd like to review some aspects particularly important to aquarists.

EFFECTS OF TIME AND DOSE

In recent years we've learned that there are no unique and absolute lethal temperature limits. Fish have been seen in nature to thrive above and survive below their so-called, laboratory-determined lethal limits.

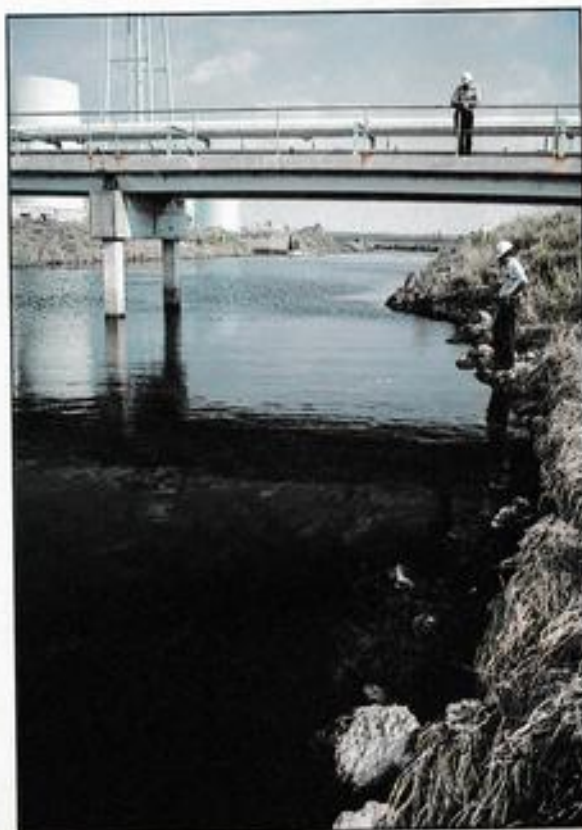
Have you ever seen a fish suddenly die of cold? Of course not. It first becomes lethargic. The same is true in a well-oxygenated aquarium in which the thermostat has failed and the heating element runs continually. The fish don't die immediately. They first display symptoms of heat prostration, and life functions are subsequently, and slowly, lost.

Heat acts like many therapeutic drugs and other chemicals. The specific effects are produced by a combination of time and dose. This explains why some fish can recover from extreme cold or extreme heat. The actual damage incurred depends on how much exposure the fish got, and requires a certain amount of time before it becomes irreversible. What damage? How does it work?

Aquarists know that hot water loses its capacity to hold dissolved oxygen, and that oftentimes heat death in fishes is really due to oxygen starvation (anoxia)

BOB GOLDSTEIN EXPLAINS THE COMPLEXITIES OF A FISH'S BATTLE AGAINST EXTREMES OF TEMPERATURE.

• PHOTOGRAPHS BY THE AUTHOR •



Attracted by the hot water discharge of a Florida power plant, thousands of tropical crevalle jacks traversed several miles of river to enter the discharge canal, to mill about searching for insufficient food.

TROPICAL

The Effects of Temperature

rather than cooking (denaturation) of their proteins. However, if the concentration of dissolved oxygen is kept high and the temperature is elevated beyond a certain point, then symptoms of heat death by protein denaturation (opacity of the flesh, rigidity of the body) will occur.

In a very cold aquarium where oxygen is abundant, do fish die of too much oxygen? Certainly not. Let's see how too much or too little heat (not oxygen) works.

MECHANISMS

Life relies upon chemical reactions. In the laboratory, simple chemical reactions often require heat and pressure to proceed. Obviously, living animals cannot accommodate those requirements, and so have modified some of their proteins into catalysts that push those reactions at ordinary temperatures. These catalysts are specific to all living creatures, plants as well as animals, and are called enzymes. Each enzyme can operate at a very narrow temperature range. Just outside that range it doesn't work, but will work again when the temperature returns to its operational range. If the temperature continues to climb several degrees more above that range, the enzyme, a very delicate protein indeed, is irreversibly destroyed and cannot be revived. That's not true at temperatures below the required range, but then other factors (such as carrying oxygen to the brain) come into play.

If that's true, then how can fish exist at a variety of temperatures and carry on their life functions? The answer is that they generally have several enzymes for each reaction, each with a different optimal operating temperature. Enzymes that do the same thing (often at a slightly different pH or temperature) are called

isozymes. The existence of a variety of isozymes in one individual, and an even greater overall variety within a whole population, is known as enzyme polymorphism. Within a certain temperature range, the fish has enzymes that can handle all its life functions. As it approaches extreme temperatures, it may run out of its inventory of enzymes to perhaps excrete ammonia, to bind oxygen, or to conduct other functions. And each function may require 20 to 100 steps, each step backed by two to five enzymes that operate at different temperatures, but always within a certain range.

Because of the demand for power, plant personnel realized that more waste heat would be dumped into the discharge canal, probably exceeding the temperature tolerance of the crevalle jacks. Here they prepare to block the upper end of the canal with a large net preparatory to driving the fish downstream.



Example: At many industrial plants, the hot water discharge (containing the waste heat from burning fuel) pours out at perhaps 10 degrees Celsius above ambient (surrounding) temperatures all year-round. In mid-summer, the ambient temperature may have risen, simply due to the sun's rays, to just a few degrees under the laboratory-determined lethal temperature. At such times, the additional heat generated by the industrial plant results in lethally hot water being discharged. The discharge spreads out into the receiving stream in a broad plume, with little mixing or dilution until the water is far removed from the plant site. However, right at the edges of the lethal summer plume, predators may congregate, rushing in to feed on the debris and mortally wounded bait fish in the hot water and then dashing out again. Feeding and digestion may have different limitations than excretion, respiration, etc. Do the

fish stop breathing when they rush into the hot plume to feed? Nobody knows. But they don't stay there long!

Is this unusual? Not at all. In fact, it is very important for aquarists to recognize, for it has important consequences in fish culture. (The series of photographs throughout this article show how the management team at the industrial plant tried to save fish that were seeking out warmer waters.)

OPTIMAL AND PREFERRED TEMPERATURES

We were all raised on the idea that fish have a limited range at which they can live, and that the best way to keep them alive was to maintain them right in the middle of that range. For example, if their observed, natural range was 65-85°F, then 75°F would be the ideal or Optimal Temperature. We also learned that, to breed them, we should raise the temperature. HAVE YOU

TROPICAL

The Effects of Temperature

EVER CONSIDERED THAT THESE GUIDELINES ARE INCONSISTENT? Fish don't breed because you've heated up their gonads. They breed because they are in tip-top physical condition. (We'll cover apparent exceptions later.) Why keep them at any temperature other than that which indicates tip-top condition? In short, the Optimal Temperature is rarely in the middle of the life range, but usually much higher.

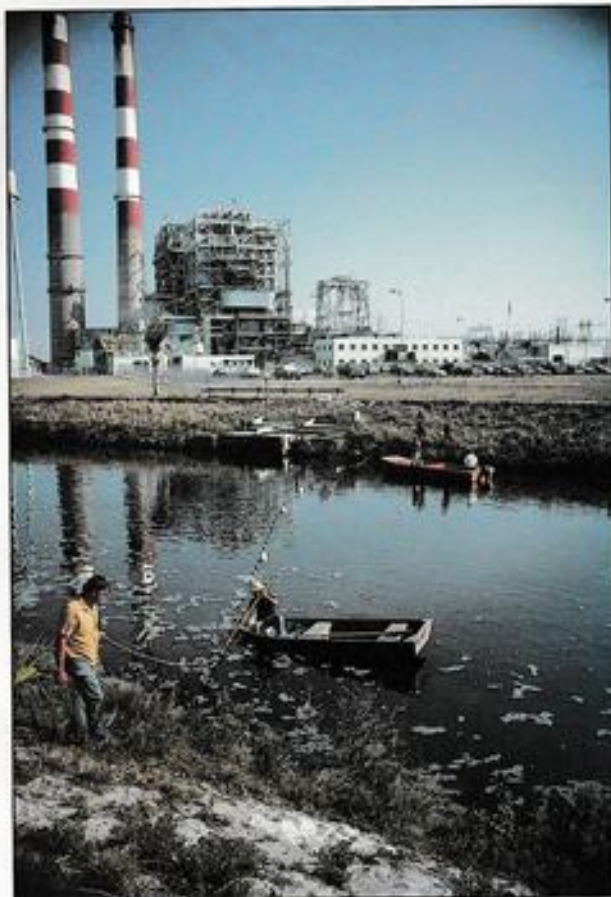
Many fish will seek out their Optimal Temperature in nature. It changes with age, and what is optimal for adults may be quite different from that for fry. This is relatively easy to determine in the laboratory, but requires specialized equipment. When the laboratory determination has been made, we call it the Thermal Preferendum, and it is species- and age-specific.

EFFECT OF LARVAL HISTORY

If we expose two batches of adult fish to extremely high temperatures (same species, same age, same conditions EXCEPT for the temperature range during the first weeks of life), we'll find that most of one batch will die and most of the other batch will survive. It appears that certain enzyme systems for temperature-tolerance must be triggered early or they won't work later in life. Therefore, IF YOU RAISE YOUR FRY WITH A WIDE VARIETY OF TEMPERATURES, THEY WILL BE ABLE TO SURVIVE GREATER TEMPERATURE FLUCTUATIONS LATER IN LIFE. Fry raised at a narrow temperature range will be far less tolerant.

CRITICAL THERMAL MAXIMUM

If we plot temperature against fish deaths, we will not get a straight line



Workers set the blocking net in place; behind them, the giant industrial boilers appear as blue buildings adjacent to the smokestacks.

slope. Rather, we'll get an S-shaped curve. That's because, based on early life history, genetics, exposure time and other factors, fish will die off slowly at first and then at an increasing rate as the temperature continues to climb and the length of exposure increases. The narrow temperature range just before deaths accelerate to almost a straight line is called the Critical Thermal Maximum. It is the point between maximum metabolic rate and killing temperatures where essential enzymes have been irreversibly destroyed. The point just below that Critical Thermal Maximum can often be recognized as the fish behaves abnormally, erratically, perhaps in a panic. In nature, many fish race away

from this temperature, and we call it the Avoidance Reaction. (They will avoid noxious conditions other than temperature, if they can sense them. Industrial discharges of chlorine is a good example.) In an aquarium, the Avoidance Reaction is the first sign that something is wrong and we usually miss it. What we see instead are the throes of incipient death as the fish now pass the Critical Thermal Maximum.

Ideally, there should always be an Avoidance Reaction inserted between the Optimal Temperature and the Critical Thermal Maximum. Then, the temperature just below that which induces avoidance should give us our best health, growth, breeding activity and all those other good results we strive to attain.

And there's the rub. For you see, many fish are not equipped with an Avoidance Reaction mechanism. Like the

moth to the flame, they will seek out the temperature that makes them feel wonderful, rushing into an area of higher and higher temperatures until they are skirting the very edges of the Critical Thermal Maximum. Some enter lethal zones of even higher temperatures, perhaps to feed, and may lose their bearings to become lost inside the hot zone, and die. That happens in nature. In an aquarium, a failed thermostat may make the difference between spawning activity and loss of the breeding stock.

Example: Clown anemone fish are not particularly difficult to spawn, but they do have several important requirements regarding water quality, diet and temperature. These requirements are difficult to provide in a home aquarium without constant attention. The temperature should be in the high eighties Fahrenheit. However, at just a few degrees more, you run the risk of

TROPICAL

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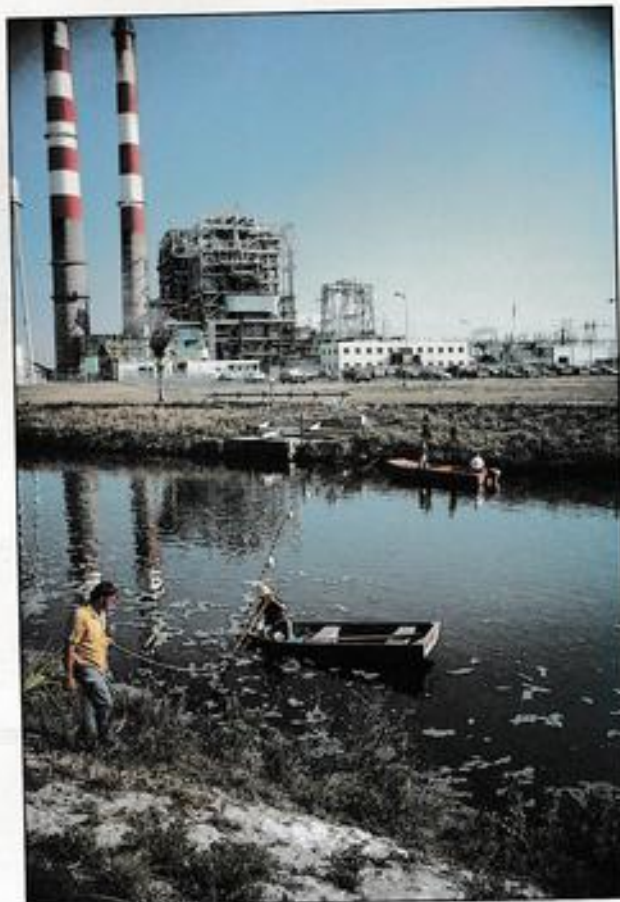
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At the end of the discharge canal, workers await crevalle jacks from upstream. The jacks will have to leave through the culverts by which they entered.

death due to heat, compounded by pollution or hypoxia (low oxygen levels).

OTHER EFFECTS ON SPAWNING

While it's true that many aquarium fishes can be brought into breeding condition by keeping them at their Optimal Temperatures, temperatures that are often just below the Critical Thermal Maximum, many fish require a temperature change to trigger spawning activity. Again, it may be time and dose dependent.

Example 1: To breed *Corydoras* catfishes, the general rule is to keep them at optimal (often high) temperatures; then drop the temperature 10°F for 24 to 48 hours, and then bring it back up. Just dropping the temperature doesn't induce breeding.

Example 2: To breed Whiptail Catfish, the temperature should be dropped 5-10°F, but not raised again.

Example 3: To breed American Sunfishes, the temperature should be dropped about 20°F or more for a period of two to three months, and then raised.

How can these variations in spawning stimulation be explained? Certain enzyme-mediated chemical reactions must occur in a specific sequence in order to produce increased levels of several different sex hormones that are required for, for example, eggs to be produced, then to mature in stages, and then to move where they will be easily shed. These reactions are often temperature-dependent and that means that the specific environmental temperature conditions must occur in the sequence that creates the hormones in their required sequence. Thus, fish that naturally breed in the spring, like sunfishes, may have the early stages of gonad ripening adapted to and dependent on a long exposure to winter temperatures. Fish that breed in rivers,



like many South American catfishes, may require duplication of cool spring rains followed by warmth (if they breed in backwaters) or not (if they breed out in the rushing river).

EFFECTS ON IMMUNE SYSTEMS

We often think of warm temperatures keeping our fish "healthy," without knowing what this really means. I'll tell you what it means:

Disease resistance has many forms, but the mechanisms are rather common to all vertebrates. For example, the skin of a fish, man, lizard, or bird is a barrier to invasion by disease-producing microbes. However, once the skin (or other part of the body) is pierced by invasive microbes, the body brings other defenses into play. There are three main defensive systems below the "skin," all based on different kinds of white blood cells, and they all are produced or housed in the immunological organs (thymus, corpuscles of Stannius, spleen, liver, and bone marrow) of the animal. The products these special white cells can make are:

1. **Interferons.** These are small proteins that attack foreign genetic materials (nucleic acids), and which are very effective against viruses. They are generally not highly specific, and an interferon produced against one kind of

virus often protects against other kinds of unrelated viruses.

2. **Macrophages.** These are the nonspecific, gobbling white cells that surround any and all foreign bodies (splinters to bacteria) and engulf them to prevent their escape or release of toxins or progeny. Some kinds of macrophages carry the destroyed invaders to the liver or kidney for further breakdown and eventual excretion, while other macrophages are created to engulf the invaders and then die at the point of infection, releasing their antimicrobial chemicals and producing pus-like accumulations of dead macrophages and invaders.

3. **Antibodies.** The most complex reaction of an animal to invaders is the production of antibodies.

Upon the first exposure to a new agent (bacterium, virus or whatever), certain white cells slowly mobilize their internal chemical laboratories to identify the three-dimensional, molecular surface of the invader and then to produce a brand new, complementary protein that will fit over that surface like a glove over a hand. Other chemicals will then be produced to kill the invader once it is locked up, perhaps by destroying its membrane (if it is a microbial cell) or clumping it up for easy removal by macrophages. A host of different antibodies, all with slightly

different functions, BUT ALL SPECIFIC TO THAT ONE INVADER, may be produced. It takes time. If the antibodies can be produced faster than the invader can reproduce itself, then that invader will be killed and eliminated. If the invader multiplies too fast, it will outpace the antibody-production system and kill the animal. This all applies to the first exposure to a new agent and we call it the Primary Response. Now suppose the animal survives. It retains an immunological memory of this experience in the form of chemical machinery in its white cells. Should that same kind of invader appear again, the response will be immediate and decisive. This time, not only does the animal produce antibodies in a matter of hours, but these antibodies are of a new and improved variety. It is as though we jury-rigged a defence for the first battle and, having learned about the enemy, took the intervening peacetime to create a more efficient weapon. This type of antibody is characteristic of a Secondary Response (or actually all future battles against that same kind of agent). Finally, although certain antibodies will work against more than one kind of invader (usually because the invaders have similarities on their surfaces), they are still very specific and virtually useless against anything very new and different.

What has all this to do with temperature and fish? Fish also have these systems, and we are learning every day of further similarities between their immune systems and our own. The principal difference between fish and people is in the effect of temperature.

The rate of metabolism in fish increases with increasing temperature. Thus, the ability to manufacture white cells, and the ability of the white cells to manufacture their chemicals, is directly related to the ambient temperature. (Since the multiplication rate of the invaders is dependent on precisely the same thing, it is often a race whether the invader or the defensive chemicals will reach decisive levels first at elevated temperatures.)

Even more striking is the recent finding that fish can only go through the Primary Response for antibody production at certain, normal temperatures. If the new invader first appears in the winter (or at very low temperatures), the fish is helpless to jury-rig a Primary Response antibody defence. BUT IF THE FISH IS EXPOSED TO A PREVIOUSLY DEFEATED MICROBE AT THESE SAME TEMPERATURES, ITS INTERNAL DEFENSIVE MACHINERY WILL OPERATE to produce the highly efficient Secondary Response antibodies.

CONCLUSIONS

For those without space-heated fish rooms, keeping fish at normal room temperature in a house may appear safer than keeping them individually electrically-heated, because of the risk of a failed thermostat. But it is not productive. Most fish have optimal temperatures for growth and reproductive success, which for many tropical species are generally higher than house temperatures. The way to avoid risks of heat death is to use high-quality, thermostatically-controlled heaters in all aquariums rather than cheap, unreliable heaters that use, and continue to fail while using, yesterday's technology.

POSTSCRIPT:

The attempt to save the fish by driving them away did not work. Three days later, a massive fish kill resulted in the deaths of thousands of five- to fifteen-pound crevalle jacks from inside the discharge canal to a downstream distance of more than two miles of river.

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Pond Diary

MAY 1996

Sun	5	12	19	26
Mon	6	13	20	27
Tue	7	14	21	28
Wed	1	8	15	22
Thu	2	9	16	23
Fri	3	10	17	24
Sat	4	11	18	25

With the increasing amount of sun on her back, **Susan Stephenson** gets busy in and around the pond



May is the month when the pond seems to make up for all the cold and inactivity of winter and spring. It is a busy month for pondkeepers but the longer days and increased warmth mean plants and animals are active and ensures that rewards for hard work are easily seen and enjoyed.

Thin plants where necessary. Overgrown clumps of Water Lilies can be thinned after lifting baskets or draining the water. Using a sharp knife cut the rhizomes about 6in back from the crown and cut the fleshy white roots underneath. Store in the shade either in water or in a box covered with wet sacking and replant the crowns in new soil. Lifting baskets to cut back side shoots or divide plants is unavoidable but the water may become muddy and take a couple of days to clear naturally. If, however, you have a pump for a fountain or

watfall a few hours of switching it on will allow the filter to strain out the silt, hastening the clearing time.

Settle in new plants and tidy up the old ones. Watch for sudden growth of the filamentous Blanketweed. To remove it push a stout

stick into the green mass, turn it then lift to remove the weed. Chemicals based on potassium permanganate, copper sulphate and paraquat will kill algae but they must only be used in strict accordance with instructions as even a slight miscalculation of concentration could kill some or all of your plants and fish.

Chemicals are probably best avoided for this reason. If you do use chemicals, remove the plants as soon as they turn brown to prevent oxygen deficiency and blanketing of other plants. Once leaves of floating plants have grown large enough to cover the surface of the water algal growth should become less of a problem.

If you think newts might be in your pond then leave an area of weed as they will lay their eggs in it and it is a favourite shelter for fish fry if you are not going to separate them.

When temperatures rise above 15°C fish can be fed high protein foods such as minced earthworms.

In warm dry weather flood the pool now and then to keep bog garden plants cool and moist.

Plants of all kinds can be planted this month but the floating ones should be planted more towards the end of the month and some (eg *Eichhornia crassipes*, Water Hyacinth, or *Trapa natans*, Water Chestnut) should not be planted until next month.

Marginal plants may need dividing. Do this in the same way as for Lilies. In the summer any excessive growth can be cut back with secateurs.

May is the month when the pond becomes a real pleasure again and a major attraction in any garden.

Blanketweed should be removed from the pond by pushing a stout stick into the green mass, turning and lifting.

PHOTO: ASP LIBRARY

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Useful May Tips

- (1) If insects have attacked foliage just above the water surface push the affected part under the water and weigh down with a plank to keep them immersed while the fish enjoy a bonus live feed.
- (2) Use lawn fertilisers or weedkillers with extreme care around the pond as these can cause a great upset to the ecosystem in the pond if run-offs, or even wind-driven spray, enter the water.
- (3) When flooding the pond use the hose set on 'fine sprinkler' or allow water to gently flow from the surroundings to avoid disturbing the pond bottom.

GOLDFISH & Other Pond Fish



PHOTO: MP. & C. PIEDNOIR

An
**AQUARIST
& PONDKEEPER**
Colour Supplement

**GOLDFISH
& OTHER
POND FISH**

'PRIMARY' GOLDFISH VARIETIES

STEPHEN J. SMITH
LOOKS AT POND-SUITABLE
VARIANTS ON AN
ANCIENT THEME.

• PHOTOGRAPHS BY THE AUTHOR •

Although these are technically 'Calico Comets' they are usually sold as Shubunkins, despite the fringe being distinctively that of the Comet.



GOLDFISH & OTHER POND FISH

'Primary' Goldfish Varieties

A good Ancestral Goldfish (popularly known as Common Goldfish) presents a most impressive figure, with its orange-red colouring and a perfectly-proportioned sleek profile. These features have made it the ideal fish for the garden pond, and it is hardly surprising that thousands upon thousands of these sometimes underrated fish inhabit garden ponds throughout the UK. Just about everyone is familiar with the shape and colour of the Ancestral (Common) Goldfish, but few are aware of the myriad varieties which are available to the pond-keeper. It is said that there are over 120 recognised varieties of Fancy Goldfish, and many of these are, however, better suited to life in an aquarium, where their round-bodied shape and extravagant finnage can be far better appreciated. However, several varieties of Fancy Goldfish have retained the long body of their "Ancestral" heritage, and these long-bodied, or 'Primary' Goldfish, are the perfect pond-dwellers.

The term "ancestral" is becoming more popular as a description for the so-called "Common" Goldfish and is far more fitting for a fish which so popular



This adult Lemon Goldfish won a first prize at a specialist Goldfish Show, and shows the perfect shape, foreshortened slightly by the camera, and finnage of the Ancestral Goldfish.

caudal (tail) and anal fins.

THE COMET

The Comet is a further popular Primary Goldfish; this prefers plenty of pond space to take advantage of its fast, sleek form and is slightly slimmer than the Ancestral Goldfish. The

Comet also has longer finnage, with a highly-developed caudal fin: forked when viewed from the side and, ideally, appears as an open pair of scissors; while, according to recognised show standards, the length of the caudal fin should be equal to that of the body. Comets are usually metallic red in colour, but are also popular as a red-and-white, or Sarassa, colouring. Occasionally, multi-coloured, or calico-coloured Comets are available, mistakenly labelled as Shubunkins.

THE SHUBUNKIN

The Shubunkin is a splendid pond-fish, and has become a specialist fish in its own right. I have often heard people describe that their pond contains both Goldfish and Shubunkins ... Shubunkins are Goldfish, after all! The colouring of the Shubunkin is most attractive, with matt scales, and occasional metallic scaling, too, on all but show-quality specimens. The scales are coloured red, yellow, and brown on an all-over background of light blue, and finished with a black speckling over the whole of the body and fins of the fish. The London Shubunkin is identical in shape and finnage to the Ancestral Goldfish, its



The Wakin has a similar body-shape to the Ancestral (Common) Goldfish, but the caudal fins are reminiscent of the Fantail.

only difference being its characteristic calico colouring. Members of Bristol Aquarists Society have, over a period of several decades, perfected the Bristol Shubunkin. This is slightly slimmer in the body than the Ancestral Goldfish and has longer finnage. The main distinctive feature is the shape of the caudal fin, which ends with rounded lobes forming a shape not dissimilar to the letter 'B' (see Jim Day's article elsewhere in this Supplement).

OTHER VARIETIES

Two additional varieties which deserve some attention are the Wakin (pronounced waykin) and the Ikin (pronounced jee-kin). These varieties because of their 'long-bodied' characteristic, can certainly be called Primary Goldfish, but they differ from the majority of the category by the fact that they have twin-tails. Consequently, I would personally prefer to keep these varieties in a pond environment, where their long-bodied form is better suited. However, the characteristics of their caudal fins mean that they do not swim quite as swiftly as their sleeker counterparts, so I would advise that these are kept in a separate pond or, for the beginner, that they are accommodated in an indoor aquarium.

Both the Ikin and the Wakin varieties tend to have a slightly fatter body than the Ancestral Goldfish. The Wakin is reputedly the traditional Goldfish of Japan and is prized for its paired, fan-shaped, caudal fins. Although not as pronounced as the Fantail-type Fancy Goldfish, the caudal fins are usually fully-divided, although "webbed" caudal fins are not unusual. Being twin-tailed, the Wakin normally has paired anal fins, while the remaining fins are short and slightly rounded. The colouring of the Wakin is traditionally all-gold or Sarassa, though I have recently encountered Calico Wakis, which make extremely attractive fish. The Ikin is a recent introduction to the worldwide Goldfish scene and was developed originally in Japan, although it has been and overwintered outdoors successfully in the UK. The Ikin has a most distinctive caudal formation, being squared and completely divided, so much so that each half is perpendicular to the tail root (caudal peduncle), while the anal fins are also paired. A perfectly-coloured Ikin is most difficult to obtain: breeders can only strive towards a silver-white metallic scaled body with red finnage and red lips; so-called 'imperfect' specimens show red colouring splashed over the body, but nevertheless make the Ikin a highly-attractive and unusual pond fish.

These young Ikin have near-perfect colouration for this variety.



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COLDWATER JOTTINGS

BY
STEPHEN J. SMITH



It's Spring Again

At last! The coldwater season is in full swing and we can all turn our thoughts away from the long British winter and towards enjoying our ponds, pondfish, and plants; not to mention getting down to preparing for a season of breeding our favourite species or varieties. And, if you haven't already, now is the time to get started. Your fish will have used up the majority of their reserves over the long winter, and feeding should have commenced with some gusto and enthusiasm of your fish, in order to get them up to full strength and to creating good strong eggs or mit. I prefer to feed my fish with one of the brands of high-digestible fish foods, as this also helps to give the filter system half a chance of itself

developing its colony of bacteria. High-digest foods are a boon as there appears to be little waste. And, at this time of the year, there is also the possibility of late frosts, so beware of feeding your fish too late in the afternoon, otherwise the food in the fish's gut may not be digested completely, and this could lead to problems — especially as your fish will be at their most vulnerable at this time of the year.

School Sitting

Frances Wymans, whose fish were featured in a previous 'Jottings', has e-mailed me in search of advice on 'fish-sitting' the local school's Goldfish during the school holidays. Normally, she says, she pops into the school two or three times a week to feed the three 2in Goldfish which are housed

Pond Cleanliness

A wise fishkeeping colleague of mine — and a sage of Goldfish breeders in the UK — often used to say to me that the three most important words in the hobby are: "Cleanliness is next to Godliness". OK, so that is five, but we all knew exactly what he meant. And those five words are the most valuable advice any fishkeeper could wish to receive. So, now is the time to get your pond emptied, scrubbed (with clean water — no cleaning fluids, please!) and refilled with fresh water. Of course, leave the water to stand for a day or so before returning the fish to the water. And the result will be that your fish will stand at least half a chance of growing, and even spawning, this season, and of giving you the utmost pleasure. Take the opportunity at this time, too, to prune and even repot your pond plants, cutting lily leaves right back to the crown, and even dividing the crown into separate pots. If you don't know where to put your extra plants, then give one to a friend!

in a 4ft tank. Significantly, Frances tells me that the water quality is good. And so it should be! Seriously, it is a pleasure to see that there is a Goldfish aquarium, somewhere, which is not overcrowded. Three, 2in fish in a 4ft aquarium is the perfect stocking level, and will help to ensure that the water quality will remain good, and the fish will thrive and even grow. The nub of Frances' question, though, centres around the fact that she will not be able to go into school over the forthcoming holidays, so intends to bring them home. Her question is: "Should I leave the filter running on the empty tank (I shall have to leave the lights on for the plants), or do I shut it off and start after the holidays rematuring it. With a view to the six-week summer break: will the bacteria survive in the gravel, with aeration, after they have exhausted any ammonia when the fish have moved house?" This question takes pride of place of all the questions posed in these columns — and the answer is

really quite simple. Yes, in my opinion, you should leave the filter running even though there are no fish in the system (though whether you really need the lights on full-time is debatable — maybe take the lid off and let the plants have a natural cycle of daylight/night-time). As for how long the bacteria will survive without ammonia, well, they don't necessarily need ammonia to survive — they are just very good at breaking it down. A further word of warning: make sure that you use water from the existing tank to accommodate your fish in their new, temporary quarters. For a six-week break this would be wise; though for a two-week break I would suggest that the fish would be happier left alone where they are. A maximum of two weeks without artificial feeding will do them no harm whatsoever, and indeed may even be quite beneficial! And thanks, Frances, on your kind comments on the new-look **A&P**. They are most appreciated!

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GOLDFISH & OTHER POND FISH

THE BRISTOL BLUE SHUBUNKIN



PHOTO: A&P LIBRARY

The Shubunkin is probably the most popular variety of coldwater fish in the country. This is not surprising in view of its beautiful colouration and graceful outline.

The Japanese are said to have produced the Shubunkin in 1900. It was then similar to the Common Goldfish, with the exception that it was multi-coloured and scaleless, i.e. had no visible scales. It was not until about 20 years later that the first specimens reached England. Later on, the produce from these and further importations into England became the prototype of the Shubunkin known as the 'London Standard.'

The breeding of Shubunkins was also taken up actively in America whose aquarists produced fish with long

JIM DAY, PRESIDENT OF THE BRISTOL AQUARIST SOCIETY, TRACES THE HISTORY OF HIS LOCAL, BUT NATIONWIDE FAVOURITE, FISH.

pointed tails and finnage, rather more developed than in the original type. Considerable quantities of these fish were imported into England and from these the Bristol aquarists set out to produce Shubunkins with fairly large rounded tails, streamlined bodies and well-developed finnage generally. This type became very popular and so we now

had three types — the London Standard, the American Standard and the Bristol.

In view of the increasing popularity of the latter, the Bristol Aquarist Society decided in 1934 to adopt a Standard for this type, to be known as the Bristol Standard. This Standard has been universally-adopted and, to intents and purposes, has superseded those for the American and London types.

Just to show that there are no hard feelings, and that I'm not being too parochial, I will briefly describe the London Shubunkin. It shares the same varied and magnificent colours as the Bristol, scalation is the same but the tail is much shorter and less developed — much the same as that of the Common Goldfish. As mentioned earlier, they have been around for a long time and there are still a few breeders who carry

on the strain. It has become noticeable lately that the 'London' is becoming quite popular again with a few more showing up at exhibitions once more.

Now down to the finer points of obtaining good fish. When buying, a healthy fish should always have the dorsal fin held high, be active and not sitting on the bottom of the tank or pond lifeless; the strong rounded tail should be also held high, the top lobe well above the horizontal — in the hobby we call this a 'strong peduncle' — it should be very wide-spread with no crossing over in the middle.

Now look at the colour. It should have a blue ground, splashed with black and interspersed with violet, red, brown and yellow; some refer to this as a painter's palette which is an excellent apt description of the many colours to be found in the ideal fish.

The shape of the body should be of a streamlined appearance with the eyes nice and clear.

If you have found all, or most, of these desirable characteristics in your chosen fish then you are on the right road — not for exhibiting — but for having a reasonable Bristol Blue Shubunkin. If you are thinking of exhibiting your fish then this is quite a different ball-game altogether, and you are best advised to get in touch with your local aquarist Society who will have a nationwide Standard Book for Fancy Goldfish and they can give you excellent advice on what to do, and what to look for, when preparing your fish for the judge's scrutiny.

But fishkeeping is all about enjoying your fish wherever they are normally kept, in pond or aquarium rather than travelling around the country in bare tanks at weekends. Shubunkins are very attractive and graceful fish that enjoy basking in the warm sun (seeing them do this is only one of the enjoyments of keeping them). They become very tame and, if you feed them at regular times, will be waiting for you if you are only a few minutes late! Although they take food from the surface, they are mainly bottom-feeders.

Shubunkins are not over particular as to their food but similar to most fish



they do appreciate a change: they take flake foods, pellets, *Daphnia*, chopped earthworms, mosquito larvae, flies etc. Adult fish should be between four and six inches.

Providing Shubunkins are in good condition and kept at the correct temperature they will spawn from March onwards. Owing to the difficulty of obtaining adequate supplies of small *Daphnia*, or other live food, early in the season March should be ruled out by the beginner. As we have seen this year, many violent fluctuations of temperature may be encountered and this is very detrimental to small fry; as a general rule, fry hatched in April and May seem to go ahead without any setbacks. Most of all the breeders in the Bristol Aquarist Society breed Bristol Shubunkins, so you can imagine that there is strong competition between them. At any Open Coldwater Shows, Bristol Shubunkin Classes attract the most entries from all over the country. But back to the fish in the pond.

As the water temperature rises in Spring, Shubunkins become very active and start to breed. If the pond is well-planted, you have a good chance of seeing some young ones hatched from eggs that haven't been eaten by the adults.

If you want to keep a fair number you should take the plant out from the pond and put it into a clean tank of water at 70°F. The infertile eggs will go white, the good ones remaining transparent. The fry can be seen in the egg after three days and will be seen moving inside the egg a day before it is due to hatch.

When the fry hatch they are very tiny

and attach themselves to the plant and sides of the tank — do not touch them at this stage — they are provided with a yolk-sac which will give them all the nourishment they need for the next twenty-four hours. Once this food store is used up the fish will become free-swimming and when this happens they will need feeding, infusoria of some kind or another. Personally, I use Liquify No. 1 (for egg-layers) for two or three days which gives me time to get my Brine Shrimp going for the next stage, which is also supplemented with TetraMin baby fish food, a fine powder in the red and yellow tub. I find that giving too much of this will tend to pollute the water, so be careful. After five or six days on shrimp and powder, I start to introduce fine, sifted *Daphnia* (the sifting also removes harmful predatory insect larvae, a point to remember if your *Daphnia* is wild-caught), crushed flake or pellets. You are now on your way, the fry will soon grow provided you maintain the 70°F temperature, keep the water in good condition — plenty of partial water changes etc — and give them plenty of space and food.

In two to five weeks you will start to cull out, this process involves selecting which fry to grow on and which to discard bearing in mind the characteristics we are looking for, as described earlier. As we are looking for colourful fish, the first to be rejected are the bronze and pink-coloured fry, along with any deformed ones too. By now, the colour should have started coming into the fish and the good ones will have equal patterning on both sides of the body with the colour (usually black)

GOLDFISH & OTHER POND FISH

The Bristol Blue Shubunkin

extending into the fins.

The selection process continues over the next few days and weeks with culling taking place for the following

characteristics in order of body shape, rounded wide-spread tails with broad lobes. During this period too, the weather should be getting warmer and

you will now be able to start weaning them off the heat.

If you have stuck to the rules — space, food, good water — your fish will be growing nicely, probably around 1 1/2-2in or even more, but it will now be getting on for Autumn. Because the weather is getting colder, cooler water temperatures mean the fish will not be eating so much and will have started their 'slow-down' for winter. Always stop feeding in the winter because the fish do not need food, although they may appear to take it, it can lie undigested in their gut for many weeks and give rise to disease problems. They will survive comfortably enough, grubbing about on the bottom of the pond or aquarium when they feel like it.

Shubunkins are very hardy fish and will come through the cold and icy winters very well — some say all the better for it as far as future breeding is concerned. I hope I have given you a reasonable insight into the Bristol Blue Shubunkin and hope it has captured your interest.



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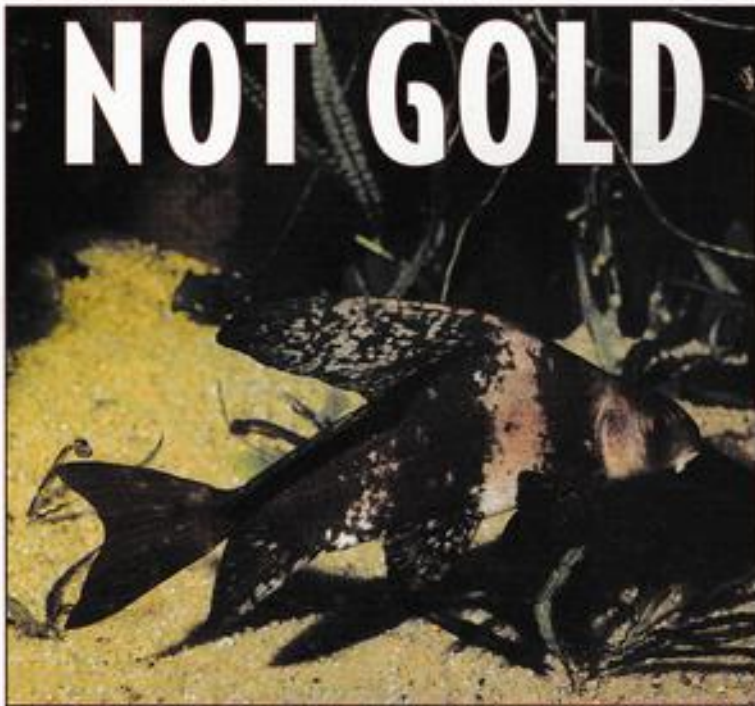
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GOLDFISH & OTHER POND FISH

ALL THAT GLISTERS IS NOT GOLD



Myxocyprinus asiaticus.
PHOTO: DAVID ALLISON

The term coldwater fishkeeping conjures up in most people's minds only Goldfish or (if you have a large pond) Koi, but there is an ever increasing number of fish becoming available that will

**JACK STILLWELL FINDS PLENTY OF
'OTHER SPECIES' FOR THE POND AND
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live comfortably in ponds and aquaria in this country without the need for artificial heat. Apart from our own rivers and lake fishes we can now obtain fishes from North America, China, Japan, and Australasia.

GOLDFISH & OTHER POND FISH

All That Glisters Is Not Gold

CLICKER BARB PHOTO:
AGP LIBRARY

Bitterlings are an excellent aquarium fish, whether you attempt to breed them or not: seeing their colours reflected by some side-lighting on a sunny morning is almost enough reward in itself. I was lucky enough to inherit Vernon Hunt's collection when he died some time ago and some of them are still alive today, adding yet another attraction — reasonably long life!

FAR EASTERN CARPS

In recent years there has been a steadily increasing influx of coldwater fishes from the Far East and this has led to identification problems, but some are now quite common and can be seen at most Shows. They range in size from the Far Eastern Dace, *Leuciscus fraatli*, at 300mm to the Venus Fish, *Aphyocypris rasborella*, at 55mm for the golden variety. I have drawings and details of 11 species but there are many, many more.

The Topmouth Gudgeon (also known as the Clicker Barb because of the noise it makes when eating), *Pseudorasbora parva*, is probably the most common of these and the Pale Chub, *Zacco platypus*, is a close second: the former grows to 110mm and the latter to 150mm, both are easy to keep and feed. Like many Cyprinids the Topmouth Gudgeon develops small white tubercles on its head during the breeding season and the long, almost over-developed anal fin of the Pale Chub may well play an important part in spawning (and sex differentiation) too.

Vernon left me a list of some 287 Chinese Carps, some found also in Japan as well. I currently have one — *Barbus parvulus* (?). The general behaviour of my particular fish is far from desirable, it objects to the presence of any other fish in no uncertain way — although only 100mm long, it killed a large Sunfish in a matter of minutes! Another Chinese Carp I have kept is the Rainbow Gudgeon, *Cheilogobius cyprinoides*, and I'm glad to say that this one is a very amiable fish.



A recent import (often seen in dealer's tanks in with tropicals) is the Saifin Sucker, *Myxocypris asiaticus*. This fish looks very impressive with its light and dark banded body and, of course, its high dorsal fin. Because, like all imported fish, it is brought in as a juvenile there is often no evidence to suggest that it will attain some 600mm — 24 inches! Also, it is wrong to assume that this is a tropical species, it will do very well in cool water and probably even better in a pond!

FAR EASTERN LOACHES

Importations of these fishes have really taken off in the last few years and many cannot as yet be correctly identified but already there are 98 known species! The Japanese Weather Loach has been kept for many years: its scientific name is *Misgurnus anguillicaudatus*, and it grows to 230mm. The more modestly-sized Hillstream Loaches are a recent import and there are three types, identified depending on how fully the sucker is formed by the two pelvic fins. The three genera are *Hemimyzon*, *Gastromyzon* and *Sinogastromyzon*, all growing to about 80mm in length.

NATIVE AND EUROPEAN FISHES

This article really would be incomplete if I ignored our own native fishes. This country has a wealth of fish that are ideal for the pond or aquaria, and they can often be had for free (but do appreciate there are strict rules about taking fish from the wild).

The Bullhead, *Cottus gobio*, grows to

100mm, it has a spined dorsal which it can raise, making it difficult for other fishes to swallow. It builds a nest and the male tends the eggs as does the Three-Spined Stickleback, *Gasterosteus aculeatus*, which is Britain's most hardy fish and grows to only 90mm. One of the most interesting furnished aquariums I have ever seen was in a Southampton school and contained breeding Sticklebacks. The male's

colours would have put a Cardinal Tetra to shame, as it guarded the nest and its harem of females.

The Common Minnow, *Cirrhocarrax (Phoxinotus) phoeniceus*, is a hardy omnivorous cyprinid suitable for the aquarium especially if more than one is present, when they will present themselves as a ever-active shoal. Like most of our native fishes, well-oxygenated water is required and a power filter will ensure that the water is kept moving, another appreciated factor.

Other fishes like the Rudd, Roach, Dace, Tench and Orfe are better kept in a pond where they will reach their maximum size. Whilst wild species of Tench and Orfe may be uninspiring in their natural colours, cultivated gold forms are more easily spotted in a pond: there are quite spectacularly-coloured other Orfe becoming available now.

An interesting aquarium fish from the continent is the Weather Loach, *Misgurnus fossilis*, which grows to 300mm and is a close relation of the Japanese Weather Loach mentioned earlier.

It is advisable not to attempt to keep the Pike or Perch as they must have live food and plenty of it!

I have deliberately omitted any form of catfish from the coldwater aquarium or pond. To my mind they become too large and their predatory instincts hardly make them suitable subjects. It's better to leave them where they are — probably making a legend for themselves in some quiet lake ready to terrorise any unsuspecting angler that hooks them out!

OTHER FISHES

There are some fishes so called "tropical" that will live without heat in

GOLDFISH & OTHER POND FISH

All That Glisters Is Not Gold



PALE CHUB

PHOTO: AFP LIBRARY

this country (again I will dwell on them but briefly as the Editor informs me that there will be a feature on these fish in the July issue!)

The White Cloud Mountain Minnow, *Taxichthys alfonsoi*, will live outside under ice one of my club members breeds them regularly and they live outside even in winter; the Chinese Paradisefish, *Macropodus opercularis*, will also tolerate very low temperatures as will some of the American Fundulus

species. The Golden Medaka or Ricefish, *Orzias* sp., is also used to not only low temperatures but according to recent scientific papers has been into space and back thus proving weightlessness is no problem either!

When you put together all these species, you will plainly see that the coldwater scene has much to offer in diversity of species, both in size shape and colours — and that's not counting the many varieties of Fancy Goldfish and

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GOLDFISH & OTHER POND FISH

THROUGH A TELESCOPE

If you have an interest in Fancy Goldfish, you are almost certain to have seen some varieties with protruding eyes. These may not be to everyone's taste, nevertheless, fishes with this development are very popular. The fact that countless thousands are imported into this country from the Far East every year is proof of this fact. Several names are used to describe fishes with this eye formation. In Britain they are normally referred to as 'Telescopes' but, other names such as 'Globe-Eyes' and 'Dragon Eyes' are in common use. In Japan they would call these fish 'Demekin'.

Trying to trace the history of Goldfish varieties can be a bit like deciphering the Dead Sea Scrolls! Information is scarce and, at best, patchy. For instance, some Chinese drawings from the Ming Dynasty, circa 1429 AD, are said to have shown fish with Telescope eyes. More recent evidence comes from a scroll sent from Peking to Paris in 1772 depicting fish of this type. There are even reports of the fish themselves being imported into France in the 1750s. Whatever the facts, it seems certain that Telescopes, like many other goldfish types, originated in

ALEX STEPHENSON INTRODUCES A PARTICULAR FANCY GOLDFISH STRAIN WHICH MAY OR MAY NOT VIEW LIFE DIFFERENTLY TO ITS RELATIONS.

• GRAPHICS BY THE AUTHOR •

China. From there they found their way westwards, being well known in Europe in the mid to late 1800s. Oddly enough, Japan, world famous for producing commercial quantities of fancy goldfish, does not appear to have had this type of fish until the end of hostilities in 1895. Since then of course, Japanese fish

farmers have produced millions.

Some doubts exist concerning the affect of enlarged eyes on the fish's ability to see. One piece of information I came across suggested that the eyes would indeed have a telescopic effect. Thus making the fish long-sighted. However, most other opinions I've seen say quite the reverse, and maintain these fish are short sighted. I wonder, could both of these opinions be true in different individuals? There are variations in eye shape and degree of development in fishes of different strains (see diagram). Personally, I don't think impaired vision bothers goldfish too much. It is argued that a Goldfish's eyesight isn't too great anyway and, in murky waters, must be of limited use. Sense of smell, on the other hand, is far better than we as humans can imagine.

Likewise, their ability to sense sounds and to use pressure waves like 'radar' is totally beyond our comprehension. In my experience, having kept 'Telescopes' with other 'normal eyed' Fancies, I have not found them to be at any disadvantage.

While we are talking 'technicalities', it is



Pom Pom Panda.
PHOTO: A&P LIBRARY

GOLDFISH & OTHER POND FISH

Through a Telescope

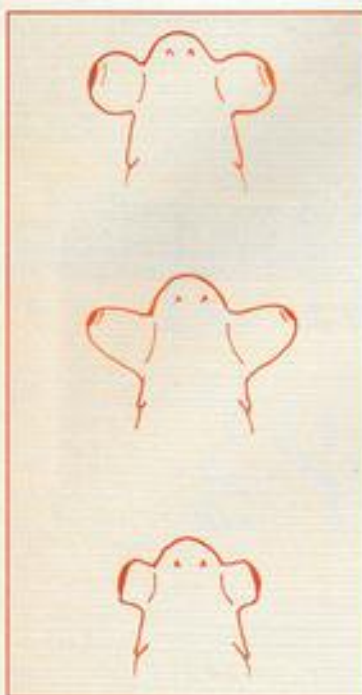


Diagram showing contrasting shapes in eye development.

interesting to note that there is a link between the formation of Telescope eyes and the retention of black pigment. If you are 'underwhelmed' by this information, let me explain its significance. In normal, metallic-scaled, Goldfish the black pigment 'melanin' is unstable and is often lost altogether. It is this process which allows Goldfish to change from the wild bronze colour to orange. When we talk about young Goldfish 'colouring up' we are not really accurate, it would be more correct to call this change 'decolouring'. Loss of melanin is fine if you want bright orange or yellow fish but, if you are producing 'calico' versions such as Shubunkins, which are multi-coloured, then this loss of black is a big disadvantage. Ideally calico or nacreous fish should possess colours such as light blue, orange, brown, purple, black, etc. Without melanin it is only possible to produce orange, yellow and white, the other colours requiring the influence of black pigment. Oriental fish farmers long ago discovered that calico versions of their Telescope-Eyed Fantails were a much better colour than calico versions of

other varieties. So, they did the obvious thing and crossed selected specimens of their Telescope strains with other calico varieties to improve the colours. This crossing, selecting, and re-crossing goes on all the time, it is how new varieties are developed and old ones improved. Before you rush off to invent a new variety of your own, be advised, this is not a quick or easy thing to do. The vast majority of progeny resulting from crosses are quite worthless in themselves, and any value they might have will only be as part of a planned breeding programme. Even when success is achieved, it still takes many generations to fix the strain. Information of this kind, although vital to anyone involved in breeding Goldfish, may be academic to the average hobbyist. Most people simply want to enjoy their fishes. So, lets take a look at what is available.

Apart from the spectacular 'calicos' there are a number of other colours available within the Telescope group. Of these, self-orange and orange and white are fairly easy to find. Not quite so common are the blues and chocolates. Blues are a sort of slate grey colour, which doesn't sound very inspiring but, they are attractive. Chocolates can vary between a light milk chocolate colour and a darker shade of brown. Be warned, I have seen bronze fish which have not undergone a colour change advertised as chocolate so, it pays to know the difference. More recent innovations, are the very striking black and white Telescopes known as Pandas and Magpies. These, when first imported into this country, were greeted with great enthusiasm. As far as I know no one in Britain has as yet developed a good hardy strain of these. The ones I had started out black and white but quickly lost the black bit and became orange and white. Still very nice fish of course but, very 'un-Panda' like.

Probably the most famous member of the Telescope group is the ever popular 'Moor'. Often called the 'Black Moor', the inclusion of the word black is unnecessary as the name Moor

should only be applied to a self black, twin tailed fish with Telescope eyes. I am sure you have seen, as I have, retailers describing fish as 'Red Moors' or perhaps 'Calico Moors'. This is quite wrong because if a fish is not all black it may well be a Telescope but, it can never be a Moor. Black fish seem to have come about at the same time, or soon after, the development of protruding eyes. This is not too surprising when you remember the link between eye formation and the retention of black pigment. Ideally, Moors from a good strain should remain black throughout their lives. Having said this, I've seen show specimens go red with age. One of mine, at the age of about ten years, went half red and became a most impressive fish. Wonderful though he was, he lost the right to be called a Moor. One thing we have not yet mentioned is finnage. Most of the Telescope varieties we are familiar with are fully finned twin-tails.

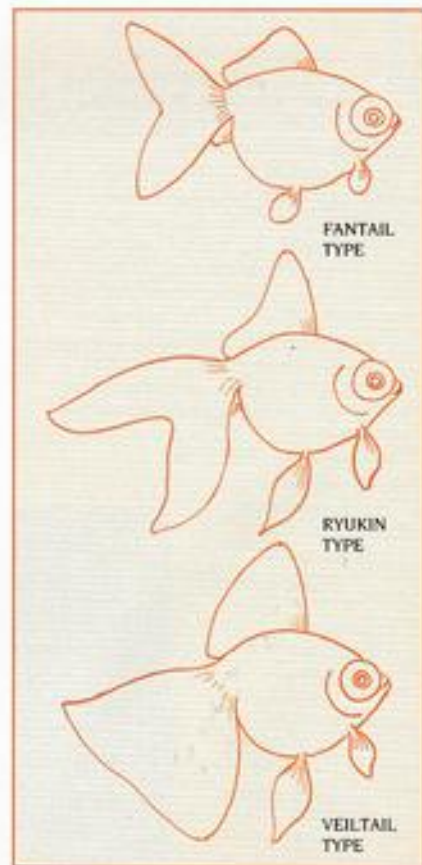


Diagram showing contrasting styles of finnage.

GOLDFISH & OTHER POND FISH *Through a Telescope*

This means they should have two of everything except the single dorsal fin. As usual with this type of fish, the body shape should be short and deep. Common faults with this required finnage are, caudals (tail fins) joined along the top edge, and single anal fins. There are fishes, such as the Celestial, which have no dorsal fin but, in these, the eye development is different and they are separate varieties.

Despite exacting requirements for finnage, styles can, and do, vary greatly (see diagram). Most imported specimens used to have finnage either like the Ryukin (Japanese Ribbontail) or, somewhat shorter, rather like a fantail. More recently, a type known as the Butterfly-tail (Tosakin) has emerged and become popular. This 'butterfly' bit

might escape you until you view the fish from above when you will see the tail piece forms the shape of a butterfly's wings. British fanciers, on the whole don't favour the oriental styles of finnage, and have developed some of their own. The Broadtail (or Veiltail) Moor is a classic example.



Moor.
PHOTO: AGP LIBRARY

Because raising Goldfish in our climate is a difficult and expensive business, you are unlikely to find British bred fish in your local 'pet shop'. If you are a 'serious enthusiast' and wish to track down 'home bred' stuff, I would strongly recommend that you contact one of the Goldfish Societies where you

will meet people who can steer you in the right direction. In addition to this, meeting and exchanging views with other 'like-minded' fishkeepers is bound to provide a 'new dimension' to the hobby.

Whatever your taste in Goldfish, I hope this article shows there is more to Telescopes than meets the eye.

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Just as Blackpool has its Golden Mile of attractions, so too does Enfield, although along quite different lines. Enfield Chase seems to have become the centre of the garden centre universe with more such outlets than you could shake a stick at. At one of the worthwhile centres of gardening excellence, Brown's Garden Centre, can be found the Crews Hill Aquarium and Water Garden Centre.

Divided into four distinct areas, the visitor enters through an outdoor display area of pond products and accessories — anything from liners to pre-formed cascades and statuary. The large area of the indoor (under cover at least, as the main end doors are usually open) is the main dry goods area where, again, everything you could possibly need is on display. The comprehensive range of pond filters include in-pond models, popular external box-types plus filters disguised as planters. Miniature, fully-integrated 'table-top' water features adorned the counter whilst the

Crews Hill Aquarium and Water Garden Centre



tanks, foods, pumps, and all the other wide-ranging products were attractively displayed and easily accessible.

Livestock is presented in two areas one at each end of the dry goods section, the indoor tropical area is well sealed from any exterior cold winds and features large shallow tanks containing a good selection of freshwater tropicals and aquarium plants.

Outdoors the large holding tanks are filled with coldwater species, Goldfish, Koi etc with a good stock of Water-lilies in their own section. Although outdoor, the coldwater stocks are also under cover so browsing even during inclement weather of the fish and pond plants is quite feasible.

Estelle, the manager, was on top form during my visit, quite expertly explaining the intricacies of the workings of an air pump to a customer who was having trouble, she makes a fair cup of tea too, but that's probably not always on her list for every visitor, but the warm welcome most certainly is.

GOLDFISH & OTHER POND FISH

MUSSEL-BOUND

Symbiosis by its most faithful interpretation describes an association between independent organisms but may not in itself necessarily imply a condition of mutual advantage. For the most part, however, the term is generally used to indicate a beneficial relationship where separate life forms have evolved a dependency resulting in each deriving advantage from the presence of the other. Such relationships occur frequently throughout the animal and plant kingdoms with in some cases the interdependency having become so great that without it survival of a species may be seriously threatened. The nature and purpose of these partnerships vary considerably among different organisms and occur not only in advanced life forms but also in the most basic of structures.

Some fascinating and remarkable examples of symbiosis are found in the aquatic world the vast majority and most well known of which occur within marine habitats. But there is one particular relationship of special interest to the freshwater aquarist — that of the Bitterling (*Rhodeus amarus*) and the Swan Mussel (*Anodonta cygnea*). These creatures present an almost perfect illustration of



Bitterling female on left showing ovipositor.
PHOTO: LAURENCE PERKINS

ROY OSMINT UNCOVERS A REMARKABLE BREEDING PARTNERSHIP.

symbiosis between two very different levels of life form where each has established a dependency upon the other for the procreation of their kind.

A member of the family Cyprinidae, the Bitterling is indigenous to freshwaters

throughout Europe (except Scandinavia and Finland). It inhabits quiet regions of rivers, tributaries and pools where the bottom tends to be muddy and it can avoid the unwelcome attention of predators. The principal diet consists of insects, plants and small crustaceans with fully developed specimens reaching a length of some 10cm, although within the confines of the average aquarium 6-7cm is likely to be a more realistic expectation. The body is laterally compressed and coated by silver scales which appear fairly large in relation to the size of the fish. A horizontal blue-green line extends from below the dorsal fin to the tail where it converges with a red spot.

During the breeding period which in its natural habitat is normally between April and June the male fish dons impressive spawning garb. Heightened colouration occurs with the belly and throat areas becoming a yellowish orange to complement the reddish hue of the fins. At the same time the female develops a greatly extended tubular ovipositor, an essential piece of equipment when it comes to the delicate manoeuvres associated with the remarkable symbiotic reproductive process.

Bitterling do not occur naturally in Britain though in some areas they have

GOLDFISH & OTHER POND FISH

Mussel-Bound

from time to time been introduced to various waters. Under these circumstances they will often thrive provided that they can establish the essential relationship with some form of suitable mollusc, and are thus able to reproduce. A most interesting illustration of this occurred in the United States during the 1920s when European Bitterling were introduced into streams around New York City.

Although the accustomed species of mollusc was not present in these waters it was not too long before the fish actually struck up a symbiotic partnership with various local species of clam and successful breeding was able to take place.

Among fishkeepers the Bitterling appears sometimes to be overlooked or underrated as an aquarium subject; this is a pity for it has much to commend it. At its best it is an extremely attractive fish perfectly compatible and relatively undemanding in its requirements. It is true that good specimens are perhaps not always as easy to come by as some other more popular species. But they are available and the aquarist who is prepared to shop around to locate quality stock will have their time and effort well rewarded.

Although the Bitterling itself is not a warm water fish it would be easy to mistake it as such, for in general body design and certain behavioural characteristics it quite closely resembles the tropical Barbs. It is therefore an ideal choice for anyone wishing to establish a coldwater display aquarium, but who does not necessarily want to include the more common varieties usually associated with such a set-up.

Gregarious by nature Bitterling are undoubtedly seen at their most impressive when kept in a small group. Under these circumstances and when housed in a well illuminated and tastefully furnished aquarium they create an enchanting display. The subtle spectrum of colour from their relatively large iridescent silver scales constantly changing with the angle of view and light. But the attractions of this little fish do not end here. In addition to making a most lively and fascinating inhabitant for any well appointed coldwater aquarium, the Bitterling also offers another very



Rutilus amarus.

PHOTO: ASP LIBRARY

special interest: for without doubt it possesses one of the most truly remarkable methods of reproduction to be found anywhere in the aquatic world.

The familiar aphorism "two's company — three's a crowd" frequently holds true, and is likely to be especially so where amorous inclinations are concerned. But this is certainly not the case for the male and female Bitterling. When their thoughts turn to mating the presence of a third party is not only acceptable, but essential. This strange tripartite liaison between the Bitterling and a bivalve mollusc provides an excellent example of the way in which evolution has enabled certain creatures to collaborate with one another to mutual advantage. The level of benefit gained by each participant is not necessarily equally shared, as in this case where the advantage would seem to be biased in favour of the Bitterling. But nevertheless any imbalance in no way serves to detract from the overall effectiveness of the relationship.

Bivalve molluscs are a group of the class (Lamellibranchia) which in total are made up of something in the order of 20,000 species of which only a very small proportion are found in freshwater habitats. One such variety is the Swan Mussel, the Bitterling's preferred partner. The shells of bivalves are composed of two halves each of which is asymmetrical and are hinged at a point called the umbo. Strong muscles cause the shells to shut tight but they can also gape open when the muscles are relaxed. Internal organs and a ventral foot make up the bivalve body all of which are enveloped within a thin mantle. Between the body and the mantle is the mantle cavity and it is here that the left and right gills are located.

Bivalves are filter feeders and take nourishment from the water with their large gills. To this end the mantle is usually formed into two tubular siphons, one to draw water onto the gills the other to carry it away again. The muscular ventral foot is used for locomotion and burrowing into the sand or mud. This together with the inhalant and exhalant siphons can be withdrawn into the mantle cavity between the shell valves for

protection. The Swan Mussel is the largest to be found in the freshwaters of Europe and it is this creature that the Bitterling will predominantly seek to use as a partner for breeding.

In the Spring the fish will come into spawning condition and locate a suitable mussel over which the male will stand guard. The female positions herself directly above the mollusc and must then wait for it to open. When this occurs and circumstances are favourable she will carefully insert her greatly extended ovipositor into the inlet siphon of the mussel and deposit eggs into the mantle cavity. This is of course a most delicate manoeuvre and one that demands careful timing. The procedure has got to be completed before the shells of the mussel clamp firmly together. The male Bitterling must also perform his function which he does by producing milt, this is then drawn into the bivalve via its respiratory and feeding current and fertilizes the eggs already inside. Hatching of the eggs and early development of the fry takes place in comparative safety inside the mollusc, with the tiny fish not being ejected until they are about 6mm in length.

This highly successful symbiotic relationship serves to ensure that the young Bitterling's chances of survival are greatly enhanced by being protected within a relatively secure environment until they are better able to fend for themselves in open water. The number of eggs produced by the female Bitterling is very small by comparison to other species from the same family but which spawn in more conventional fashion. This alone demonstrates clearly the survival success rate resulting from this strangely unique reproductive strategy. All of this affirms the distinct benefits derived by the Bitterling from

the symbiotic partnership — but what of the Swan Mussel, how does it gain advantage from the association?

The answer lies in the parasitic nature of the mussel's own larvae called *glochidia*. These develop from fertilized eggs which are retained in pouches within the mussel for some nine months. To enable the *glochidia* to continue development they must become parasites on fish. They are thus equipped with sharp teeth with which they are able to clamp themselves to the fish's skin. Once locked on the larvae will commence to burrow down to form a cyst and will gain nourishment from the body tissue of their host for up to three months. Eventually they will simply drop off and fall to the bottom where they will grow into mature mussels. The Swan Mussel's *glochidia* larvae are usually released at the same period as the Bitterling's reproductive process is under way. They are therefore able to use the female and/or the fry fish as hosts. The mussel consequently ensures the effective nurturing and widespread dispersal of its own young. Although the *glochidia* larvae of the Swan Mussel are known to sometimes be injurious to fish to which they become attached, no such ill effects appear to befall Bitterling. They seem to have been given immunity to any parasitic damage as part of the mutualistic arrangement.

Breeding Bitterling in the aquarium is perfectly possible and is in fact not as difficult as it might first appear provided the circumstances are correct and favourable conditions created.

To induce a spawning firstly bring the fish into condition by offering a generous and varied diet of live food and quality flake for about a week. Ensure good water quality and reduce the temperature to around 50°F (10°C) for a period, then introduce the essential Swan Mussels. The temperature should then be gradually raised to about 68°F (20°C). During the breeding episode the male Bitterling will frequently become territorial in defence of a particular mussel and defend it quite aggressively against intruders.

It can take up to three weeks before the free swimming young are ejected from the mussel's shell when they will accept newly hatched brine shrimp and dust fine dried foods. It is also probably a good idea to isolate the mollusc once the eggs have been deposited inside it to ensure the safety of the fry when released.

Do not overlook the food requirements of the mussel itself, this is a filter feeder and suitable nourishment must be introduced to the water to enable it to survive. It is almost certainly more difficult to maintain the mollusc in good health than it is the Bitterling and care should be taken to ensure correct feeding and water quality.

Bitterling will take two to three years to become sexually mature and have a life span of some five years.

Rhinias ecriatus.

PHOTO: ACP LIBRARY





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GOLDFISH Q&A

Q I have been keeping and breeding Fancy Goldfish for the last three years but my query is not so much about fish problems as such, more about finding more information in book form. I am having difficulty in locating a copy of Fancy Goldfish Culture by the late Frank Orme that you recommended in the January issue of A&P.

Could you also tell me if there are any publications I could buy (in addition to A&P, of course!) which specialise in Fancy Goldfish? I am a member of a Goldfish Society based in the Midlands but they don't produce a Newsletter and, as I am unable to get out much, I cannot get to the meetings.

A The late Frank Orme lived in Birmingham and was regarded (and still is) as one of the best Goldfish enthusiasts ever. I am happy to say that I have tracked down a copy of his book for you. As with all out of print books you do best by contacting a specialist book dealer and one of the best for aquatic subjects (including reptiles too) is: Stephen Simpson (Books), 23 Melton Street, Melton Constable, Norfolk NR24 2DB. Tel: 01263 860170. Fax: 01263 860175. Contacting him will surely get you the book(s) you require.

As for other publications, there is 'Practical Fishkeeping' in which Dr Joe Smartt provides occasional articles; Dr Smartt (together with E. Bundell) has a book due to be published on Goldfish Breeding & Genetics (ISBN 0-86622-2095-2) by TFH Publications but as yet no publishing date has been announced.

Dr Chris Andrews has published 'Fancy Goldfish' in the Salamander/Interpet 'Fishkeeper's Guide to ...' series. You will find information on relevant reading matter at the end of most articles in A&P plus of course extra highlighted titles in the advertising pages produced by various book services.

Q My four interconnected garden goldfish and Koi ponds have become infested with leeches which, despite using

proprietary remedies (and the more mundane pieces of liver hung in the water overnight), simply refuse to budge. I have read that calcium hydroxide can be used having first removed the fish and plants. Where can I obtain this lime (is it the same as that used in gardening or building work?), how much do I use, how long for, will it damage liner material and/or pump?

A First let me say I have no experience of using calcium hydroxide (it sounds a bit drastic!) in dealing with leeches. As for your questions I would suggest you follow up the initial source of information (Interpet Encyclopedia of Koi) with a direct contact to the company. They also publish the Interpet Manual of Fish Health, an invaluable 'gem' of information for the hobbyist and may well have more practical information about remedies for leeches.



PHOTO: KETH LAMBERT, WILDWOODS WATER GARDENS LTD.

Of course, you must realise that there are hundreds of Leech species throughout the world with about a dozen or so common in this country; most of the large brown leeches do little harm and can be regarded with the same surferance as beetles, water boatmen, etc. If, however, your leeches are *Piscicola* sp which actively attack fish then your problem is very real.

The only way I know of getting rid of leeches (and many other pond pests) is to remove all the fish and plants, pump out the water and let everything dry out for several days. This will kill leeches and their eggs too which are laid everywhere —

plant stems and leaves being favourite places. The egg capsules are resistant to just about everything (except nuclear attack, it seems!) and are not normally destroyed by chemicals safe enough to use in a pond. You realise, of course, that using this method means you need to throw away all of your pond plants plus all the planting medium etc. When replacing these be sure to clean and disinfect them well or you could find yourself back at 'square one' again.

Any fish which are host to leeches need to be treated with a suitable proprietary remedy; alternatively a salt bath can be effective.

QUESTIONS FOR THE GOLDFISH Q&A SHOULD BE ADDRESSED TO: ALEX STEPHENSON, c/o MJ PUBLICATIONS LIMITED, CAXTON HOUSE, WELLESLEY ROAD, ASHFORD, KENT TN24 8ET.

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TECHNICALITIES for beginners

PETER MOON
tackles the
mysterious
world of Redox

A somewhat difficult subject to explain in simple terms, as so many factors influence the Redox, ORP (Oxidation Reduction Potential) of our Aquariums, but let's be brave and throw "caution to the wind" and explain, as simply as possible this water parameter.

What is Redox?

Firstly, the word is made up of two abbreviations for the REDuction (surrendering of oxygen) and OXidation (the acceptance of oxygen) processes that are continuously in action in our aquariums. Moving on, 'Redox' is the ratio of reducing compounds to oxidising compounds, which is determined using an electronic meter that measures millivolt units, simple eh? Well not quite, there's more. Oxidation involves the loss of electrons by an atom, resulting in an increase of positive charge, conversely a gain of an equal number of electrons by an atom increases a negative charge. The sum of these oxidation and reduction reactions can be measured using a meter with an LCD or LED screen.

As stated earlier, Redox is measured in mv. On most meters the scale is from: +1000 to -1000 mv. The meter works by placing a probe in the water to be measured (after calibration). Probes used are Platinum/Silver/Silver Chloride.

Measuring

The Redox value can be interpreted as follows: The greater the number of oxidising agents present equals a higher reading, but a larger number of reducing agents equals a lower reading, fairly straightforward, but what are these positive and negative agents?

Oxidising Agents — Chlorine, Fluorine, Ozone, Oxygen, Potassium Permanganate, Iodine.

Reducing Agents — Nitrite, Low dissolved Oxygen, dead or decaying food, clogged filters/

Airstones and insufficient (or none) Protein Skimming.

The Numbers Game

The range being sought is between 250 and 350mv as stated by most writers on this subject, but don't get carried away or obsessed if your particular Aquarium does not fall within these values — it's not the Lottery — so don't get caught up in the competition.

Providing your other water parameters are in check and your filters operating at optimum levels don't worry. I have seen on my travels, beautiful aquariums, vibrant and healthy with a Redox value of 240mv, while others half as good with readings of around 370mv. Observing the animals in the tank and noting whether they look, or act, healthy is the key to success; look at it this way. Drinking water has a Redox of around 300mv, but in some instances tastes awful and looks decidedly cloudy, but it has the desired Redox value, get my point?

The 'Nitty Gritty'

Let's look at some examples, starting with pH. Most of you (I hope) test the pH of your water regularly, but just as a tank's pH fluctuates, so does its Redox, but opposite to what you might think. As a tank's pH increases (gets more alkaline) the Redox decreases and vice-versa. This is because the balance between Hydrogen ions (H+) and Hydroxide ions (OH-) shows an increase in H+, resulting in fewer free atoms of oxidising oxygen. The general trend is for an aquarium pH to fall over time due to biological processes being acidic in nature; another factor is that the buffering capacity (compounds that neutralise acids) tends to become depleted.

Dissolved oxygen greatly affects Redox. Low levels are limiting, but test kits are available for monitoring. Increased water circulation greatly helps, especially turbulence created across the surface of the aquarium. Temperature decreases the amount of dissolved oxygen in the water so, in the summer months when temperature creeps up, Redox creeps down unless you are lucky enough to own a chiller.

All of these factors are, also influenced by the time of day, therefore (just like pH) readings need to be taken at the same time each day with the probe located in the same spot. Usually the highest readings occur prior to the lights being switched on and vice-versa. The reason for this is quite simple in that the aquarium inhabitant's metabolism is increased during daylight hours as feeding, consuming more oxygen and producing wastes are the order of the day. The reaction by plants to the Redox level can be quite different: algae (especially *Caulerpa* in marine tanks) love a high level whereas *Cryptocorynes* can manage quite well on low readings.

A water change makes an interesting point. Some brands of salt have typically low Redox potential (the next time you buy a bag or box of your favourite salt, ask the redox potential when made up fresh, it's bound to cause a laugh!) and when mixed with the tank water the Redox falls, however after several days the value should begin to rise as some of the reducing agents have been removed with the partial water change.

The additions of various supplements such as, Iodine can raise Redox by 12 to 15mv when added according to the manufacturer's instructions. Probably the most potent method of increasing Redox is through the use of ozone (O₃) an unstable form of oxygen.

Ozone can be administered through a Protein Skimmer or reactor, but never directly

into the aquarium. Ozone rapidly oxidises any compound that it comes in contact with, so the contact time needs to be maximised, but excess ozone must not be allowed to enter the aquarium — activated carbon and a residual ozone test kit will monitor this.

To conclude

Unfortunately the meters required to measure Redox are fairly expensive, nonetheless if you feel that this way of checking your water parameters is necessary then OK. I personally look at Redox as an "overview" of my other tank parameters, but certainly a higher Redox potential helps in the eradication of certain species of troublesome algae (cyanobacteria) that can drive us to despair; also, if you like playing with gadgets like me, then it's probably worth it.

UNTIL NEXT MONTH,
HAPPY FISHKEEPING

TYPICAL REDOX VALUES

140-180mv Poor to Very Bad
200-270mv Low (new water added?) to Too Low
270-340mv Medium to Good
340-390mv Better to Best
390-450mv High to Too High
over 450mv Too High to Dangerous and beyond

Relative readings over a daylight period: early morning to late evening

Good Aquarium — 400 dropping to 390
Aquarium under stress — 390 dropping to 350
Aquarium with steadily falling Redox — 390 dropping to 360 followed next day by 360 falling to 330

AQUARIUM KITTENS



JANET MARSHALL LOOKS AT THE SMALLER 'CATS' IN THE AQUARIUM.

• PHOTOGRAPHS BY THE AUTHOR •

Corydoras and other members of the Callichthyidae family are ideal fishes for community aquariums of all sizes. These peaceful, sociable and endearing fishes can add interest and movement to the lower levels of the aquarium. They are known collectively as dwarf armoured catfishes as they can be identified by the presence of two overlapping bony plates which cover their body. These fishes are also able to supplement their oxygen intake by gulping air from the water surface and holding the swallowed air bubble in their stomachs. Once the oxygen content of the bubble has been used up the bubble is expelled and another is swallowed.

The family Callichthyidae includes a number of species apart from the well-known *Corydoras* — the ones most commonly encountered by aquarists are *Brocks*, *Hoplosternum* and the two members of the *Danania* family, namely *Danania longipinnis*, the Porthole catfish, and *Danania arostrata*, the Flagtail catfish.

The general care of these fishes is very similar, most of them will adapt well to normal community conditions and will tolerate harder water than that of their natural South American environment. A temperature in the region of 76°C is acceptable. All the fishes mentioned like company of their own kind and should be kept in groups of at least three or



more of each species. They are all shoaling fish in the wild and will not be happy when kept as individual specimens.

Feeding these fishes is not a problem — they will eat anything that is offered and enjoy commercial catfish tablets and pellets, frozen live food, chopped prawn and earthworm and crushed peas. They are often used in an aquarium to eat food left over from top and mid-swimming fishes, but it is important to ensure that they have a good balanced diet of their own — preferably placed at the bottom of the tank just before 'lights out' in the evening. These fishes are generally crepuscular — meaning that they are most active at dawn and dusk, although extra feeds during the day normally has them searching around the aquarium in the hope of finding a snack!

CORYDORAS

There are well over a hundred species of *Corydoras* known and many of these are readily available from aquatic outlets. *Corydoras* are happiest when kept in small groups of their own kind and many species breed readily in an aquarium. In general female *Corydoras* are larger and plumper than the males.

These little fishes are a welcome addition to any tank, they are lively, friendly and peaceful and are also relatively long-lived — anything from five to ten years is quite common and many of mine are now well into their fifth and sixth years and continue to be as active and healthy as when first purchased.

It is important with *Corydoras* (as with all other bottom dwelling catfishes) to ensure that the substrate is well 'hoovered' when carrying out water changes as dirty gravel may lead to barbel degeneration in which the sensory barbels can be lost due to bacterial infection and death normally occurs. Sometimes the barbels can be worn away by fish constantly foraging in the gravel and, in this case, the fish can survive quite happily for many years.

Corydoras are available in sizes and prices to suit every aquarist — from the diminutive pygmy varieties — growing only to 1in (2.5cm) (and with these it is imperative to keep them in a shoal of about six or more) to the largest of the species, *C. barbatus*, in which the male can reach about 4in (10cm). Most other *Corydoras* grow to about 2in (5cm) to 3in (7.5cm). Amongst some of the most commonly available (and therefore the

the first pectoral fin ray, in the male, is markedly longer and blackish in colour.

Another very attractive and sought after *Corydoras* is *C. sterbai* which has bright orange coloured pectoral spines. These fishes are quite shy and ideally need to be kept in groups of about six to give them confidence and therefore to ensure that they are seen at their best.

C. similis is another very pretty fish and is also known as the 'Violet *Corydoras*'. It is basically a grey and black speckled fish but it has a striking violet-blue caudal peduncle spot. There are, of course, many other *Corydoras* to choose from and a browse around a good retail outlet should offer a good selection.

BROCHIS

These fishes resemble large *Corydoras* and, in fact, share the same friendly and peaceful nature. They can be identified by the larger amount of dorsal fin rays which, depending on the species, is between 10 and 17, whereas in the *Corydoras*, there are only 6-8.

Brochis are generally more active during daylight than *Corydoras* and are happiest in small shoals of their own kind. They grow to about 4in (10cm) and normally the females are larger than the



ABOVE
Corydoras
barbatus.

LEFT
Corydoras
virgatus.

cheapest to buy) are *C. palustris*, *C. anas*, *C. aneus alpinus*, *C. delphax*, *C. aeneus*, *C. trilineatus* and *C. virginiae*. These fishes also tend to be quite handy and settle well into aquarium life. More expensive, and less commonly found, include *C. barbatus* — more elongated than most *Corydoras* and these also have a marked sexual difference as, in maturity, the male sports bristles around the head region thus giving this species the well-known name of 'Bearded *Corydoras*'. Also

males. There are three species of *Brochis*. The most commonly seen is *Brochis splendens* — known as the Emerald catfish due to its attractive bluish-green colour. Ideally these fishes prefer a fairly deep tank and because of their larger size aquariums over 20 gallons in volume are recommended.

The other two species less often seen are *Brochis multilineatus* (identified by having the largest number of dorsal fin rays) also known as the 'Hog-nosed

TROPICAL *Aquarium Kittens*



Breckia splendens.

Breckia, due to its long snout, and *Breckia fritski*, which is similar to the *malinadates* but lacks its long snout. Although these fishes are omnivorous (eat a general diet) they do have a preference for live foods and these should be included in their diet.

HOPLOSTERNUM

The most well-known of this genus is *Hoplosternum thoracatum* (the other species is *H. littorale*). These very robust fishes can grow to 8in (20cm) in length though they normally only reach 5in to 6in (12.5-15cm) in an aquarium. They are very



ABOVE
Hoplosternum thoracatum.

BELOW
Dianema longibarbis.

friendly, nosy and generally greedy fishes and have a great deal of character. In maturity, the first pectoral fin ray of the male becomes red in colour and he is larger in size than the female. These fishes (like *Dianema* described below) are bubble-nest breeders; when ready to spawn, the male builds a nest of bubbles at the water surface — which also incorporates pieces of plant in which to place the fertilized eggs which he then guards until the fry are hatched. Although normally very peaceful fishes, the male can sometimes become very aggressive particularly towards similar looking fishes (known as conspecifics) at

breeding time. When young, *Hoplosternum thoracatum* have an attractive speckled pattern but, as they mature, this patterning will disappear.

DIANEMA

This group contains the Porthole and Flagtail Catfishes. They are

both shoaling species and should be kept in small groups. The Porthole Catfish, *Dianema longibarbis*, looks like an



TROPICAL *Aquarium Kittens*

elongated *Corydoras* but, unlike its close relative, does not spend most of its life on the substrate, preferring to swim in the middle areas of the aquarium where it will often rest in the centre of a plant or on a rock. This fish also has the ability to 'tread water' and is able to hover motionless in the water for long periods of time. The Porthole can reach 4in (10cm) in length and males are generally more slender than females. These fish are apparently quite long-lived and, in some reported cases, have survived for at least 13 years.

The Flagtail Catfish, *Dianema arstriata*, is very similar in appearance and habit to the Porthole



Dianema arstriata

Catfish with the exception of the very strikingly-patterned caudal fin which has alternating black and white stripes which gives this fish its name. It grows somewhat larger than the Porthole catfish reaching 5in to 6in (12.5-15cm) in length and is more suited to an aquarium of 48in or more, bearing in mind the fish's preference for living in a shoal. As mentioned earlier, both these fishes are bubblenest breeders although breedings in a home aquarium are very rare.

All these fish make ideal additions to an aquarium and, with a little planning for their individual requirements, can give many years of interest and enjoyment.



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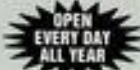
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CYPRIO have produced a Prima Pump Super Strainer for their range of Prima pumps.

Designed to be eco-friendly this strainer basket can accommodate Primas up to the 2000 model, but will also fit several other popular brands of pumps on the market. As well as being an addition to the filter system, this item is designed to prevent fry, frogs and newts being sucked into the pump inlet. The strainer has also been designed to convert into a pre-filter by the addition of two Cyprio biocompact foam cartridges.

New In-Pond Filter

Called the Bio Compact 500 De-Luxe, this filter is aimed at owners of ponds up to 500 gallons who wish to combine filtration with a fountain or other feature. It can accommodate most fountain pumps although it was specifically designed for use with the larger Cyprio Futura pumps. One of the plus points stressed by the Company is its low maintenance requirement requiring less cleaning than its competitors.

Futura 680 Fountain Pump

This addition to the Futura range is capable of pumping 680 gph. It is ideal for use with other features such as waterfalls and comes with a two year guarantee.

Feeding Rings

These new four-chambered rings from Prima can be anchored in the optimum location. Floating food, either in pellet or stick form, is placed in the chambers. The fish soon get used to coming to the one place to feed every day.

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Eight sizes of these new baskets are available and due to the design no hessian liners are needed.

Floating Water Silkies for instant colour

Cyprio now offer what are probably the most attractive and convincing artificial Water Lily pads available. The silken blooms come in a variety of colours and are 6in in diameter. Can be used in both indoor water features or outside.

Details from: Cyprio, Hards Road, Froggnall, Deeping St James, Peterborough, PE6 8RR. Tel: 01778 344502. Fax: 01778 348093.

Professional Standard UV Pond Purifiers

By calculating the effect of UV light on bacteria and algae, and using unique computer software to optimise UV chamber design, UVAQ have applied latest technology to achieve two-three times the performance levels of some other products. The maximised effect means that economical products can outperform larger, but poorly-designed, alternatives: the 8 watt Clearmaster unit will frequently clear a pond of algae faster than some 15 watt units.

The company believes that guidance should be given as to maximum pond size that can be cleared under various conditions: algae problems

increase with prolonged fine weather, high fish stocks and little shade — as many pond owners found out during the summer of 1995. Where other UV purifiers failed to cope, UVAQ units (being more conservatively-rated and professionally-designed) gave no problems.

Safety and quality are never compromised; positive seals are used for weather-proofing; all design have sleeved UV lamps internal to the water chamber for peak efficiency; UV chambers are always made large enough to provide good contact (exposure) time. Buyers should consider all these points when selecting units, not just judge by the power of the lamp alone.

Details from: UV Systems Ltd., Constitution Hill, Sudbury, Suffolk CO10 6QL. Tel: 01787 376259. Fax: 01787 881452.

Continued on page 84 ▶

New Fish Food from Pettex

Leading pet products manufacturer Pettex Ltd has launched two new floating fish foods — Pettex Premium Pond Sticks and Pettex Premium Pond Pellets. Both are suited to all pond fish from Goldfish to Koi, providing the optimum formula for

better fish health, colour and growth whatever the fish's age.

The Pond Sticks contain stabilised vitamin C (only released when eaten) to protect against disease; a full complement of trace elements ensures all year round health whilst



spirulina enhances colour and beauty.

The more traditional Pellet whilst allowing the fish to benefit from all the previously mentioned ingredients has a higher protein content to encourage fast growth.

Both foods have been 'engineered' for sustained floating to enable the enjoyment of watching fish feed that much longer. Retail prices are £13.50 for a 5kg bag of Pond Sticks and £17.50 for a 10kg bag of Pond pellets, both prices include VAT.

Further details from: Pettex Limited, 62-70 Fowler Road, Hainault Industrial Estate, Hainault, Ilford, Essex IG8 3UT. Tel: 0181 501 1033. Fax: 0181 501 3943.

BUY LINES

Everglades Aquatic Products

Everglades have launched the first Complete Planting Kit for Aquaria. Designed for 20 gallon aquaria, the kit contains:

Everite No 1 — Iron-rich substrate; Everglades Humus Supplement. Special supplement for specimen plants; Everplant 'D' Trace Element Fertiliser; Everplant 'M' Basic Fertiliser Tablets; Everclear. Keeps the tank free of smothering algae.

As a Special Launch Offer the Kit price is £27.50, representing a saving of £4.96 on the normal price.

Details from: Everglades Aquatic Products, Baunton, Nr Cirencester, Gloucestershire GL7 7BB. Tel: 01285 654656.

Champion Mouldings

This year's innovation from Champion Mouldings is a range of high integrity, rigid, Polyethylene moulded containers. These range from a 30x10in simple bowl through a range of square and round tanks up to a massive 1,600 gallon model measuring 9ft 6in in diameter by 4ft in depth. Most are designed to be totally free-standing, completely full of water. These tanks are U/V stabilised and the material is chemically inert. These ponds have a multitude of uses for both hobbyists and professionals including: Stock Tanks, Sales and Display, Koi Display and Photographic tanks, Quarantine, Filtration and Water Features. All tanks are available in Black, Blue or Green.

Details from: Champion Mouldings, PO Box 73, Accrington, Lancashire, BB5 0PH. Tel/Fax: 01254 393007 or 389600.

Conservation Pays

The secret to conservation must be education right from the start. To this end, Life on the Coral Reef, a beautiful and highly informative poster and activity pack will surely play its part in impressing schoolchildren the necessity for conservation. The A2 sized Poster illustrates locations of reefs, life on the reef, reef builders, threats to the reef and land next to the reef and how the reef protects it. Four double-sided A4 Activity Cards provide extra facts and activities and the whole pack is ideal for teaching Key stage 2 of the National Curriculum both for geography and science.

Produced by Coral Cay Conservation, a UK-based, non-profit making organisation which uses volunteer divers to help worldwide governments conserve and protect threatened coral reef resources, Life on the Coral Reef Education Pack is available, price £12.00 from: Ransom Publishing, Ransom House, 2 High Street, Watlington, Oxon OX9 5PS. Tel: 01491 613711. Fax: 01491 613733.

Pond and Fish Treatments from Hozelock

Hozelock Aquatics' range of products for the pond and pond fish is comprehensive.

The Pond Water Test Kit is an easy-to-use kit to monitor potential toxic waste levels; chlorine in new tap-water can be removed with Tap Water Conditioner, ensuring safe 'top-ups' for ponds.

Green water (now becoming a threatening reality in ponds at this time of year) can be

INTERPET PRODUCTS

The popular Easy Test range has been extended by the addition of a Hardness Test Kit, an economical Kit as both temporary and total hardnesses effectively giving two tests for the price of one. The simple-to-use dropper counts out the drops in direct proportion to the hardness and a definite colour change indicates the level. Using the Test Kit gives you two fishkeeping options — match the fish to the known value of hardness or change the hardness to suit the fish you want to keep. All is explained in the 'Guide to Aquarium Water' included with every test Kit.

The new Modular Undergravel Filtration system is easy to install and is designed for peak efficiency. Two to four plates (depending on aquarium length) are all that is required, no building up from lots of smaller blocks. The five different filter plates are designed to fit most popular sizes of aquarium — 18in, 24in, 36in and 48in. The large number of 'slots' coupled with 1in diameter uplift tube produces better circulation. Almost instantly-fitted Activated Aqua Carbon and Zeolite Cartridges can be incorporated to further purify the water. Suitable for both fresh- and saltwater aquariums, the filters incorporate tiny slots so that even coral sand can be used but are sturdy enough to support decorative rockwork.

Ammonia and Nitrate problems are two important factors which must be addressed in the healthy aquarium. The new Ammonia Remover filter media is seen as an aid to the natural bacterial removal of ammonia and it particularly useful in new aquariums where biological processes have not become fully established. The purity of zeolite used enables the remover to be twice as effective as some other zeolite-based products. Easily re-charged (usually around every four weeks) by soaking the zeolite in hot saltwater for 12 hours, the Remover should have an active life of around 12 months.

Nitrate, the final by-product of biological filtration, can be removed by further (but different) bacterial action using Nitrex®; this can be used in slow-flow (trickle) filters or contained in a box buried in the substrate.

Details from: Interpet Ltd., Vincent Lane, Dorking, Surrey RH4 3YX. Tel: 01306 881033. Fax: 01306 885009.



Interpet has launched a new range of modular undergravel filters which provide better aquarium water circulation and more versatile filtration.

treated with Green water treatment whilst pond sludge can be removed using Pond Sludge Remover. Pond Balance is an effective and reliable treatment to deal with Blanketweed naturally without putting a strain on your filter system.

Anti-Fungus and Bacteria treatment acts against Fungus,

Finrot and Mouthrot; Anti-parasite will deal effectively with Whitespot, Flukes and Slime Disease organisms.

Details of all products from: Hozelock Ltd., Haddenham, Aylesbury, Buckinghamshire HP17 8JD. Tel: 01844 291681. Fax: 01844 290344.

ARE YOU SITTING COMFORTABLY?



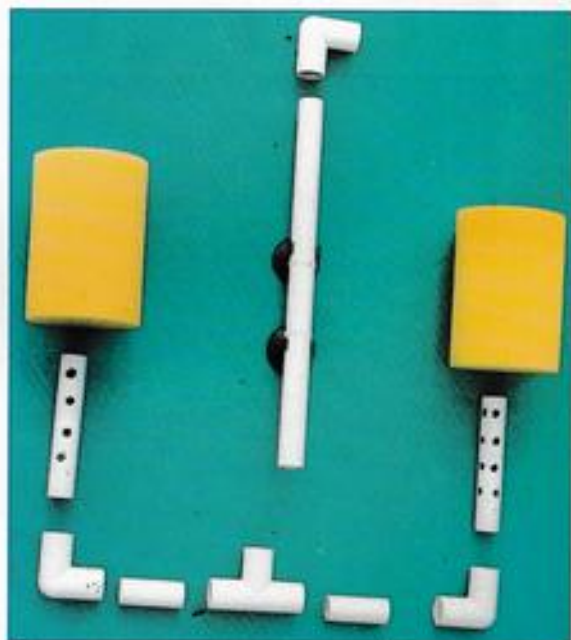
General overview of fish facility.

BRIAN MIDDLETON MAINTAINS THAT CLEANLINESS IS PARAMOUNT IN SUCCESSFUL DISCUS KEEPING.

• PHOTOGRAPHS BY THE AUTHOR •

As a result of keeping and breeding virtually all varieties of Discus over the past 25 years, I have discovered that there are a great number of successful keepers (and breeders) of Discus who each achieve varying success using an equally great number of methods. However, one thing that does not alter is that there is a basically simple set of rules that shouldn't be broken. The way that this set of rules is followed though, is open to personal preference.

In this article I shall give you a



A basic biological sponge filter.

TROPICAL

Are You Sitting Comfortably?

resume of the methods I use, and the reasons why I use them. I can accept that other Discus keepers will do things differently, and have their own methods of success. If you are keeping Discus successfully at the moment, then you have obviously got it right already.

A year ago I built a purpose-made Discus breeding facility, which combines many of the things I have learnt over the years. It has also rectified a great number of the mistakes which I have made in the past. The most important article in my Discus room is a comfortable chair! — The reason for this will be explained later.

I use two basic designs of filters. The dimensions of my breeding tanks are as follows:

30in long x 20in high x 18in wide, with a capacity of 46 gallons. In these tanks, I use a very basic biological sponge filter. I construct these myself using 1/2in white overflow pipe (available from most DIY stores or builder's merchants). The sponges I use are quite large (5in long x 3 3/4in diameter), and are manufactured especially. Although these are basic, they are totally efficient. My nitrite readings are always nil as a result.

The reason these basic filters work so efficiently, is that these tanks are never overpopulated, never containing more than four adult fish, and usually only

accommodate a pair. In these tanks I change five gallons of water per day, and clean the sponges weekly. The sponges are cleaned by simply squeezing them out a few times, in a bucket full of the discarded tank water. Once a week the tanks are given a thorough cleansing with a green nylon pan-scrubber, and a 2in paint brush, which is used solely for this purpose. The paintbrush is great for getting into all those important little places. It is essential that all cleaning materials are sterilized before use in any other tank, to prevent cross-infection (I use Sterazin®). This is all the maintenance that these tanks will require. The success of this system is due to the daily syphoning out of detritus, and water replacement.

The second design of filter is more complex, for the following reason: my "growing out" tanks contain a much higher population of fish, and therefore these tanks require a filter system capable of handling the great demands put upon it. The dimensions of my "growing out" tanks are: 60in long x 20in high x 18in wide, and have a capacity of 90 gallons. I have two of these tanks connected together, with a large capacity three stage filter system, which is loosely based on a Koi pond filter. Again, this is home made, but totally efficient. It consists of four filter boxes

(10 gallon domestic header tanks), connected together using 1/2in white overflow pipe. The boxes are gravity fed. Box 1 contains Flocor, with the water being delivered through a spray bar; the water then trickles through the Flocor down into box 2, which contains Lytag, exits through two pipes in the bottom and enters the bottom of box 3 which is packed with fine biological filter sponge. The water then permeates up through the sponge, and overflows through two outlet pipes into the top of box 4. The function of this box is to heat the water to 86°F by heater/stats, thereby eliminating any heaters in the aquarium. The water is then returned to the aquariums by means of a converted central heating pump. The water is completely re-circulated every 90 minutes.

A great advantage of this system is that oxygen is being incorporated into the water at each stage of the filtration process. This makes a most efficient biological filter. These tanks are also cleaned of detritus, and undergo a 10 gallon water change, on a daily basis. The only maintenance that this filter system requires is thorough cleansing, again in discarded tank water, every three months.

THE COMFORTABLE CHAIR

I find that 86°F is the ideal temperature at which to keep Discus of tank-bred stock although my wild fish are happier at a temperature of 82-84°F. Some European Discus keepers maintain their fish at a temperature even higher than 86°F but, from my personal experience, if a Discus is happier above 86°F then they are possibly suffering from intestinal parasites. Now to the issue of the chair ...

The reason for the comfortable chair is for the purpose of OBSERVATION. In my opinion, this is the MOST important rule of Discus keeping, whether you have one aquarium or fifty. This is the only way to familiarise yourself with the "normal" habits and



Close-up of three stage filter.

condition of your fish, for without these initial observations it is impossible to really know when your fish are acting abnormally, or showing signs of distress.

After all, the first rule of any basic scientific study or experiment, is the use of a completely normal comparison or "control". In short, you must first recognise "normal" behaviour, before you can declare "abnormal" behaviour. With practise, you will be amazed at how, even the smallest quirk, will become immediately noticeable. In effect, this is the equivalent of a very efficient early warning system.

I have found that using this method is virtually fool-proof. Very few illnesses or ailments, which Discus are susceptible to, happen suddenly. The course which most ailments take, show the same common initial symptoms:

1. Become suspicious when, at the first meal of the day, you notice

that any fish is hanging back (a healthy fish should always be hungry at the first feed).



There is always a reason for this abnormal behaviour:

2. The same applies to a fish which obviously prefers to be on its own.
3. Also, under normal conditions you will note that Discus usually have their dorsal and anal fins in a flexed, open position; if this is not the case, and they appear clamped, again this could mean trouble!
4. Another symptom to look out for is faeces which are "milky", and hang in strings from the Discus (healthy faeces should break off at about 3cm).
5. Very rapid gill movement (more than one per second), or irregular gill movement on either side, can also be a sign.

Each of these pointers should give you important, extra needed time to narrow the options down, and therefore promptly start the correct treatment regime. Remember that incorrect treatment can prove as fatal as the disease itself.

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Tetra



EUTHANASIA OF ORNAMENTAL FISH

Not a pleasant subject, I'll be the first to admit. We spend all of our time trying to make the lives of our fish as comfortable and fulfilling as possible by providing them with suitable environmental conditions, plenty of food and, where appropriate, members of the same species or opposite sex. However, from time to time fish become terminally ill, cullings must take place or sacrifices for the good of the many have to be made. This is when we, as their keepers, must assume shades of the "Grim Reaper". However we must continue to be concerned with the welfare of the fish even up to and including euthanasia. To

LANCE JEPSON TOUCHES ON THE TECHNICAL AND MORAL ISSUES.

• PHOTOGRAPHS BY THE AUTHOR •

Possibly the most humane method of euthanasia — overdose with a soluble fish anaesthetic such as MS222 or Benzocaine.

do this properly we need to consider what our actual aims are and how these are best achieved.

Death of the fish can be considered to occur following either:

- (1) Extensive physical damage to the brain and central nervous system
- (2) Extensive chemical damage
- (3) A terminal lack of oxygen to the brain, which causes irreversible damage

Furthermore, the ideal technique for euthanasia should achieve:

- (a) The technique should be practical, for the person involved.



TROPICAL *Euthanasia in Fish*



Euthanasia of a large fish, by injection of pentobarbitone into the caudal (tail) vein.

(b) No stress immediately prior to euthanasia.

(c) Immediate and lasting insensibility.

(d) Should a postmortem be required, there should be no damage to any internal organs.

Unfortunately no one technique fulfils all these requirements. As a veterinary surgeon working with ornamental fish I have found the following techniques of most use.

(1) Small fish — less than 2in. These can usually be quickly decapitated with a pair of sharp scissors or a knife. Fish appear to go into immediate shock and become insensible and death follows oxygen lack due to separation from the circulatory system. Attempting this with larger fish can cause unnecessary suffering because they do not seem to go into shock so readily, and their ability to survive low oxygen levels (by anaerobic respiration) means they could survive decapitation for some time.

(2) For larger fish the ideal method is to overdose with anaesthetic. Placing the fish in a concentrated solution of MS222 or benzocaine/acetone mixture will work quite rapidly. One is relying upon the fish's circulation to carry the anaesthetic from the gills to the brain; death is not immediate but this is offset by the minimal stress suffered as the fish "goes to sleep".

This method can also be used to euthanase several small fish. I feel that this technique is the most practical and humane approach to fish euthanasia by

the aquarist. There are minimal changes in the postmortem appearance.

Other methods include:

(3) Intravenous injection of pentobarbitone by your veterinary surgeon into the caudal (tail) vein (as you would a dog or cat). Suitable only for larger fish, this involves same initial handling and hence stress, but afterwards the fish gently slips into unconsciousness. There are minimal postmortem changes.

(4) Electronarcosis. Used commercially (for trout), the electricity stuns the fish, but this may not be fatal so a second technique is required to kill the fish outright. Do not experiment with homemade versions — mixing **ELECTRICITY AND WATER CAN BE FATAL!**

(5) Throwing the fish at the floor/wall, dropping a brick on to the fish or using a 'Fisherman's Priest' all have their advocates but they can be messy, and may require experience to carry out properly.

(6) Initial anaesthesia using fizzing "Alka-Seltzer" followed by a second method to achieve euthanasia, such as decapitation. The advantages of this are that Alka-Seltzer is readily available, insensibility will occur quite quickly prior to euthanasia proper, and stress

will be kept to a minimum. However one must be sure of insensibility before the coup de grace is performed, needless to say, the

second technique must be performed effectively before the anaesthesia wears off. Death purely by overdose may be difficult to achieve with larger fish. Anaesthesia is achieved with the high levels of carbonic acid formed following the release of carbon dioxide as the Alka-Seltzer fizzes.

(7) Pithing. This is the instantaneous destruction of the brain and upper part of the spinal cord with a sharp instrument. If performed correctly this can be a very effective technique. However it has several disadvantages — a certain degree of practice is required to perfect the technique; there is a high degree of handling involved and so stress prior to euthanasia; with larger fish the skull and dorsal musculature may slow down entry into the cranium. Until one becomes practised, initial anaesthesia as outlined above is preferable.

NB: Following those techniques, which rely on physical trauma, there may be some reflex movements of the opercula even after the fish is "brain dead". Only terminal anaesthesia and pithing (which destroys the necessary nerve pathways) will not produce this.

Now we come to those techniques which I feel are unacceptable:

(1) Flushing down the lavatory. Many people still consider this to be the

standard way of dealing with unwanted fish! Certainly it is aesthetic to the aquarist, involving very little participation on their part. But the fish is merely flushed into the sewerage system where it may survive for days — the fish dies slowly — out of sight, out of mind. It avoids the responsibility of making the decision to euthanase; it is a cosmetic death throughout which the fish will suffer.

(2) Severing of the spine behind the head. The potential problem with this is that if only the spinal cord is severed, there may still be adequate blood supply to the brain for it to continue to function. Bear in mind that oxygenated blood leaves the gills via a series of arteries (one from each gill arch), enters the dorsal aorta, which in turn supplies the brain. The incision behind the skull may not sever the dorsal aorta after all of these arteries have joined it. In this situation oxygenated blood will still be able to reach the brain and so unless the fish goes into immediate shock, suffering will be prolonged.

(3) Freezing. This, I feel, is a particularly barbaric "way to go" particularly for very hardy fish such as Goldfish.

Consider:

(a) There will be a significant delay

between placing the container plus fish, presumably at room temperature, into the freezer, and the water freezing solid. As we all know, the temperature drop will be stressful.

(b) The drop in water temperature will lower the fishes' metabolism, causing a reduction in heart rate and output and respiratory rate. There will, in response, be a redistribution of blood to those organs of importance such as the brain, kidneys and liver. Eventually these will shut down but not before the fish has suffered. As the metabolic rate falls, the body's demand for oxygen also falls and so the reduced heart and respiratory rates may not have quite as much impact on the fish as expected. Looking at Goldfish in particular, there are many accounts of them surviving being frozen in ice. This may, in part, be due to the Goldfish's ability to respire anaerobically (without oxygen) plus a quirk in their physiology whereby instead of producing lactic acid as an end product of anaerobic respiration, ethanol is produced instead — a very good anti-freeze!

(c) The lowered temperatures will slow down nerve conduction and muscle movements, without necessarily affecting consciousness, or pain sensation.

(d) It has been recommended that the addition of some salt to the water will lower the fish's metabolism and make its awareness drop. I cannot see how, as if this were the case then we would not have tonic salts to add to aquaria. Incidentally, salt will lower the freezing point of the water, possibly delaying the final death in temperature-hardy species, such as Goldfish.

(e) Hygiene — Captain Birdseye would shudder at the thought of putting a sick fish in such close proximity to his products. Seriously though, fish tuberculosis could just be passed on in this way ...

The only advantage that this method (and also toilet flushing!) has is that it is an aesthetically pleasing to the aquarist but is this really such a humane way?

As I outlined at the beginning, the welfare of ornamental fish, which is our prime concern, should not stop at water quality, nutrition and tankmates, but should extend to and include euthanasia if necessary such that the fish suffers no more than it need.

Acknowledgement: I would like to thank my colleague John Nichol MRCVS for his helpful comments during the preparation of this manuscript.

Tetra OFFER

TETRA CALENDAR OFFER

To illustrate their appreciation of the Koi, Tetra have commissioned a series of 12 exclusive paintings by the renowned artist Keith Siddle which will form the 1997 Koi Calendar. Beautifully printed in full colour, and lavishly illustrated with a different Koi variety for each month, this 20x 1in calendar is sure to become a collector's item!

Anyone wanting one of these 'Fine Art' Limited Edition copies should cut out and collect the pack weight symbol off any TetraPond Koi Foods pack. Once they have collected pack weights totalling 5kg, enthusiasts should send their proof of purchases along with a cheque for £4.50 (made payable to Tetra) to: TETRA CALENDARS, PO BOX 1025, NAILSEA, BRISTOL BS19 2FX

However, if Koi enthusiasts cannot wait that long to receive one of these beautifully-illustrated prints, they can purchase the



calendar for £8.99 plus one proof of purchase from any TetraPond Koi food.

These exclusive calendars will not be available until 1st June 1996.

The new A&P wins debut award



We feel sure that readers won't be surprised (or even mind) if we take a little space to tell you of a very happy event for the **A&P** production team.

Maintaining the magazine's support for major aquatic Shows, **A&P** began its season at Fish Fairs '96, The Yorkshire Aquarist Festival, at Doncaster Racecourse's Exhibition Centre over the weekend of 13-14 April. Flanked by an eye-catching display of all the best in aquatic books, the new magazine's first four issues, together with the new ruby-red binder, took pride of place beneath the new banner-head with the ever-popular Supplements being separately available.

MJ Publications' Mick Beeken and Jeff Swaffer (MJ — geddit?) were on hand on Saturday both to meet readers and Traders and to find out at first hand what the crazy world of Fish Shows was all about. After two hectic days it came as a complete surprise to Editor Dick Mills and Advertising Manager John Young to be called forward to receive the Doncaster Exhibition Challenge Trophy for the Best Trade Stand.

We would like to thank all concerned in making our weekend so enjoyable, we always look forward to putting faces to the names of our readers and contributors and look forward to repeating the process throughout the year. Do come and say 'hello' any time you see **A&P** — the sign of good fishkeeping reading.

Picture above shows Editor Dick Mills (left), Sales Assistant Joan Haynes (centre) and John Young (Advertisement Manager) right

Learning from each other — National Pet Week 1996

If only our pets could talk, now that would be interesting. National Pet Week celebrates its eighth year in 1996 with the theme "Learning from each other" and its week of activities (4-12 May 1996) is designed to raise awareness and understanding of the mutually beneficial relationship which people and their pets share. In addition, National Pet Week 1996 is focusing on small animals and their increasing popularity, and the important role that pets can play in children's lives.

Thousands of people will be involved in events ranging from church services for pets to pet shows and from veterinary practice open days to school projects. Literally hundreds of events take place around the country emphasising the fun, the unusual and the more serious aspects of owning a pet and the benefits they bring.

It is a well known fact that pets are good for our health and they are also good companions. Pet ownership can help children to develop socially as they learn to share the responsibility of looking after their pet. Equally, it is our responsibility to ensure that the pet's needs are met in full, just as we would for any member of the family. These needs include all aspects of health care and training. Pets should also

be chosen for their compatibility with their owners' lifestyles and expectations.

Scientists, doctors and veterinary surgeons at a recent international conference on "Animals, Health, Quality of Life" in Geneva, reported on studies on the interaction of people and their pets and what we can learn from each other. Studies from Germany, for example, looked at over 300 families who owned a dog and 90 per cent of parents interviewed thought that the dog played a role as an "educator" in their children's lives and 80 per cent of the children interviewed considered their dog, before anything, as their friend and confidante. Just as we learn from our pets, so they can be trained to help us, particularly companion animals such as Guide Dogs, Hearing Dogs for the Deaf and Dogs for the Disabled which help their companions to lead independent lives.

National Pet Week is a registered charity (number 2803667) which promotes responsible pet ownership and increases awareness of the benefits of pets to people. It is unique in bringing together the work of animal welfare charities and professional bodies throughout the UK with the common goal of improving the welfare of pets.

More people are needed to help the charity reach its aims by coordinating events in their areas or by running specific events. If you have some time to spare, care about animals and would like to get involved with the charity, please contact Floss Slade, National Pet Week, PO Box 101, Northwood, Middlesex HA6 3RH. If you would like to get in contact with your local events coordinator, ring the National Pet Week information line on 0181 421 6166.

For more press information, please contact Arabella Martin, Manjari Shah or Louis Hill: The National Pet Week Press Office, Grayling, 4 Bedford Square, London WC1B 3RA, Tel: 0171 255 1100. Fax: 0171 631 0602.



OFI (UK) launches fish care leaflets

The first in a series of information leaflets was launched by OFI (UK) during April. Entitled 'Introducing new fish to your aquarium or pond', this first leaflet outlines the essential stages of the acclimatisation process. It reinforces the need for care and promotes the use of test kits to ensure that the water quality needs of the fish are met.

Continued on page 96 ►

... News Desk ... News Desk ...

Keith Davenport, Chief Executive of OFI (UK), explained: "Each of our members have received 500 of these leaflets. It is intended that they be given, free, to anybody buying ornamental fish. This will give all our members the opportunity to give written information on this very important topic to reinforce their verbal advice. It is intended that a series of topics are covered either by leaflets or posters."

"We are able to provide these leaflets free, for the time being, because of the tremendous support our import levy scheme is receiving. Those importers not contributing levy, while seeking to gain an individual, competitive edge on the responsible businesses paying the levy, contribute nothing to the development of such initiatives."

Details from: Ornamental Fish Industry (UK) Ltd., Unit 5, Narrow Wine Street, Trowbridge, Wiltshire BA14 8FJ. Tel: 01225 777177. Fax: 01225 775523.

Hozelock has high hopes for the future

Reporting recently at the Company's Press Conference in London, Mike Pugh, Divisional Manager of Hozelock Aquatics, anticipated a real upsurge in interest in ponds and associated equipment. For all the those people already owning a pond, there is (according to market research results) an equal number of people thinking about doing so — an effective doubling of the

PDSA offers multi-pet support

From young to old, the People's Dispensary for Sick Animals (PDSA) offers all manner of support for pets, plus the opportunity to honour brave pets themselves.

The Pet Protectors Club was launched in 1993 to encourage youngsters to learn more about responsible pet ownership. Children aged five or more are invited to join the Club for an annual membership fee of £4.00. They are then entitled to a Pet Protectors Badge, Membership Card and a quarterly Animal Antics Magazine.

Members who enrol before the end of June will each receive a free T-shirt and the chance to win a Pontin's family holiday. The holiday competition will feature in Animal Antics and the prize will be a family holiday for four, to be taken any time up to June 1997.

Talking of holidays, whilst you are away do you worry about your left behind pets? There is no need for the PDSA has prepared a useful leaflet 'Pets and Holidays' to explain what you can do to lessen the worries. It is available by sending a large SAE to the address below.

Finally, if you know of a particularly brave pet who recovered against seemingly impossible odds then it could become the Pet Survivor of the Year, an award provided by the PDSA sponsored by Seven Seas Veterinary. Nominated Finalists, representing eight regions, will take part in the National Final in September and winners could receive a luxury break for two with Hilton International, a framed portrait of your pet or a year's supply of healthcare pet products.

For Leaflets, Entry Forms and Club Membership please write to the appropriate department at: PDSA, Whitechapel Way, Priorslee, Telford, Shropshire TF2 9PQ. Tel: 01952 290999.



Rescue operation in Telford

Officers from Wrekin Council's Landscape and Countryside Services section joined forces with the National Rivers Authority to rescue fish from a local pond.

The fish were removed from the pool outside Telford Magistrates' Court because the pool liner was leaking.

Wrekin's Landscape Contract Management Technician Mark Greaves said the fish would be transferred to a temporary home in another pool. "We will then drain the pond outside the court, repair the leak and clear the pond out. But the fish will be put back once the refurbishment works are completed, which will probably be some time in May," he said.

The National Rivers Authority will also be consulted when the fish are returned to the pool.

For more information ring Phil Hipkiss, Public Relations Manager, Wrekin Council, on 01952 202453. Fax: 01952 202244.

Mark Greaves is pictured above rescuing one of the fish from the pond.



potential market. Already well-known in gardening circles for their water-delivering equipment, household-name Hozelock is equally adept at providing all that is needed for a full watergarden scene. Anything from the pond liner itself literally upwards — from pumps, filters, pond lighting (in or around the pond), decorative mock waterlilies, to treatment to eradicate green water and blanket weed.

One prime area of concern is safety and to this end low-voltage systems for pumps and

lighting have been developed, all capable of performing just as adequately (if not more so in some cases) as the mains-operated counterparts.

The very modern factory, assembly-line and despatch complex on the outskirts of Birmingham is now really getting into its stride and will remain at the forefront of design, delivery and service for many years to come. Details of Hozelock Aquatics products can be obtained from Julie Legge, Hozelock Marketing Services Manager, on 01844 291881.

RECALL OF BRINE SHRIMP EGGS MA ARTEMIA SUPPLIES/ MONUMENT AQUATICS

wish to recall any 454g tins of Artemia purchased from themselves. The quality of the product supplied is inferior to the original sample and therefore does not meet our standards as it produces a very low hatch rate.

The majority of customers have been contacted and full refunds of purchase price are being arranged.

If you have one of these tins and we have not contacted you please contact us on 0191-512 0688.

SHORE WATCH

An ABC of



BY ANDY HORTON

Rockpooling

May brings about the growth of the more delicate green and red seaweeds, which in turn provide habitats for many small crustaceans and molluscs. Juvenile fish are very common in the pools during May.

Two books from the publisher Dragon's World are worth having a look at. The first one 'Saltwater Life' by Leslie Jackman provides a splendid introduction to marine life for young children. The second book is 'The Pocket Guide to Saltwater Fishes of Britain and Europe' by Alysne Wheeler. This book contains colour illustrations by Colin Newman and descriptions of most of the marine fishes in British seas. The illustrations of the Rays and Flatfish are particularly clear. It is good value for money at a full price of £6.95.

i

ICHTHYOLOGY is the science of the study of fishes, including sharks.

The **IMMUNE SYSTEM** is the defence system of an organism to fight off disease and infection. If a fish is kept in unsuitable conditions its immune system is impaired and it is much more likely to succumb to disease.



Dogwhelk with eggs. Female dogwhelks with a condition called 'imposex' develop male characteristics and grow tissue that makes them sterile. PHOTO: ANDY HORTON

IMPOSEX is a phenomenon in which the female snail grows a penis and is prevented from laying eggs. It is almost certainly caused when levels of a metal pollutant called tributyltin in the water are excessive. It has been observed in the gastropod molluscs of the family Thaididae, notably in the

British species called the Dogwhelk *Nucella lapillus*. Breeding is prevented in local populations which are totally wiped out.

INDIGENOUS means native to a particular area or habitat. This is still true of most marine species. The opposite is an alien species which has established itself from other areas or parts of the world, e.g. the Slipper Limpet, *Crepidula fornicata*, a mollusc that is very common in The English Channel, but it originally arrived from America.

The Blenny is a small rock pool fish indigenous to the British coastal zone.

PHOTO: ANDY HORTON



THE INFRALITTORAL FRINGE

is the narrow intertidal zone that is only uncovered by the lowest spring tides. The fauna is almost identical to that of the shallow sea. It is important area for rockpoolers as it is particularly rich in the variety of species and almost any fish or invertebrate found on the shore or the shallow sea can be discovered. It can also be the zone favoured for the breeding of several species of rock pool fish and different Sea Slugs.

INQUILISM is a relationship between two or more species whereby they live together with one species called the inquiline does not cause harm as a parasite or confer benefit as in mutualism. The relationship between the Ragworm that lives in shell of Hermit Crab and host animal is an example.

INTERSTITIAL pertains to microscopic animals like tiny worms that live between particles of sand, silt etc.

INTERTIDAL means between the tides from Chart Datum, or extreme low water mark, to the highest point that the tide rises up the shore in normal circumstances.

An **INVERTEBRATE** is an animal that has not evolved a backbone. There are at least 33 phyla, or major groups, of invertebrates that include the Porifera (Sponges), the Cnidaria (Jellyfish, Sea Anemones etc.), the Annelida (Segmented Worms), the Mollusca (Snails, Mussels, Octopuses etc.), the Arthropoda (Insects, Crustaceans), and Echinodermata (Starfish, Urchins).

In fishkeeping circles, the term is often abbreviated to inverts.

An **ISOHALINE** is a line on a

map connecting points of equal salinity. The salinity of the open oceans have a small variation between 3.7% at its most saline in the Indian Ocean to 3.4% around the British Isles. (Gr. Isos = equal).

An **ISOTHERM** is a line on a chart or a map marking temperature. Marine aquarists are concerned with sea temperature which in the open sea remains fairly constant, and can be plotted for a given month in a year. It is crucial that any marine fish or invertebrate kept in captivity is kept within the temperatures it is naturally found.

J

JAWLESS FISHES are surviving members of the earliest vertebrate animals to appear on this planet around 450 million years ago during the Ordovician period. They increased in numbers during the Silurian period about 425 million years ago.

Their descendants belong to the superclass called Agnatha, and two species are found in the seas around Britain. In the south the migratory Lamprey, *Petromyzon marinus*, breeds in freshwater and migrates to the sea to feed. The northerly Hagfish, or Blindfish, *Myxine glutinosa*, lives in the mud in depths of over 20 metres. Dead specimens are sometimes washed up on the Scottish strandline.

JELLYFISH are well known invertebrates of the open ocean. They are classified with sea anemones and corals in

the phylum Cnidaria because of their stinging cells called cnida. There are six species of true pelagic jellyfish recorded from the seas around Britain, plus at least seven species of very small stalked Jellyfish that remain attached to seaweeds and eelgrass.

Most Jellyfish go through three stages. They start life when the fertilised female releases swimming larvae called planula in the autumn. Each planula fastens itself to a rock like a sea anemone polyp for the winter, before resorbing their tentacles and drifting away as a medusa for their adult life.

The Moon Jellyfish, *Aurelia aurita*, is the white jellyfish that is both common and widespread and lacks a severe sting, although it could be mistaken for immature specimens of the Lion's Mane Jellyfish, *Cyanea capillata*, which should be avoided as the sting can still cause serious injury after it has been washed up on a beach. The other

spines of its first dorsal fins, and similar spiny fins on its first anal fin. It lives alone or in small schools of about five fish. At 40cm long and a height almost to match, it is not suitable for home aquaria, but it can be seen often in Public Aquaria where they have the resources to provide very large numbers of small fish for it to catch and swallow.

The **JURASSIC PERIOD** in our prehistory dates from 213 to 144 million years ago, and is the middle part of the Mesozoic era, which is middle era of life on this planet, and is known as the age of the reptiles or dinosaurs.

During this time Britain was part of the Pangaea supercontinent and located at 400 latitude which roughly corresponds to southern Italy today. Planet Earth and seas were warmer and provided a home for active squid-like animals called belemnites and ammonites. Other invertebrates included Brachiopods or Lampshells, Bryozoans and



The John Dory, *Zeus faber*, approaches its prey slowly before protruding its jaws and swallowing a large variety of small fish. PHOTO: ANDY HORTON

species seen in the south and the west is the colourful Compass Jellyfish, *Chrysaora hyoscilla*.

The **JOHN DORY**, *Zeus faber*, is the British fish with a distinctive black blotch on the side of its laterally flattened body. It has a rather unusual appearance with nine large

Cnroids or Sea Lilies on long stalks above the muddy the sea bed.

In the sea the first of the modern bony fish (Teleostei) began to appear, but there were more of the primitive fish which were to die out at the end of the era. The aerial pterodactyls swooped down to catch fish on the surface, and reptilian ichthyosaurs chased fish like dolphins do today.

The jellyfish *Cyanea lamarkii* is washed onto eastern coasts after a period of easterly winds. The sting of this species is reported to be painful.

PHOTO: TREVOR McDONALD



It Seems To Me ...

Sleepless **Andrew Werendel** thinks about good wine in tatty bottles and thinks we may be taking retrograde steps in our design thinking

You know, as one gets older, insomnia creeps up on you. So there I was, lying awake the other night and thinking to myself that it's thirty years this year since I first kept tropical fish — just goes to show what sort of thing stays in one's mind the longest!

I have an old neighbour to thank (or blame) for this occurrence. Pete from Hoo in Kent (are you still out there somewhere?).

Once the bug had bitten, I went off with my saved pocket money (I was only 12 at the time) to my local retailer who was in Parrock Street, Gravesend. It would be nice to know whether this shop still exists but I

suspect the original owner has long since moved on to other things.

Anyway, I returned home with a small angle-iron tank (about 24x12x12in I think) with a separate heater, thermostat and gravel. Pete, from next door, gave me some *Vallisneria* and a few days later male and female Guppies; and so it began. Things went well and soon I bought a bow-fronted (all the rage) acrylic tank, hood and light. My fish stocks grew with Mollies, Platies and Angels. After a few months (and one completely opaque fish tank later) I noticed something revolutionary had become available — a plastic-framed glass tank put

together and sealed with this new silicone stuff!

I still have this tank today (can't bear to part with it) and guess what? It's a John Allan product and still going strong 30 years later. This must say something about quality and how it's worth paying a few pence more. To quote one retailer: "Long after the price has been forgotten, the quality still remains."

Anyway, back to my sleepless night thoughts, it seems to me that here we are 30 years later and going backwards. I bought a beautiful aluminium hood for my early tank but now I see so many tanks with wooden hoods needing cover-glasses

to protect them from going rotten, and hinges from rusting — so where is the progress? Even worse, I've even seen steel hoods pretending to be something else and stamped 'suitable for marines'!

Still, enough of nostalgia, what I cannot understand is people prepared to pay any amount of money for filtration equipment, rocks or fish and not prepared to think about the receptacle to keep them all in — the tank.

After all, you wouldn't furnish a ramshackle dog kennel with antiques, install air-conditioning and central heating would you? But that is exactly what some of us are doing.



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CONGRATULATIONS TO ALL OUR WINNERS — PRIZES WILL BE SENT DIRECT FROM OASE.

out & about

A&P Editor *Dick Mills*
pays a visit to ...

**SWALLOW
AQUATICS**
AQUALIFE & WATER GARDEN CENTRES

About three years ago, to the sound of a Traditional Jazz Band, the then new Swallow Aquatics Centre opened at East Harling just outside Thetford in Norfolk. Since then, the Company has expanded the number of its outlets, so when Mick Seaby invited **A&P** to look in it



stocked with healthy freshwater inhabitants; then, as your eyes become accustomed to the dimmer overall lighting you notice a huge saltwater aquarium in the centre of the area with another massive freshwater aquarium immediately behind the sales counter. Oh, by the way, on your way in (if you had turned left instead of carrying straight ahead) you would find two marine 'halls' — one concentrating on invertebrates and one on fishes.



seemed a good idea to take in East Harling and the Stanway (Colchester) outlet in one combined tour. Fortunately both the weather and traffic (M25!) were more than kind so the journey was an extra enjoyment on a beautiful Spring day just before Easter.

At East Harling things had changed although the basic layout was the same. However, instead of a continuous 'walk-through' presentation of aquariums as seen at the original opening, now a large 'tropical fish house' awaits you in the very centre of the building. What a welcome! On either side of the doorway stands a large deep aquarium — one for tropical marines and one for African Rift Valley Cichlids.

Once inside you encounter row upon row of exceptionally immaculate aquariums, all

SOME EAST HARLING ATTRACTIONS.

Dylan, who manages this area, took me behind the scenes (lots of regimented pipes, filters, reservoir tanks and sterilisers) and upstairs where his own favourites live — no, not fishes but amphibians and reptiles. There were Tarantula spiders (babies rapidly developing into the real big things), turtles (Dylan won't forgive me for saying he operates a rescue operation for these) and some Tortoise eggs also hatching. Newly-imported reptiles are also housed in this area during quarantining and it is a quiet area where they can recuperate from the stresses of travel too.

Back downstairs, ignoring the tropical area, moving along passes some coldwater tanks (some beautiful Darters on show) and reaches the main pond fish display — 32 large aquariums each with an associated lower pool, containing several varieties of Fancy Goldfish plus Bitterlings, Shiners, Clicker Barbs, Blue Orfe, Green and Gold Tench (separate fishes, not two-coloured!) and, of course, Koi. Outside, the planting pools were only just beginning to show promise for the coming season but already there was a large display of pre-formed ponds, garden statuary and fountains.

Add to this, a well-stocked 'dry goods' shop and you can see that you could easily spend some time here browsing around. Don't worry, they've thought of the 'inner person' too, in the form of an excellent cafe for much needed refreshments!

Visiting other 'branches' in some multi aquatic outlets often brings on a sense of 'deja-vu' but at Stanway things were different again. At the present time, the retail



premises is under some physical re-modification as they have only recently been acquired but that is not to say there weren't any attractions.

Again, a very large marine aquarium caught your eye on entering the fish area; in fact, it was quite unusual to enter into a completely marine section first. Once more the aquariums were immaculate and well-stocked. To my mind, it seems that, to quote that oft-used phrase 'in real terms' the prices of marine fish has come down over the years; compared with some of the prices one could be facing when looking at some of the newer 'tropicals' (I call them designer fishes) many marines were practically a bargain!

Moving through a doorway led into a freshwater section containing both tropical and coldwater fishes; this in turn led outside when a pathway drew you around a number of ponds before ending up beneath

some roofed-over coldwater holding tanks. I noticed some construction work being done inside a nearby polytunnel (despite the sunshine there was a nip in the air); Paul, the manager, told me that this was to be the coldwater display section and the ponds were in the process of being built. The bottom drains for the filtration system were already installed and it was hoped that the section would be fully functional within a month (probably by the end of May).

Retracing one's steps through the fish sections, another door led through a passage to a higher level dry goods area — in fact had the new coldwater section been opened you could have gained access to the shop through it. Here there is plenty of rooms for

everything the aquarist and pondkeeper can possibly want.

One thing common to both outlets was the extra attraction you found on 'turning left'. Whilst at East Harling it was marines, here at Colchester it was reptiles! A great collection of scaly animals ranging from the small to (judging by the squeals from surprised visitors) the absolute terrifying. In one vivarium, something mysterious happened to be moving about, still in its transportation bag — not many people stayed to find out what it was!

So, whilst one Swallow doesn't make a summer, on the strength of what I saw, several Swallows can, and do, make aquarists, pondkeepers and reptile keepers very happy indeed. My thanks to Steve and Dylan at East Harling, and to Paul and his staff (sorry, I didn't get all the names) at Stanway for taking time out to show me the attractions.

If you're headed East Anglia, Essex or North Kent way do make a detour and drop in. You will find Swallows at East Harling (Norfolk — 01953 718184), Stanway (Colchester — 01206 210360), Rayleigh (Essex — 01268 781265) and Southfleet (Gravesend — 01474 561123); all are open seven days a week all year round.



STANWAY HAS A LOT TO OFFER, TOO.

You Write



Dear Sir,
I wonder if readers could help me track down information on my particular favourite fish — the freshwater Stingray? Most will be fairly familiar (even if only by pictures) of the marine species but I want to find out all I can about those that frequent the fresh waters of such rivers as the Amazon etc. Apart from general classification information, has anyone out there ever kept them? Many thanks for any help.

Scott Poucher,
105 Fuljamb Drive,
Bolton Magna,
Rotherham S65 4HG.

Editor's Note: Having seen a photo or two of Potamotrygon in Axelrod's Atlas, it seems that these fish could be dangerous to keep because of their poisonous stings, but maybe readers know better. Don't send all your information to Scott, let A&P have some of it too!

Dear Sir,
I was most interested to read the views put forward by Norman Young (Bio-Plast Letter of the Month, A&P March). Your readers may recall that Tyne/Tees Area Association held an Aquatic Festival at Tynemouth last August. As our first attempt, this festival was considered to be a success and we intend to hold a repeat event TYNE-TEES AQUATIC

FESTIVAL '96' on August 25th 1996, once again at the Park Hotel Tynemouth.

The festival Committee had already decided that the way forward for this festival would be to offer hobbyists space (at a nominal fee) to sell their home-bred fish. There will also be an Open Show, lectures, competitions, Trade Stands, Specialist Society Stands and TTAA-affiliated Society Stands. Dr David Sands will also hold a heat of Aquarian's AquaChamp Competition.

Any hobbyist wishing to sell their fish at this Festival are most welcome to contact me on 01325 466630 for further details.

Mrs J. A. Bell,
Secretary,
TTAA.

Dear Sir,
Many pond-owners have taken advantage of advice and made their pond animal-safe. This is good news for hedgehogs who can use the pond to drink from.

If you have a regular hedgehog visitor, be prepared for some odd noises in the night because May is mating month for hedgehogs — and they are less than quiet about it! It is by no means unusual for the police to be called to investigate a prowler, only to discover that what was lurking in the undergrowth was a pair of amorous hedgehogs.

Many readers will know of the

existence of the British Hedgehog Preservation Society and its aims to encourage and give advice about the care of Hedgehogs, particularly when injured, sick, orphaned, treated cruelly or in any danger. We also encourage the younger generation to value and respect our natural wildlife in general and Hedgehogs in particular. We also fund research into Hedgehog behaviour and to ascertain the best methods of assisting their continuing survival.

For more information about the Society, please send an SAE to: British Hedgehog Preservation Society, Knowbury House, Knowbury, Ludlow, Shropshire SY8 3LQ.

A. H. Coles

Dear Sir,
We are delighted to announce that the National Marine Aquarium (NMA) has achieved its funding target and will soon start building Britain's first National Aquarium.

As a charity, its role is to encourage understanding of the sea and our impact on the marine environment. This will be done by stunning exhibits and programmes of education, conservation and research, which will allow us to contribute to the protection of this last great frontier.

We are now seeking further support from the Millennium Commission. With these funds we will be able to add that extra

special ingredient to an already exciting project. It will transform an excellent national facility to a truly spectacular world-class aquarium to rival the best in the world. It will lift a good building to a landmark "signature" building of great architectural merit. It will allow us to work, expand the education and conservation programmes with the provision of new classrooms, laboratories, a conference centre and a major new exhibit hall devoted to topical marine issues and events.

We shall all benefit from the NMA. Whether drawing attention to global warming, or pollution, or the birth of a shark the NMA will be at the forefront of science. It will explain how the sea works and show its vital role in our lives. It will identify the part we can all play in looking after the sea.

As well as environmental benefits, it will boost the regional tourist economy, create jobs and act as a catalyst for urban regeneration. How can you help?

The Millennium Commission needs to be aware of the depth of public support and I should like you to write to me indicating how much you endorse the NMA. Letters should be sent to me, Dr Geoff Potts, Chief Executive, National Marine Aquarium, Plymouth, Devon PL1 2PB.

Your help is much appreciated, with many thanks,
Dr Geoffrey W Potts



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Koi America '96!

It is the First All-American Combined Koi Show and Vendor Fair & Exposition to be held in Philadelphia, Pennsylvania, on May 31 through June 2, 1996. Sponsored by the newly formed American Nishikigoi Promotion Association and organised and sponsored by the Mid-Atlantic Koi Club, Koi America '96 promises to be a huge event with Koi, Goldfish, Water Plants, Bonsai, Crafts and every kind of pond-related item imaginable!!

The Mid-Atlantic Koi Club is a non-profit volunteer organization of about 1,000 member families mostly in the mid-Atlantic States though we have membership throughout the US. Our purpose is to create, promote and enlarge the hobby of keeping, breeding, appreciating and exhibiting Koi; to disseminate information about the hobby to the membership and public and to engage in educational and social activities related to our hobby. MAKC is noted as being

one of the fastest growing and progressive Koi Clubs in the U.S. Our publication, Mid-Atlantic Koi, goes to the over 50 U.S. Koi Clubs and has a print distribution of 1,200.

If you have any questions about Koi America '96 or the Mid-Atlantic Koi Club, call Editor Susan J. Boland or write to her at: 3920 Shaker Court, Dumfries, Virginia 22026 USA. Tel: (703) 680-2663. Fax: (703) 730-1424.

New Cichlid Group

Formed in conjunction with the British Cichlid Association, the WESSEX AREA CICHLID GROUP held their initial meeting on the 12th March at which aquarists from as far afield as Bournemouth and Basingstoke attended in addition to local Southampton people. It was decided that regular meetings would be held on the 2nd Tuesday of each month at the Eastleigh Hotel, Southampton Road, Eastleigh, Hants.

Full details of membership and future programme attractions can be obtained from: Jayne Mallard, 10 Jellicoe Close, Poole, Dorset BH14 0PX or from Mike Dedman on 01202 673342.



AAGB Secretary Chris Clark presents Willi Harvey with a photograph of the original *Parosphaeromus harveyi*, a fish named after him. PHOTO: DAVID FORD

Anabantoid aquarist honoured

Willi Harvey is a German aquarist who studied fish breeding before World War Two. He was captured by the Allies and ended up in a Scottish POW camp. Because his home was in East Germany he decided not to return home when the war ended and settled in Scotland, marrying a Scottish girl and following an engineering career.

His knowledge of fish proved useful in the early days of fishkeeping in Britain and Willi worked in various aquatic shops and fish farms. He became a world expert on the Gouramis, among other species. Hence he joined the Anabantoid Association of Great Britain when it was formed over a decade ago.

He always attends their Annual Convention, held at Sheffield University in March or April. In fact he often meets his fellow countrymen there because German Anabantoid Aquarists usually visit the Convention each year, before moving on to the Yorkshire Aquarist Festival.

This year Willi becomes an octogenarian so the AAGB decided to give him a special gift. It was a mounted photograph of the original fish *Parosphaeromus harveyi*, collected by member Allan Brown in 1987 and actually named after Willi.

Also at the Convention or 'Member's Weekend' as it is known, were American Anabantoid fishkeepers Ray and Dianna Torres from New Jersey. Over 20 of the specialist fishkeepers attended the Convention Dinner at Sorby Hall over the weekend March 23 and 24. There were lectures by members Allan Brown and Kevin Webb plus Aquarian's Dr David Ford, who also ran a heat of the Aquarian AquaChamp Competition, won by Steve Jones, Secretary of the YAF.

The table show included many species of Anabantoids, especially Bettas (there are currently 40 species of this fish) and the Best in Show was a *Belontia signata*, the Combtail Gourami, by Cliff Hildred.

Anyone interested in Anabantoids can receive information on the AAGB by writing to: The Secretary, AAGB, Ms Chris Clark, 19 Chiltern Crescent, Sprotborough, Doncaster DN5 7PE.

Tamworth club forges ahead

Gordon Davis, the Club's Magazine editor, reports that the Tamworth Fish Club has an increasing membership and a thriving Newsletter. Meetings are held every first Thursday of each month at 8pm at the Amington Liberal Club, Amington, Tamworth, Staffordshire.

For more information about the Club's activities please

contact Gordon Davis on 01827 874911.

Hounslow and Bracknell take honours in first leg of three-way inter-club

In the First Round of three

DAVID FORD reports ...

Ad Konings visits British Cichlid Association for 25 year Celebrations

Over 200 BCA members attended their 25th Anniversary Convention & Auction held in the large hall of Silcoates School, Wrenthorpe, near Wakefield in West Yorkshire on Sunday, March 10th. Ad Konings and fellow German aquarist Frank Warzel visited the Show and gave talks on Cichlids.



An Auction of Cichlids.

PHOTO: DAVID FORD

The BCA was formed 25 years ago and the national Society are celebrating with items such as anniversary mugs and tea-towels. The Convention at Wakefield was the first meeting for the 1996 season. The morning session was an auction with bidding for nearly 300 listed Cichlids with reserve prices ranging from only £1.50 to £10.

The afternoon session included two lectures by the German Cichlid experts. Frank Warzel lectured on the South American Pike Cichlids with many beautiful slides of known and unknown species. This was in fact Frank's first public lecture, but delivered in perfect English for a fascinated audience.

Ad Konings followed with an also perfect English lecture about the Rift Valley Cichlids, especially Tanganyikan species. There were many exceptional photographs of the fish, projected by Mike and Gina Sandford from the hall balcony onto a giant screen.

Several stalls were at the show selling BCA items, soft drinks, snack foods, tombola goods plus a range of aquatic books and accessories by Animal House (UK) Ltd., who helped sponsor the show.

Inter-Club Table Shows and Quizzes between **Basingstoke A.S.**, **Bracknell A.S.** and **Hounslow & D.A.S.**, hosts Hounslow's 'B' Team triumphed in the Quiz by the narrowest of margins — 79½ points to Basingstoke's 79½, with Bracknell 79 and Hounslow 'A' 75½.

However, in the Table Show Bracknell easily turned the tables on their opponents with 19 points (including Best in Show) to Basingstoke's 10 and Hounslow's seven. Best in Show was Terry Hewitt's *Arnoldichthys spilopterus* with 81 points.

The next round will have taken place on 24 April (at Bracknell) with the final leg being held on the 10 May at the Wote Street Club, Basingstoke.

STOP PRESS Yorkshire Hot Shots (full report next month)

Tableau Winner: Europäischer Anabantoid Club.

Best in Show: *Synodontis angelicus*, Mr and Mrs P. Jones, CAST 88.

Fish of Fish: *Pterygoplichthys gibbiceps*, S. and S. Crich, Sutton A.S.

Best Exhibit: Mr and Mrs P. Jones, CAST 88.

AquaChamp Qualifier: Anthony Fisher, Bradford A.S.

Highest Society: Lincoln & D.A.S.

Best Trade Stand: Aquarist & Pondkeeper.

Society World is provided to help all Societies to promote themselves and their activities. One of the most difficult tasks within any Society is that of Programme Secretary, who is expected to fill every meeting with something of interest. These columns are a source for all manner of ideas for Societies' entertainment, and could lead to many a Speaker finding fame (if not fortune!)

So do your bit to let readers know of your good fortune, whether you have found an excellent Speaker or have come up with good ideas which have helped to entertain your Club's membership.

We can help you only if you provide the information. Depending upon availability of space, we are also pleased to incorporate highlights of Show results (major prizewinners only, please, and DO please include first names) together with photographs if they are suitable.

And, of course, ensure that as many people as possible have advanced warning of your Meetings, Shows, and other events, by sending us details for our comprehensive 'Diary Dates' column in good time.

Send your information to: **'Society World' Aquarist & Pondkeeper, Caxton House, Wellesley Road, Ashford, Kent TN24 8ET**; or you can e-mail direct to: societyw@sppredemon.co.uk (please let us have your information at least six weeks prior to publication).

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