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AQUARIST AND PONDKEEPER

APRIL 1990
VOL. 55 NO. 1

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COVER STORY

(Photograph: Jane Burton/
Bruce Coleman Ltd.)

Swordtails are, deservedly, among the hobby's top-selling fish. They are hardy, colourful, eat a wide range of foods and are generally quite peaceful towards other fish (though two males kept in the same aquarium will take great exception to each other).

Originally, all Swordtails could be safely regarded as being members of the species *Xiphophorus helleri*. However, hybridisations carried out by commercial breeders over the years between Swords and two closely related species of Platy — *X. maculatus* and *X. variatus* — have led to a situation where, today, few, if any, of the Swordtails found in home aquaria are pure in genetic terms.

DOLPHINS(?) FOR SALE

I had a most unusual 'phone call the other day. The caller sounded somewhat confused. Not surprising, I thought, when he told me that he had just been assured by his local retailer that the large, and very expensive, fish he had in the shop were Amazonian Dolphins — the first-ever imported into the UK!

"Did the 'fish' have scales?" I asked.

"Oh, yes", came the answer.

"Were the fish small?"

"No, they were quite large".

"What sort of dorsal fin did they have? Was it a broad-based one, or a thin, narrow one?"

"Thin and narrow".

"Were the fish freshwater or marine?"

"Freshwater".

At the time, I couldn't make head or tail (or scale or fin) of this dolphin! Come to think of it, I can't make head or tail of it even now. There's a Dolphin Cichlid (*Aequidens inayi*) — freshwater, of course, and some marine Dolphin Fishes belonging to the genus *Coryphaena*.

The marine Dolphin Fishes can, obviously, be ruled out immediately. The freshwater 'dolphins' were also excluded; first because, at a maximum length of some 6in (15cm) for a prime male, they couldn't be regarded as 'large'; secondly, because *A. inayi* have been, and are, available in the UK, and thirdly, because they have the typical long-based cichlid dorsal fin.

Then, of course, there's a little matter of biology. Dolphins are mammals, not fish. In addition, Amazonian — or any other Dolphins, for that matter — cannot be offered for sale by any retailer anywhere in the UK.

So why did this retailer say that he had these never-before-seen Amazonian Dolphins? Can someone really have sold him that line? Equally alarmingly, did he know that he had a fish and not a real dolphin? I really don't know, but I can't really believe either of these possibilities. What I do know is that someone, somewhere has got something very wrong indeed . . . or else is using common names much more loosely than they were ever intended.

At a time when there's a growing trend towards using common names more frequently, plus a welcome desire in some quarters to try to bring some form of uniformity to the use of these names, incidents such as the above are, shall we say, less than helpful.

I wonder how many of our readers have found themselves in a similarly confusing situation as that described by my caller regarding the use of common names. I wonder . . .



John Dawes
Editor



For the best goldfish varieties, other types of coldwater fish . . . and plants, plus expert advice on how to look after them, make sure you read our superb Questions & Answers Supplement in this issue of *A & P*.

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OUT AND ABOUT

Tetra Talking Fish by Derek Lambert

The first Tetra Talking Fish Seminar, held at London Zoo, was extremely well attended, with nearly 200 people turning up on a very wet winter's evening.

Many had travelled long distances and taken time off work so that they would be able to arrive in time for the Aquarium tour at 5.30 pm. The tour proved a great success and was followed by an excellent presentation from the Assistant Curator, Dr Chris Andrews. The statistics gathered by the Aquarium on losses of newly-imported Singapore fish pro-

voked many informed and concerned questions about the quality and health of the fish being sent to this country by the Far Eastern exporters.

Next up was a film by the Survival team entitled *Fighters and Archers*. Although this had been shown on television not too long ago, it was still new to many of the audience, and even those of us who had seen it before, enjoyed a second viewing.

After the coffee break, Dr David Pool gave the final presentation which concentrated on fish senses and methods of propulsion. All in all, this made a balanced programme which provoked comments from the audience such as "Excellent" and "Really enjoyable".

My only criticism — if it can

be called that — is with the advertising of the event. Reading these adverts you would think the main subjects covered would be the care and maintenance of aquarium fish. These subjects were almost totally lacking in the presentations. However, this didn't matter in the end, as most people who attended were already aquatic club members who thoroughly enjoyed a great evening out.

For years commercial companies in this country have supported the show scene, but only limited attempts have been made to provide opportunities to learn about the fish we keep. Tetra, with their Talking Fish seminars, are, commendably, moving to fill this void. Other similar evenings are being planned by Tetra so, as they say, "Watch this space!"

management. Not only did he graduate with distinction from the course, but it heightened his resolve to set up his own quality retail outlet, with a view to improving the image of fishkeeping generally.

Within months of completing the course, he had found a suitable property close to his home in Besthorpe and set up a complete aquarist shop. From a basic detached bungalow emerged a shop equipped with tanks, heaters, pumps and ancillary equipment, plus a dry goods and office area — all completed within eight weeks of purchase.

AQUATECHNICS, which was specially designed around the hobbyist's needs, opened in November '89.

Apart from the well-stocked shop, designed by Richard for easy viewing, there is also an extensive coldwater section with all accessories, which should be open by the time we go to press, together with a newly-built 'running-on' facility. There is a separate breeding site for fish with special quarantine requirements, including a large marine quarantine facility. This separate site is equipped with over 150 tanks and ponds.

Aquatechnics has ample car parking space for up to 50 cars and is situated in Silver Street, Besthorpe (signposted from the A11) just north of Attleborough, Norfolk. Richard's energy and enthusiasm are also demonstrated in the opening hours, which are 10am to 7pm, seven days a week.

Richard's intention when designing the shop's layout was to create a comfortable and aesthetically pleasing atmosphere in which his customers could view beautifully laid out tank settings of tropical, coldwater and tropical marine fish. Due to steadily increasing interest, the marine section has already been extended and is well worth a visit.

Aquatechnics keep abreast of the latest fishkeeping techniques and use the latest high technology equipment in their own displays. The shop also stocks imported pot-grown plants from Holland and the Far East.



How does a Hatchetfish fly? The answer, along with numerous other equally fascinating ones, was revealed in Dr. David Pool's lecture.



Dr. Chris Andrews spoke on some new exhibits at the London Zoo Aquarium, including a 2000-gallon pool containing 300 Piranhas.

A passion for Fishkeeping

Long before the age of 12, when he persuaded his parents into allowing an ornamental fish pond in the corner of his bedroom, Richard Ferrari's passion for fishkeeping and breeding had developed through a series of tropical and coldwater fish tanks.

Following two years at Norwich City College, Richard decided to pursue a career in fishkeeping by attending the unique course in Ornamental Fish Management offered by Sparsholt College, Hampshire. This course covers all practical and theoretical elements of fish



It may look like a bungalow... but this brand-new building marks the birthplace of one of the UK's newest aquatic ventures - Aquatechnics.

The fish Richard sells come from various sources. He imports direct and uses wholesalers, varying supplies between the two to ensure his customers can select from the best available fish at all times.

He also provides specialist advice on filtration systems, fish diseases and plants, and answers customers' queries on all aspects of tropical, marine and coldwater fishkeeping.

Apart from the retail outlet, Aquatechnics also provide a 'setting-up' service and can design exclusive set-ups for particular areas, such as restaurants



Marine display tank (foreground) and dry goods area at Aquatechnics.

and waiting rooms. One of Richard's proudest achievements was the conversion of a swimming pool into a 'natural' pond with enough plants, fish and micro-organisms to achieve an ecological balance. He has also set up a commercial filtration system for another local fish breeder.

He is currently studying for a degree and when he graduates, hopes to arrange and participate in seminars for his clients on all aspects of fishkeeping, with invited speakers from the industry. He also hopes to expand Aquatechnics so that there is one branch in every county in East Anglia.

For further details contact Richard Ferrari, Aquatechnics, Silver Street, Besthorpe, Attleborough, Norfolk NR17 2NY. Tel: 0953 453 645.

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by Phil Baber



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ONE FROGGY DAY

The story of the frog that returned to Jason Endfield's garden . . . and restored his flagging confidence.

It's always good to see successful conservation projects, and many readers will share my enthusiasm for 'water-related' schemes in particular.

Last year, I read with interest (in *A & P*) of the launch of 'Pondwatch' — a nationwide survey of the country's ponds organised by the Wildfowl and Wetlands Trust. Such projects are to be applauded and will, hopefully, lead to successful conservation of our natural wetlands — those that are left.

Cynic that I am, until recently I might have said that it was too late. According to statistics, more than half of Britain's ponds have been lost during the past hundred years, which doesn't bode well for the future in these days of frenzied, thoughtless development. This, together with disastrous industrial accidents such as oil spills (like last year's one in the River Mersey) is bound to have a calamitous effect on our native

aquatic wildlife.

Depressing isn't it? Well yes, but Mother Nature doesn't give in easily, and I saw signs that she is fighting back very close to home — in our very own back garden.

The story begins two years ago. In a field behind our house, spring would see the annual mass migration of frogs to some distant pond for breeding purposes. No doubt, this had been occurring for very many years, though quite where their breeding site was remains a mystery — the nearest established pond that I know of is a good few miles away. But, obviously, each year some made it across roads and through housing estates to 'do what comes naturally'.

Then the inevitable happened and the field was sold for development. Throughout the winter, work progressed on a large new housing estate which left not an inch of the old field undisturbed. It seemed impossible

to envisage the frogs' return the following spring. Sure enough, spring brought no frogs.

No doubt, they tried to use their natural 'right of way' but it was well and truly blocked. Such an assault course of houses, walls and roads had plainly proved too much for them. And who knows if their breeding ground would still have been there for them anyway? It was a sad, frogless summer, and I pondered over the fate of the little creatures which seemed to have gone forever.

The year passed and during early spring our gardener left us (We still don't know why — although I was at home during the last of his visits and the ghastly sight of me peering through the window probably affected him beyond cure).

As a family, we are usually rather busy, and so, the garden grew . . . and grew. Weeds flourished and shrubs became wild and unruly. But something rather nice happened — butterflies flocked to the garden, birds nested in the undergrowth and, one day, the ultimate came to pass — a frog came a-visiting! They had returned! It's impossible to know how, but they had found a way around or through the estate and there they were — back. Well, at least, one was.

Our dog found it, and not having encountered anything quite like it before, had assumed that it was a bone (stupid or what?). I found her about to terrorise the poor frog and in a moment of inspiration shouted, "Leave it, it's a rabbit!" (I should explain that she wouldn't dream of hurting one of our rabbits which she grew up with). A little confused, she retreated, no doubt fearing for my sanity — funniest looking rabbit she had ever seen! So the frog lived on and made several appearances in front of an enthusiastic audience of the whole family, who emitted gasps of 'Ooh' and 'Ah' whenever the thing moved; you'd think we had the only jumping frog in history.

And (we hope) where there's one there's more. So — with spring upon us once again, it might be time to install a pond, especially as I'm not sure where the frogs might be heading to breed this year, or what they'll find (or won't find) when they get there.

The incident has restored my confidence in believing that it isn't too late, and that it needn't ever reach that stage. At the same time, we are to count ourselves lucky that nature is adaptable and, up until now, has managed, in many cases, to accommodate the destructive influences of the human race. We must not be complacent, though. Sooner or later we could reach the point of no return.

Meanwhile, operations such as 'Pondwatch' will no doubt alert the public to the plight of our wetlands. And, as individuals, we can make a huge contribution by just conserving our own backyards.

Oh, and here's a thought to be going about your good work with: throughout the ages, frogs have been a favourable omen, signifying friends and good fortune. An old book I have states confidently that: "if you meet a frog . . . you will recover some money unexpectedly."

Well, we could all use more frogs in that case, couldn't we?

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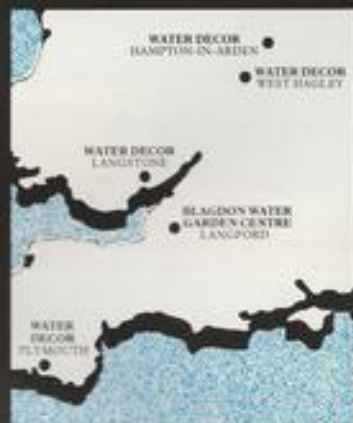
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Tomorrow's Aquarist



By David Sands

The letters have started to arrive.

Please do not worry if it takes some time for a reply to wing its way back to you because I tend to become involved in many and varied things.

Top Loaches

Last month I asked about your Top Ten fishes and, while I wait for a response, I have been asking a few young fishkeepers who I have encountered in the past week or two, which fishes they liked.

given by nature?

The great thing about these little loaches is that they are very peaceful and are true community fishes. They scavenge in the tiny nooks and crannies that other fishes would struggle to fit into.

Michael Doney (aged 10) from Lodge Moor, Sheffield, likes loaches of another kind. He's happy with his coldwater Weather Loach, another super community fish, and finds it, not surprisingly, amusing. Anyone who has kept Weather Loaches will know that these



The Kuhli (or Coolie) Loach appears to be near the top of the popularity stakes with many young fishkeepers.

One fish that came up a few times was the Kuhli Loach. I wonder if it is because they look like underwater snakes, with their brown and beige banded pattern, or if it's the cheeky little barbed faces they've been

cheeky fish are the clowns of the aquarium. Michael has written a great poem with a little drawing in response to my request for poetry on fishes (I'd like to produce a book of fish poems...).

The Weather Loach
My loach is a very strange creature
His body's long and thin
He looks like an over-grown sausage
But that doesn't worry him.

His dorsal fin is very strange
And flops from side to side
It's rather short and stubby
But he waggles it with pride

His eyes are just like tiny beads
Set into his head.
Sometimes he looks so lovely
I could cuddle him in bed

He cannot swim like other fish
He has to squirm and try
For him it must be as difficult
As swimming in the sky!

He's not much good at forecasting
Though I call him Michael Fish
But he helps to keep the gravel clean
And that's all I really wish

EDITOR'S NOTE
Thanks for the poem, Michael. In appreciation, we've made arrangements with Interpet for you to receive one of these superb Interpet Guides. The subject is a most appropriate one: Catfish, and the book has by written by (who else?) David Sands himself. We are sure you'll enjoy it.
John Dawes

Keep your poetry coming. I would be happy for a school to enter a selection of poems...

Adults beware

Alison Ronald (aged 12) of Aberdeen wrote me a despairing letter about how adults react to her when she says she is a fishkeeper. They immediately think of a little girl keeping a goldfish in a bowl, instead of a potential marine biologist! Well, in these days of real equality, Alison could become a future scientist, so, watch out adults!

Alison finishes her letter

stating that children can be as competent (and better) fishkeepers as adults... and I believe her completely.

Ben Clayden (14) wrote to me from Bishop's Stortford in Hertfordshire saying, among many other things, that he would like to see more colour pictures in this feature and others in the *A&P*. I agree with him on that point, but I dare say the editor will argue something about the cost... Ben asks about a 'fungus infection' on the mouths of some of his fishes including a white coating on the body.

I've found this type of infection occurs on fishes with a low resistance to disease. Salt in the water and Fin Rot dip treatments seem to do the trick. I had some success with WS3 and Liquitox combined during a recent outbreak. Others suggest a dip in formalin. New aquaria suffer most because the fish are already under stress as the water 'balances bacterially'.

Ben likes to ski, bike-ride, score in cricket and use the school computer, sometimes for parts of the aquarium system.

He wondered if fishes could be disturbed by the loud music he plays in his bedroom... if that were true my Tanganyikan tank occupants would be nervous wrecks as I play loud music all the time! Some catfishes, loaches, tetras and barbs might be slightly disturbed because they are sensitive to sounds, but I've never had a problem playing music.

Keep the letters flowing - I'll answer them all... eventually! Happy fishkeeping!

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David Sands



Michael Doney's great gift from Interpet

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Send completed entries to: TETRA, LAMBERT COURT, CHESTNUT AVENUE, EASTLEIGH, HAMPSHIRE, SO5 3ZQ.

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- The decision as to the winner shall be final.
- It is a condition of entry that the rules of the competition are accepted as final and the competitors agree to abide by the rules.
- No correspondence will be entered into.
- All prize winners will be notified by post.
- Entries must be received by 30th September 1990.
- A list of prize winners will be available to anyone sending a S.A.E. with their entry.
- This competition does not represent a legally binding contract.

CLOSING DATE
30th SEPTEMBER 1990

Match the correct letter from the 6 Koi photographs shown with the names below...

- | | | |
|---------------------------------------|------------------------------------|--|
| <input type="checkbox"/> SHIRO UTSURI | <input type="checkbox"/> AI-GOROMO | <input type="checkbox"/> TAISHO SANSHOKU |
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Need we say more —

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Dear Sirs,

This letter is to say "THANK YOU" so very much for ALGIZIN (A)

For years, every Summer we have had the same problem — thick Algae on the sides of the pond and that thick green slime on the top of the "peasoup" green water. We have spent £ pounds £ on different firms' stuff trying to clear the water. None of them ever worked!

I put your ALGIZIN (A) in our pond 3 weeks ago, not really expecting it to work. But the water has remained crystal-clear as you say on the box and all the blanketweed is dead. It has stayed that way all through the past hot few weeks. It gives us so much pleasure to see all our fish at the time of year when we can sit in the garden. Before this we could only see them in the Winter months and only then if it was frosty weather.

We will recommend ALGIZIN (A) to all our friends — and once again — Thank You.

Yours sincerely,

M. Obay (unsolicited letter received 7th June, 1989)

Dear Mr and Mrs Obay,

Many thanks for your extremely kind letter dated 30th May, 1989, concerning 'ALGIZIN (A)' which I received today. I have shown your letter to all members of Staff, all of whom are as proud and delighted with it as I am. It is so very rare that anyone takes the trouble and time to write as you have done. Believe me, your letter has put a "lift in the stride" of all of us which will last for a very long time.

As a small token of the Company's gratitude. I have sent you by separate parcel post a small gift — an 'ALGIZIN (P)' (2000 gallons pack) and a 'STERAZIN (P)' (2000 gallon pack).

PURPOSE AND METHOD OF USE OF 'ALGIZIN (P)' and 'STERAZIN (P)'

A) **GENERAL.** Fish diseases and parasites can strike in a pond or aquarium at any time of year if stressful conditions are present, (ie. overcrowding, overfeeding, greenwater, underplanting, lack of filtration, purchasing diseased/parasitized stock, low oxygen tension due to absence of aeration from fountain/waterfall, etc). However, it is a well-documented fact in fish pathology literature that twice each year, **first in Spring and then again in Autumn**, aquatic pathogens (ie. disease-causing organisms) and aquatic parasites peak in numbers. That is to say, they undergo a huge population explosion. This strange phenomenon occurs twice a year, **every** year, in all bodies of freshwater, brackishwater and seawater, irrespective of whether we're considering a tiny goldfish bowl or the mighty Pacific Ocean.

Thus, when considering a garden pond, it is vitally important that at least twice each year, every Spring and every Autumn, we carry out first a course of 'ALGIZIN (P)' and then, 10 days later, a course of 'STERAZIN (P)'.

B) 'ALGIZIN (P)' is an extremely potent protozoacide/fungicide/bactericide. It also controls blanketweed as a side effect. It has no equal in the eradication of fungus, "white-spot", "velvet", *trichodiniasis*, *costiasis* and most bacterial diseases. Only two treatments are necessary on Day 1 and either Day 4 (= filtered ponds) or Day 5 (= aerated ponds) or Day 6 (= stagnant ponds). Depending on the weather, these two treatments should be carried out in late March or early April each year and again in September/October. Then, 10 days later: —

C) 'STERAZIN (P)'. This is a parasiticide for the destruction of all parasites of pondfishes, such as gill-flukes, body-flukes, anchorworms, fish leeches, fish-lice (*Argulus*), water-tigers, thread worms, round worms, tape worms, etc.

CAUTION: 'STERAZIN (P)' MUST NOT BE USED TO TREAT PONDS CONTAINING ORFE OR RUDD, although it is totally harmless to all varieties of goldfish, nishiki koi and tench.

For this reason no serious pondkeeper should ever include ORFE or RUDD in his collection of fishes since, if he did, he would be totally unable to rid his fishes of their parasite burden twice each year.

Finally, I promise you that if you carry out the simple medication programme detailed above, you will **NEVER AGAIN** lose fishes prematurely due to disease or parasitisation. They will only die of old age — which is as things should be.

Yours sincerely,

Graham F Cox
DIRECTOR
"Waterlife"

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BREEDING THE RED BELLIED

Breeding piranha in captivity is a rare event. Breeding these impressive fish over 20 times in a home aquarium is a feat that has challenged — and defeated — aquarists worldwide . . . until now. Piranha-breeder extraordinaire, William Dearman, reports on his major breakthrough.

(Photographs by the author)

Many aquarists keep the Red Bellied Piranha (*Serrasalmus nattereri*) perhaps because of its bloodthirsty reputation. In most cases only one or two piranhas are kept in the same aquarium, and it is probably because of this that they have very rarely been bred in captivity. The details of breeding that are available are based on observations made in large public aquaria and are rather limited.

Over the past six months or so, I have been fortunate enough to observe over twenty spawnings which have taken place between two pairs of piranha in my home aquarium.

Aquarium conditions

A group of six piranha are kept together in a 6 x 2 x 2ft (1.8m x 60 x 60cm) aquarium. The aquarium is sparsely decorated with a three-inch layer of aquarium gravel on the bottom and pieces of inert stone and bogwood to provide some interesting features. Filtration is by means of a Fluval 403 which contains mechanical and biological media, together with charcoal and aquarium peat. This filtration, together with 6-weekly partial water changes, maintains constant water conditions.

Over the period in which spawnings have occurred, the following water quality conditions have been recorded using Tetra Test kits:

Temperature = 84°F (c29°C)
Ammonia = 0-0.25mg/litre
Nitrite = less than 0.1 mg/litre
Nitrate = 50-75mg/litre
pH = 7.8-8.0
General Hardness = 9°dh.

The water is treated with Tetra Blackwater Extract to reproduce Amazonian conditions. In addition to the six piranha, the aquarium also housed a large 'Plecostomus' and several Bronze Corydoras. These were removed when regular spawning commenced, but at no time were they attacked by the piranha. The piranha were fed on ox liver, ox heart, sprats and, occasionally, cheese.

Sex differences

The parent fish were 7 inches (c18cm) in length and approximately 20 months old when the spawning behaviour commenced. There are no external differences between the sexes.

They could only accurately be sexed during the spawning process, when the oviduct of the female extended for approximately 2mm. This was only apparent on one occasion, but using this, it was possible to determine the guarding behaviour of each parent, which, in turn, enabled the second pair of fish to be sexed.



A small shoal of piranha, with a mating pair in the background. One of the fish in the shoal has a badly damaged mouth — the result of vigorous (and sometimes vicious) pre-pairing behaviour.



PIRANHA

Immediately below, a mated pair prepares a nest site, while a second pair guards its nest site, and an unpaired individual looks on.

Extreme bottom, a pair (male — lower fish) hovers over a batch of newly-laid eggs (just visible in the extreme right foreground as a diffuse patch which is slightly yellower than the surrounding gravel).



The final moments just before the first eggs are laid.



The moment of egg release.

Courtship and spawning behaviour

The behaviour of the piranha prior to spawning is so violent and aggressive that it has to be seen to be believed. They attack each other, and severe biting and, subsequently, severe injuries, are commonplace. This goes on for an hour or so until a pair of piranha, or two pairs, will cease fighting and swim together looking for a spawning site, one pair in one place, the other pair in another.

The first signs of impending spawning are when the parent fish begin to circle each other and chase the other piranha away from the selected spawning site. The same piranha paired on each occasion, suggesting that they remain faithful.

Two pairs formed in the aquarium, then each pair selected two sites which they used alternately, one being at the back wall, and the other at the front wall of the tank.

After the preliminary circling and chasing, both parents begin to excavate a spawning

hollow. This is undertaken by pushing the head into the gravel and forcing water out through the mouth. When a suitable hollow is formed, the fish move closer together until they are side by side, at which point they start to shimmy (swim on the spot).

They then slowly pass over the hollow with their anal fins pressed together and rubbing along the gravel. Once over the hollow, both fish shudder and the eggs are released and fertilised. After each 'run', the fish swim up into the water, examine the hollow, and then repeat the procedure. This continues for up to 60 minutes, by which time several hundred eggs have been released. The eggs are approximately 1mm in diameter and are light brown in colour.

The initial courtship behaviour can become quite frenzied, and both pairs of fish have shown signs of damage, including pieces bitten out of fins, and badly damaged mouths.



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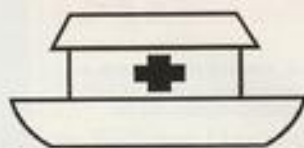


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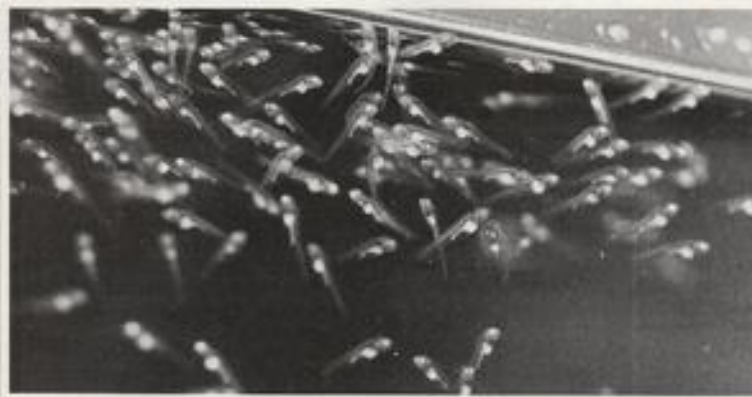
Parental behaviour

Immediately after spawning, both parents commence guarding duties. The male swims in very tight circles approximately 1 inch (2.5cm) above the eggs, apparently fanning the gravel. The female positions herself 3 to 4 inches (7.5-10cm) away and remains motionless, her task being to chase away any fish which comes within twelve inches (30cm) of the spawning hollow.

The female moves away within 24 hours of the fry's eyes developing. However, the male continues to fan the eggs during the three or



This close-up of a female shows the extent of the damage that can result during the early stages of courtship.



A shoal of healthy 4-day-old Red Piranha fry just after feeding on Liquifry (evidenced by their full white bellies).

four days they take to hatch and then up until the brood disperses, only moving to chase away intruders. After 6-8 days, the male's parental behaviour disappears quickly over a period of 3 hours. This coincides with the fry becoming more adventurous.

Initially, males seem to tolerate the presence of other fish more than previously, following this with movement away from the spawning area. In some cases, the parents spawned again, in the same place, within 36

to 48 hours.

A number of interesting observations were made during the spawning period. For instance, on one occasion, the male left his guarding duties, picked up half a sprat which was being fed to the other piranha, and carried it back to the spawning hollow. He then dropped the sprat into the hollow, apparently for the fry, and guarded it against the other fish.

A number of experiments were also conducted with the parents. These included



This large piece of sprat was brought to the nest — in which several newly-hatched fry can be seen — by an adult male (see text for details).

leaving them in contact with the other piranha, separating the spawning pair from the other fish using a mesh screen, and removing the eggs to a separate aquarium. The parents continued their guarding behaviour, irrespective of whether the other fish were separated or not. When the eggs were removed, the parents would continue guarding, if a small number had been missed, but would quickly stop if none were present.

Interestingly, the fry which were raised in a separate aquarium became very active and dispersed throughout the aquarium as soon as they were free-swimming. Those which



At four months, Red Piranha juveniles measure around 2 1/2 in (6.4cm) in length.

were being guarded by the male remained more tightly grouped in the spawning hollow, until the male lost interest. At this stage, the young piranha would disperse in the normal way.

Raising the fry

The fry were raised in a screened-off partition of the main aquarium in a separate 36 x 15 x 12 in (90 x 38 x 30cm) tank.

Initially, they were fed on Liquifry. When 6 or 7 days old, they were given live *Daphnia* and Copepods, together with finely ground Tetra Cichlid Flake. At 1/2 of an inch long (1.9cm) this diet was supplemented with fish and chopped worms.

In the early spawnings, problems were encountered, owing to poor water quality (raised ammonia and nitrite levels). Perhaps, because of this, relatively few fry survived from the first spawnings. These problems were overcome with the use of undergravel filtration, supplemented by two foam filters and regular partial water changes.

The pH of the water was found to have a great influence on fry survival. In neutral or slightly acidic water, poor fry survival occurred, whereas at pH 7.8-8.0 very few perished.

The growth of the fry is very rapid if they are given good food and good water quality, some of them measuring 1.5 inches (3.8cm) in length after only fifteen weeks.

The information presented here is a summary of the notes I have made during many hours of observations. I hope they will be of interest and use to other aquarists who may wish to breed these lovely fish.

UNLIKELY ALLIES

A & P editor **John Dawes** reports on three, very different, but equally enterprising projects aimed at the conservation of the Amazon and its inhabitants.

A brewery, a national bank and an association of ornamental fish exporters may, at first sight, appear to have little or nothing in common. True, some of the exporters might drink the beer in question, and, both they and the brewers, might carry out their business transactions through the national bank, but that's about all that one could realistically come up with as a common link.

Enter rainforest conservation... and all is revealed. Confusing, isn't it? Well, no, not really.

Drink a Beer — Save a Tree

The beer is Brahma — one of the nicest light lagers I've ever tasted — a lager that is so popular in Brazil that its name has been assimilated into the nation's language in the same way as 'biro' forms part of present-day English.

I'm not the only European to have succumbed — not, I hasten to add, in an intoxicated stupor! — to the many delights of an ice-cool Brahma Chopp (draught Brahma). I'm in good, and fast-growing, company, perhaps the most 'original' member of which is Justin Frewen.

Justin visited Brazil about three years ago and quickly became a fan of the ubiquitous Brahma Chopp. So much so, that he decided to import the lager into the UK.

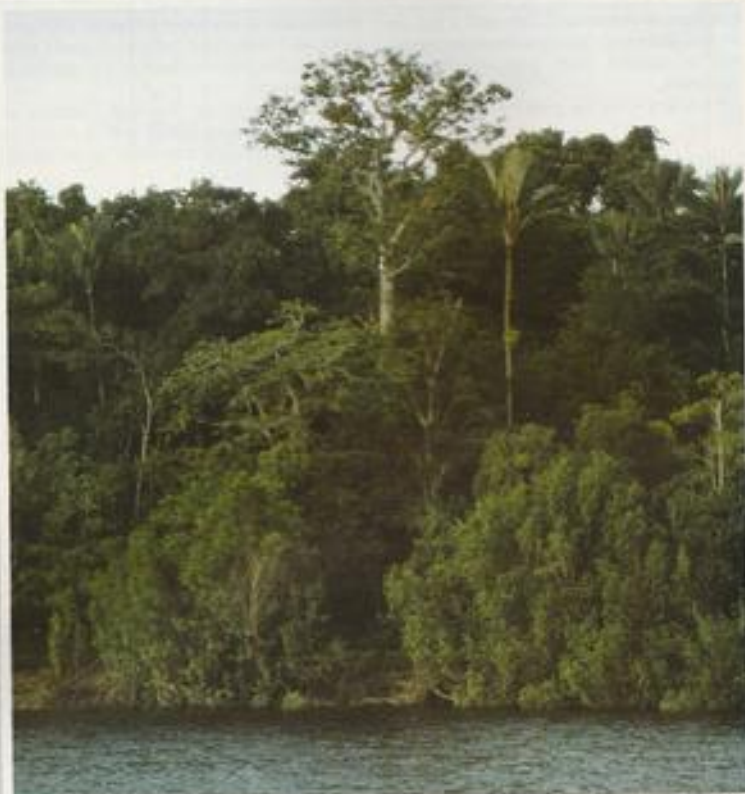
That's where the 'originality' referred to, above, comes in. For many years, Justin had been involved in, and committed to, the conservation of Amazonian rainforests. Importing Brahma which, after all, is almost the national drink of Brazil (with due apologies to the brewers of Guaraná and the distillers of Cachaça), presented him with a novel way of raising funds for conservation projects.

The idea is beautifully simple: for every bottle of Brahma beer sold in the UK, Justin Frewen — through his company, Brahma Distributors — donates one penny towards rainforest conservation.

Now, one penny may not sound like much, but multiply it many thousands of times



"Extincao" — one of Rui Machado's powerful oils.



© SIMON NORTON

every month, and it soon starts to mount up.

Numerous conservation organisations have already benefitted as a result of Justin's fund-raising activities. Anything that benefits rainforest conservation, benefits aquatic life, and is, consequently, of very direct relevance to aquarists and pondkeepers worldwide.

I take my hat off (not that I wear one!) to Justin Frewen, a man who's converted his thoughts into direct action, and has come up with a most unusual, original, positive and creative contribution in the fight to save the Amazon.

Close the Rivers — Save the Fish

Manaus is... well, Manaus is Manaus! Let's just say that it's seen better days. Yet, for all its apparent lack of obvious charm (the magnificent Amazonas Opera House being a glittering exception), Manaus is the birthplace of a very special Amazonian conservation project — one that excites me so much that I'm more than willing to put up with the oppressive heat, the giant pot holes,

the choking fumes, and everything else that this bustling city has always managed to chuck at me during my visits there. And long may it continue to do so.

There are fourteen exporters based in Manaus, the hub of the Amazonian ornamental fish industry. Some three years ago, these exporters got together and formed ACEPOAM, short for Associação dos Criadores e Exportadores de Peixes Ornamentais do Amazonas.

Even before the Association was formed, the exporters had decided to prohibit the collection of Cardinal Tetras during the main breeding season, ie May, June and July. They had also 'blocked' fishing in two rivers — the Téia and Jufari — for two years.

Both steps had been taken as conservation measures, even though there hadn't really been any particularly noticeable drop-off in catches.

Once the Association was formed, further decisions were taken. For instance, as from this year, the May/June/July ban on collecting will be extended to all Amazonian fish, not just Cardinals. In addition, no fish at all will be exported during June and July.

Stocks which are in existence at the beginning of this period will have to be held until August.

They have also proposed to the Government that river 'blocks' should be extended to take in the Rios Aiuana and Quares, in addition to that currently in force on the Jufari. All three are excellent Cardinal rivers.

Further proposals for the Government to consider are the setting up of a register of collectors of ornamental fish, and a ban on the establishment of new companies based, both in Manaus itself, and elsewhere in Amazonas.

Now, how's that for positive action?

Paint a Picture — Save a Life

During our recent (January/February) visit to Manaus, John Scarll (Belton Fish Farm), Roy Scott (The Water Zoo, Peterborough), and I met a rather remarkable gentleman.

Rui Machado works for the Banco do Brazil, the country's foremost bank, part of whose stated policy includes the protection of Brazil's incomparable faunal and floral heritage. To this end, it regularly finances conservation projects, including films depicting the plight of the forests and its human and other inhabitants.

Instrumental in these activities is Rui Machado, an eloquent, dynamic defender of Amazonas. Rui also happens to be an artist of rare talent indeed, with an almost uncanny ability to hit you right between the eyes

through the power of his images.

Rui Machado is mounting his own personal crusade on behalf of the Indians and the forests they live in, and gradually his message is spreading within Brazil.

It is crying out for international recognition, though... but no-one knows about him outside Brazil. This is a great shame because I am absolutely certain that his pictures would make a unique and powerful contribution, and — exploited imaginatively (perhaps, by a committed patron) — could raise considerable sums of money for rainforest conservation.

In the meantime, Rui will continue to fight his unending battles within Brazil — another dedicated man who puts action, where others put words.



Manaus, home of the world-famous, recently refurbished, Opera House, is also the birthplace of a new and pioneering approach to fish conservation.

Closing Thoughts

Over recent years, we've regularly tackled

a wide range of conservation issues in *Aquarist & Pondkeeper*, particularly those that we feel are of direct and special relevance to our readers. It is patently clear from the response we get, that our efforts are appreciated. It is also patently clear that, quite often, the message that we have to deliver is not a particularly optimistic one.

It is therefore very pleasing, and refreshingly exhilarating, when we can report on positive, determined efforts by individuals and organisations who refuse to buckle under the enormity of the challenge they face.

In its own unique way, each of the three examples which I have outlined in this article shows what can be done, given a deserving cause, and an unflinching grittiness to take on a challenge of such monumental proportions.

Next time you buy an Amazonian fish, it might be well worthwhile sparing a thought for the breeder, the exporters and the painter who are trying, in the best way they can, to ensure that both the fish, and the Amazon itself, have a future to look forward to. Personally, I think we owe them a sincere vote of thanks.

Footnote

If you would like to know more about the Brahma Amazon Conservation Project, contact: Justin Frewen, Park House, 140 Battersea Park Road, London, SW11 4NB. Tel. 01-627 4727.

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WATER FEATURES PUBLICATIONS LIMITED

HORSE ILLUSTRATED ♦ DOG FANCY

AND A WHOLE RANGE OF BOOKS

CAT FANCY ♦ BIRD TALK ♦ WILD BIRD

THERE'S MORE TO PONDKEEPING

A carefully selected assortment of plants will bring a colourful and delicate touch to any pond.

Peter Cole shows how you can bring this about with a little fore-planning.

Plants not only enhance and harmonise their surroundings, but also help in establishing the biological balance of the aquatic environment by, for example, providing a refuge for all manner of insect life, and purifying the water (by absorbing the waste products of digestion and respiration). This, together with adequate surface cover which reduces the penetration of sunlight, will dissuade the multiplication of algal blooms that would otherwise cloud the water and deprive us from seeing our fish.

Although at first it would seem obvious to add plants to a pond and its surrounding areas, this will not always be the case (eg as in crystal-clear Koi pools. The element of attraction in these set-ups is the colour provided by the Koi themselves. Therefore, the surrounding areas can be totally devoid of plants, or be covered with carefully selected rock garden plants. With the addition of miniature conifers or bamboos, for example, one can add a certain peaceful Oriental flavour to the area surrounding a Koi pool.

Because the bottom of a Koi pool will need regular cleaning and will not therefore contain any soil, it might seem impossible to add plants to such a system. This is not so; with modern, practical planting techniques, Koi enthusiasts can also enjoy the beauty of aquatic plants.

STOCKING LEVELS

One water lily can eventually occupy 2.5 sq metres of pond surface area, so choose carefully.

A pond that does not have a filter system will require coverage of approximately

2/3rds of its surface to reduce the amount of sunlight penetrating the water sufficiently to prevent the uncontrolled multiplication of algae that turn the water opaque. One can obviously add more lilies from the start, but there is always the risk that, eventually, you will be unable to see the fish!

Oxygenating plants are sold in bunches and they will require planting at the rate of approximately four or five evenly spaced bunches per square metre.

Marginal plants should be planted at irregular intervals of between 30 to 60cm (12-24in) apart; the same formula can also be applied to moisture-loving varieties.

PLANTING TECHNIQUES

There are two basic techniques involved in planting marginals and submerged aquatics. The first involves planting directly into an already established bottom soil, while the second, relies on the perforated baskets that are made specifically for this purpose. The former method would be ideal for those who already have a pond that contains sufficient bottom soil to accommodate plants, or for those who are building a pond where fish will not be the dominant feature.

The initial bottom soil can be established by adding an overall layer of 10 to 15cm (4-6in) of aquatic compost and 20 to 25cm (8-10in) in the areas where the plants are to be situated. If aquatic compost is unavailable, you could create your own by using an equal mixture of ordinary compost, dead leaves and earth. To keep the soil in place it will need to be covered with approximately 5cm (2 in) of clean sand or washed gravel.

Plants such as water lilies and oxygenators



Typha minima is a small rush which is suitable for most ponds.



Among the irises, the Yellow Flag is the tallest and most robust.

can be planted just before filling the pond with water. To achieve this without disturbing the soil, a broad plank of wood can be used to walk on or, better still, placed across the diameter of the pond. To fill the pond without disturbing the soil, attach the end of a garden hose inside a bucket that has been weighted sufficiently to stop it from floating or falling over and stand this on a piece of plastic sheeting of about 1 sq metre (approx 1sq yd). To retrieve them, make sure that they are all well attached.

The modern technique of planting into perforated baskets is undoubtedly the easiest and most practical method. For example, it allows those specialised hobbyists who collect Koi to clean the bottom of the pond regularly, thus avoiding heavy accumulations of solid wastes that can eventually have adverse effects on the health of the fish.

The baskets can also be easily moved or removed for maintenance or propagation, and provide a wider and easier margin of control over the growth rate and arrangements of the plants.

The ideal size should be approximately 30cm (12in) deep with 3/4 of the basket filled with aquatic compost and a 5-6cm (2-2 1/2in) layer of washed gravel to keep this in place. The addition of a layer of large stones or pebbles will prevent the larger fish from



Around the edges, some types of *Lysimachia* (the 'golden' plant in this shot is a variety of *L. nummularia*) will show up very nicely among darker-leaved plants like *Ajuga* (Bugle).

NG THAN FISH . . .



PETER COLE

Semi-filled pond showing two different types of planting.

disturbing the gravel and eventually uprooting the plants. If baskets with large perforations are used, the inside can be lined with hessian or a fine plastic mesh. A laundry basket for example, could make an ideal container to house a water lily, but regularly shaped pots tend to fall over.

If the pond has been made by using a liner, to avoid damage, the baskets should be stood on a strong plastic sheet or an offcut from the liner itself. It is also a good idea to attach a plastic covered wire handle to the baskets. This will prove helpful when lowering into place or removing them for maintenance. Conveniently, baskets containing plants can also be suspended over the sides of the pond.

If you need to keep the surface of the water relatively free, especially if you have a small pond, or one that is not easily adapted, you can dig out a trough at the side of the pond and line it with a PVC liner. In order to house plants adequately in such a trough it would need to be approximately 40 to 50cm (c16-20in) deep. Adding a thin layer of clean

soft sand beforehand, will prevent any sharp objects from piercing the liner from underneath. The trough should contain approximately 20 to 25cm (8-10in) of soil.

TYPES OF PLANTS Water lilies

When we think of pond plants, we immediately think of water lily. There are 5 main varieties of the rustic, or hardy, water lily: red, rose, white, yellow and copper. Easily obtained, these types adapt themselves to most freshwater situations.

There are many different varieties throughout the world. However, for the European climate the rustic species are ideally suited, withstanding low and regular temperature changes, as well as most other adverse weather conditions. The more delicate exotic varieties (eg blue (*Coerulea*)) are not so easy to obtain and can be difficult to cultivate.

The success and rewards of growing water



JOHN BAVES

Lily rhizome with fresh growth. The crown — the part from which the leaves originate — must not be covered over during planting.



Many lilies, like 'Attraction', are vigorous growers and will provide good surface cover.

lilies, as with most other aquatic plants, depends on their constant exposure to the sun, and proper planting (eg) at a depth of between 50 to 120cm (20-48in). Their rhizome, approximately 4 to 5cm (1.6-2in) thick, should be planted horizontally in the soil and covered with a thin layer of sand or gravel to keep it in place. The crown from which the leaves and flowers grow, should remain just above the surface of the gravel or sand.

As with other plants, lilies should be planted at the end of March or the beginning of April; planting later in the year will not always produce rewarding results. But if growth is slow, do not be led into believing that the plant is dying; my neighbour had a similar experience with a £2000 Bonsai that she threw into the dustbin last autumn. . . ! One other possibly alarming situation, for example, can be found with red water lilies that will sometimes produce white flowers during the first year. In such cases, it's worth waiting until the second season before coming to any definite conclusion.

Submerged plants

Such varieties as *Elodea* and *Myriophyllum* can be planted directly into the soil at the bottom of the pond. They will provide extra vitamins for the fish, and shelter for fry and many species, of aquatic insects.

However, as these plants are very invasive, they can, if necessary, be housed in planting baskets.

Hornwort (*Ceratophyllum*) is a feathery submerged aquatic which does not produce roots.

Marginal and Moisture-loving (Bog) plants

As with water lilies, marginal plants also need plenty of sunlight, and should be planted early to obtain the benefit of their flowers during the first year. The important thing is to respect their required water depth.

Bog plants are somewhat more flexible as to their needs, and will only require that their soil remains humid. Such plants can therefore be planted outside of the pond in an area that can be kept moist.

There is a huge selection of marginal and moisture-loving plants available these days. Most are suitable for ponds of all sizes. However, some, like the Bullrush (Reed Mace) will only be appropriate for larger set-ups. For example, *Typha latifolia* — the Bullrush — grows to an average height of approximately 180cm (nearly 6ft), and therefore will not be ideally suited to all ponds. Nevertheless, it can be used to create barriers or wind breaks in certain situations and will be ideal for several species of nesting birds. The miniature variety, *Typha minima* (50/70cm — 20/28in), can be easily adapted to a smaller pond.

Both of these types of rush will multiply quickly by sending out runners that produce new shoots. In certain cases one must be vigilant and control their growth rate before they suffocate other nearby plants.

There are other species of plants that are

ideal for siting in any surrounding area of the pond that may remain relatively shaded. For decorative purposes, those plants can, for example, be mixed among ferns. To name but a few: *Aranurus* (100cm — 39in) *Lysimachia punctata* (60cm — 24in) *Phalaris* (50 cm — 20 in) or *Troilus ladebourii* (60cm — 24in) would make quite suitable, attractive subjects.

Among the most popular of all the marginal plants are the Irises. They will flower during the summer months, but the yellow variety *Iris pseudacorus* (80cm — 30in) will flower a little earlier. The Water Hawthorn (*Aponogon distachyus*), often referred to as a deep water marginal, is a plant that will require at the least 30cm (12in) of depth. Planted using the same technique as for the water lily, it can be situated in part of the pond that receives some shade during the day. Its exceptionally beautiful, heavily perfumed white flowers will appear intermittently from early April through until October.

Floating plants

Floating plants such as the Water Lettuce (*Pistia stratiotes*) and Water Hyacinth (*Eichhornia crassipes*), are particularly unusual and attractive plants that will be moved from place to place on the pond's surface by the changing breeze. The roots that hang down into the water are also particularly attractive to spawning fish.

To keep clumps of these plants together,

they can be tied or, alternatively, placed inside a wooden or nylon hoop. This will make an attractive floral island that will move around the pond.

Water Soldier, *Sarracenia alvodes*, is another interesting choice. It floats and sinks with the seasons and adds an unusual touch with its pineapple-like leaves.

SOME USEFUL TIPS

There are very few diseases and predators of aquatic plants. However, Koi, at 70cm (c28in) in length could uproot some of your efforts, but with a good choice of plants, and having followed appropriate planting techniques as previously described, there is less chance of this happening.

Common pests like greenfly, for instance, which often invade roses, will sometimes find their way to water lilies. The invaded flowers or any affected leaves should be cut away and burned, and the nearby garden flowers treated; submerging affected leaves also works sometimes.

Certain pond treatments can have unfavourable effects on plants, so check directions carefully beforehand.

Insecticides should not, of course, be used in or around the close proximity of your pond, but if you are treating your garden flowers, it's worth looking to see which way the wind is blowing . . .!

Most garden centres will sell aquatic plants, usually from about the beginning of April. Such centres can also give advice and sometimes order those varieties that are not

always carried in stock. Prices sometimes vary quite a bit, but this usually depends on a number of factors, including presentation, size and quality of the plants.

Planting early will provide opportunities later on during the growing season for propagating plants by dividing the rhizomes, root clumps, etc.

Many plants will be sold in small pots. Those that are, should be re-planted following the guidelines provided earlier.

There are many cases each year where considerable amounts of money and countless hours of dedicated labour have been lost ruining a small pond, by planting species that are completely out of proportion with its dimensions.

Whatever your choice of flowers, remember to aim at beauty and continuity, adding plants of various colours that will flower at different times of the year and situating these among other species that keep their flowers throughout the spring and summer months.

Do not collect plants from natural sources. Not only will you be disturbing the balance of the environment and possibly introducing unwanted parasites into your pond, but you may also be breaking the law!

Pond plants bring a colourful and delicate touch to any garden, enhancing and harmonising the surroundings while, at the same time, helping to produce a biologically balanced aquatic environment.

There's more to pond keeping than just fish . . .!



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Seaview



by Gordon Kay

GOLDEN RULES (Part 2)

For rules 1, 2 and 3, see the March '90 installment of *Seaview*.

4 BUY ONLY HEALTHY SPECIMENS

It may seem superfluous to mention this, yet still so many people seem to disregard well-documented advice on how to buy healthy fishes.

Buy only from a reputable dealer who knows what (s)he is about. Don't forget that if a shop in your area is selling fishes which are priced well below all the others in the vicinity, then there must be a reason.

It surely has to make more sense to pay a pound or two more for a fish that has been properly quarantined before sale and is feeding well, than to save that pound or two by buying a fish that is not quarantined, not feeding and, even worse, has only just come into the country (which is usually the reason why fishes can be sold cheaply).

A good healthy fish will be feeding, will be alert to movement outside the tank and will be behaving normally. One point here — make sure you know what 'NORMAL' for the species is. The fish will have no unnatural marks or spots and will be full-bodied, with no sunken areas around the belly or behind the eyes.

If you don't believe the dealer when he or she tells you that a fish is feeding, then you

shouldn't be thinking of buying a fish from that dealer anyway.

On, one last point, don't buy anything out of a tank which has dead or diseased fish in it.

5 TAKE CARE WHEN INTRODUCING NEW FISHES

How many times have you heard it said that one of the most stressful times in a person's life is when that person moves house? I've just moved for the umpteenth time and I know that this is true, and fish — being only human! — are really no different.

Stress is the biggest cause of disease in fishes, and so, it makes sense to minimise the stress caused them when they move 'house'.

Traditionally, the advice has always been to float the plastic bag you bring them home in in the aquarium, adding water from the aquarium until specific gravity and temperature are equalised. In my experience, this causes untold stress in itself, if not done properly, as the bag folds in on itself and the fish starts to panic, causing all the other fishes in the tank to come 'stickybeaking' around, worrying the poor devil.

A much better way — because it's MINE! — is to buy yourself one of those small plastic goldfish tanks that all dealers sell. When you buy a fish, ask the shopkeeper to let you have a little more water than usual and when you get the fish home, empty it into the small tank. Feed the fish in the main aquarium and start to turn the lights off, at the same time adding a small amount of water from the main tank into the small one. By the time you have the specific gravities and temperature equalised, the lights in the main tank will all be off and the new fish will be quite happy in the safety of the small aquarium.

It is then just a simple matter to lift the fish and place it gently into the aquarium. Leave the lights off until next morning, by which time the new fish will be swimming about looking for food — totally ignored by the established fishes.

One thing though, I never

put the water from the small tank into the aquarium. What's the sense in tempting disease into a healthy collection? The small amount of water you will have used can be topped up with tapwater with no effect on salinity. I have been using this method of introduction for years and it has never failed.

6 FEED CORRECTLY — PROVIDE A BALANCED DIET

I firmly believe in the old adage which says "you are what you eat" and fishes are no different.

Just like us, they need their supply of vitamins and minerals, proteins and fats in order to stay healthy. We know so little about fish nutrition that the only sure way of ensuring that we provide everything our fishes need is to provide as much variety as possible.

Only by eating a rounded, balanced diet will our fishes stay robust enough to grow healthy and ward off any parasites.

So there you are — it really is that simple to keep a healthy, trouble-free aquarium. As I was told many, many years ago as a beginner: 'AN OUNCE OF PREVENTION IS BETTER THAN A TON OF CURE!'

Snippets

1 There is no biological difference between whales and dolphins. The big ones are whales, the little ones are

dolphins. End of story.
2 Sperm whales are so-called because they contain, in their head, quantities of spermaceti, a liquid wax which is used in cosmetics, among other things. It was once thought that this was the sperm of the whale, hence its common name.

3 The 'Right Whales' — species like the Bowhead — have blubber that is so thick and full of oil that they will float even when dead. The right whales to kill!

4 A Blue Whale — at 105 tonnes and 26 metres when adult — is equivalent to 25 elephants and is considerably longer than a cricket pitch.

5 The Bowhead Whale (*Balaena mysticetus*) has a jaw which is so long and highly arched that two coaches could drive through from either side and not touch.

6 In a restricted gull, sea-water enters a narrow opening and spreads out owing to surface currents, evaporating as it does so. Thus, the most concentrated solutions occur here, and vast thicknesses of evaporites may form. As concentrations increase, calcium/magnesium salts form first, followed by sulphates, sodium chloride and, lastly, potassium and boron — both of which are quite rare.



In extreme conditions — such as those which occur in the Dead Sea — evaporation can lead to concentrations of solutes which are lethal to all forms of life. Large crystal structures are also common.

Your questions answered

Having problems? Send your queries to our panel of experts who will be pleased to be of service. Every query receives a personal answer and, in addition, we will publish a selection of the most interesting questions and responses each month.

Please indicate clearly on the top left hand corner of your envelope the name of the experts to whom your query should be directed. All letters must be accompanied by a S.A.E. and addressed to:

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Hodgkinson, Plants, Barry James, Discus,
Eberhard Schulze, Marine, Graham Cox.**

DISCUS

Giant Discus

I bought five Solid Cobalt Blue Discus. They were about 2in (c 5 cm) in body size and were kept in a 200-gallon (900l) aquarium, fil-



tered with an 'Eheim Dositron'. The fish were fed four times a day on either a quality flake food or grated beefheart. 10% of the water was changed twice a week and the temperature was maintained at 86°F (30°C).
The fish seem to thrive, eating extremely well, with the colours intensifying by the month. Now, twelve months later, the fish are starting to 'pair off' and this is where my problem lies. There is a great difference between the largest and the smallest. The largest is about 9in (c 23 cm), whereas the smallest is only about 6 1/2in (16.5cm) in body size.
Should I get rid of the stunted fish before they pair off, despite their having perfect colour and shape?

Adult Discus can vary a great deal in size, but a 9in (c 23cm) fish is quite exceptional. The only specimens of this size which I have come across in more than 25 years were wild-caught Browns like the small young fish shown in the photograph.

I must say that I was rather surprised to read that some of your Discus have reached a size of 9 inches. Although I have been keeping Discus since 1963, I have only ever once come across such large specimens. They were wild-caught Browns.

Most Discus will, these days, grow to about 5 1/2-6in (14-15 cm). The size of the fish greatly depends on the size of the aquarium and, since the majority of set-ups for Discus fish seem to be around 4-5ft (1.2-1.5m) 5 1/2-6in body size seems to be the norm. Also, there are some strains which will produce larger-than-average sized offspring, just as there are strains which will produce smaller-than-average sized offspring.

Even your 'stunted' fish seem to have reached an average size. However, if these fish come from an exceptionally large strain, then they are indeed stunted. If, however, the genes of the parents (which partly determine the size of the offspring) were only transferred to some of the youngsters, you may then consider yourself as having some average Discus, with a few exceptionally large individuals. Remember, not every offspring will carry all the genes from both parents.

Try to look after the smaller ones in a different aquarium, giving them special attention, and see if they will increase in size. Discus seem to continue to grow until they are about 2 to 2 1/2 years old.

HERPETOLOGY

Stocking wildlife areas

We have a pond and wild area in our garden and would like to stock it with amphibians such as Marsh Frogs, Edible Frogs and Smooth Newts. Is this a good idea?

Marsh Frogs (*Rana ridibunda*) were introduced onto Romney Marsh, Kent, during the winter of 1934-35. They have remained fairly localised in the drainage ditches and gravel pits of the marsh, especially in the Brookland and Walland areas. Where the Marsh Frogs have become well established, they have replaced Britain's native Common Frog (*R. temporaria*). Adult Marsh Frogs are large and eat the tadpoles of their own kind and those of other species of amphibian. Therefore, they are probably not the best type of frog to introduce into the amphibian conservation area in your garden.

Edible Frogs (*R. esculenta*) are a good species to keep near to a private pond because the adults do not wander very far from the water.

However, being an introduced species, it is illegal under the Wildlife and Countryside Act to release this species into the wild where it would compete with the native *R. temporaria*.



Ponds and wildlife areas in gardens should be stocked with native British amphibians such as the Smooth Newt (*Triturus vulgaris*)

Spawn and/or tadpoles of Edible Frogs can be obtained from a specialist amphibian dealer such as:

Xenopus Ltd.
Holmesdale Nursery
Mid Street
South Nutfield
Redhill
Surrey RH1 4JY
Tel: Nutfield Ridge
(073 782) 2687

With regard to the native Smooth Newt (*Triturus vulgaris*), your local County Naturalist Trust should be able to help you colonise your pond. Indeed, it is really better to populate a garden pond with native species of frog, toad (*B. bufo*) and newt for conservation purposes, and for the very sound reason that these species are adapted to the British climate. Your County Trust (address available from your local reference library) should be able to help locate excess frog and toad spawn in garden ponds in the spring (refer to **Spawn Exchange, in Herpetology Matters**, August 1989 edition of *Aquarist & Pondkeeper*.)

MARINE

Priceless advice

I would like to start a tropical marine aquarium and am willing to spend £70.00 on my fish. What would be a good collection of fish to keep?

I fancy keeping a Lionfish, two Clownfish, one small sea anemone and a Clown Trigger. I would like to keep more fish as well. I have kept freshwater fish for two and a half years.

Could you also give me a list of prices? I live in Scotland and would like to know how our prices compare with those in the south.

unless you have a good-sized anemone to protect your Clownfish, or else you will lose them.

Please remember that in order to succeed with an anemone — (and most living corals) you must have very powerful lighting — otherwise the anemone will get smaller and smaller and, eventually, die.

With regard to prices, I'm afraid that I haven't been to Scotland for over 10 years and, thus, have no idea how they currently stand. I suggest that you visit your local dealer and



CORAL WORLD - ELLAY

Lionfish and Clownfish don't mix, the former often making a meal of the latter.

First of all, I must tell you that NO-ONE can advise you as to which fishes would make a good collection. The possible permutations are absolutely enormous. Furthermore, in your case, since you don't tell me what size your aquarium is, how you intend to filter it, or what your lighting arrangements are, I wouldn't even know where to start!

One species of Clownfish which you are likely to be able to keep alive is the Ceylonese Teak Clownfish (*Amphiprion melanopus*). Unless you have a 6ft x 2ft x 2ft tank (150 Imperial gallons gross capacity = 680 litres), then I would forget the Lionfish (*Pterois* spp), since, sooner or later, it would make a fine meal of your Clownfish.

Similarly, the Clown Triggerfish (*Balunoides conspicillum*) should only be a juvenile specimen, unless you have a 150-gallon aquarium. Even then, don't buy a Clown Triggerfish

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COLDWATER

Lionhead hunt

A few months ago I decided to keep Lionheads. I set up the tank and have since covered most of Devon and Somerset in search of these beautiful fish. Sadly, I have yet to see a single specimen worth buying. I am now feeling quite frustrated and would welcome your assistance in tracking down good-quality fish.



MALCOLM HODGSON

Good Lionheads are difficult to produce. Numbers and quality therefore vary from season to season.

Though the Lionhead is much sought after, it only appears in reasonable numbers and quality from time-to-time. Some seasons see them offered for sale throughout the hobby with, occasionally, some extremely good specimens being found. Other seasons, they are seldom available, and those which are seen, are very poor quality indeed which, as you yourself have said, are not really worth buying.

The Lionhead has been one of my own favourite goldfishes for many years. Having bred them over a long period, I can appreciate why so few good specimens are offered for sale. Last year I saw quite a good

number of extremely fine examples with good body and finnage shape and quite the best hood development I have seen in many a long time. Of course, they were rather expensive, but knowing the difficulties in producing fish of their standard, I thought them priced about right.

I have made some enquiries, but have not been able to discover if we are likely to see good-quality Lionheads this year. I am enclosing some addresses where you might be able to obtain some but I also suggest that you contact the goldfish societies who may be able to help.

T.J. Sutton, 83 Coleshill Road, Water Orton, Birmingham. Tel: 021-749-3711

H. Tisbury & Sons, Spice Pitts Farm, Church Road, Noak Hill, Romford, Essex RM4 1LD. Tel: Ingrebourne (04023) 41376

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Association of Midland Goldfish Keepers, Miss E.J. Edmunds, 17 Woodside Ave, Boothville, Northampton. NN3 1JL

KOI

Koi fry foods

How do I go about feeding Koi fry if I manage to breed my fish this year?

On hatching, you will find the fry either lying against the tank walls, or hidden among the spawning material. They will remain like this until they become free-swimming and require food. This generally takes up to seven or eight days, depending upon temperature.

Feeding the fry once they are hatched, is not too difficult, as

several commercial fry foods are available. The thing to remember is that on hatching, the fry will still have their egg sac attached and will not require feeding until they become totally free-swimming.

Alternatives to commercial foods as first feeds would be hard boiled egg yolk passed through a very fine sieve, or newly-hatched Brine Shrimp.

Both are good first feeds. After a week to ten days, the fry should be able to take very fine powdered dry foods, such as the

dust that remains in tins of flake foods.

Initially, the fry should remain in the hatching container for the first month, or until they have reached nearly half an inch (c1.3cm) in length. They can then be transferred to tanks, vats or pools to grow on. You must remember that different fry will grow at different rates; any fry growing faster than the others should be separated, as it will soon begin to feed on its brothers and sisters.

MARINE

Priceless advice

I would like to start a tropical marine aquarium and am willing to spend £70.00 on my fish. What would be a good collection of fish to keep?

I fancy keeping a Lionfish, two Clownfish, one small sea anemone and a Clown Trigger. I would like to keep more fish as well. I have kept freshwater fish for two and a half years.

Could you also give me a list of prices? I live in Scotland and would like to know how our prices compare with those in the south.

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TROPICAL

Disease-prone Mollies

Both my Black Mollies contracted White Spot very soon after I bought them. I managed to cure the fish but they then went down with Fungus. One died, while the other developed Fungus on its lips, followed by the disease on its caudal and dorsal fins and top half of the body.

No sooner do I manage to clear one attack when another one starts. Why is this?



Black Mollies, despite their wide availability as community fish, require brackish conditions for longterm health and survival.

Your problems with the Black Molly (probably *Poecilia mexicana*) are very common. These

so-called community fish are not at all suited for the typical community aquarium and become stressed, start 'shimmying', then develop Fungus and/or White Spot, followed by Columnaris (a bacterial disease we refer to as Mouth Fungus) and death.

The reason is that these fish originate from the mildly brackish areas of Florida and Mexico. They do not therefore like the fresh, often soft and acid, waters of the British community tank. The Black Molly actually fares better in seawater, and many mariners use them to mature new saltwater set-ups.

If you want black fish for contrast, choose Black Widows or Red-tailed Black Shark, but if you want to specialise in Black Mollies, set up a mildly brackish water aquarium. It helps to raise the temperature as well. Some tropical community keepers with Black Mollies run their tanks at 80-85°F (c 26.5-29.5°C), when the shimmying stops and the fish are less prone to White Spot.

PLANTS

Non-flowering lilies

I have a 20 x 6 ft (6 x 2m) pond with Koi and goldfish. The water is about 3ft (1 m) deep. I have tried to get water lilies to flower, but without much success.

Would you please advise me on how to plant my lilies, what medium I should use, and how far below the surface I should place the baskets?

Water lilies grow best in warm, shallow water, in full sun. They require a stiff compost containing plenty of well-matured clay. On no account should peat be added to the compost.



Water lilies are gross feeders which require still, warm conditions if they are to flower successfully.

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Herpetology matters



By Julian Sims

Female toad deaths

Common Frogs (*Rana temporaria*) usually breed during the early months of the year — deposits of frog spawn can be found during the months of January and February if the winter is mild. Spawn has even been found in a pond on Christmas Day in southern Cornwall.

Male frogs wait at the edge of ponds for the arrival of the females. A male then pairs with a female in amplexus.

If Common Frogs and Common Toads (*Bufo bufo*) breed in the same pool, male frogs might still be at the water's edge when female toads start to arrive. Common Toads tend to reach their spawning sites in late March or early April. Male frogs therefore sometimes pair with the first



Two female toads, drowned as a result of being clamped by male Common Frogs which, despite the death of the females, are still holding on to them. A third female toad (foreground) has also been clamped by a male frog, but is still alive.

female toads to arrive.

Male Common Frogs are larger than male Common Toads and, unfortunately, this difference in size can prove fatal for female toads. Male frogs can actually drown female toads during amplexus. Even after the female is dead, the male frog still continues to cling to her body. In fact, a second male frog might then clasp the corpse on the opposite side to the original male. The two males remain attached, even after the female toad has been lifted out of the pond — a sad example of amphibian fatality.

Amphibian waste products

Excretion is the act of getting rid of waste materials produced by the biochemical reactions which maintain life. It therefore follows, that all living things produce excretory products.

Deciduous trees — the types which don't keep their leaves through winter — transport waste products to the leaves prior to their loss. In this way, when the leaves fall off or are blown away in the autumn, waste products are removed from the tree. Leaf fall is only one example of the methods used by plants to lose the waste materials they produce.

Animals also employ a variety of methods to get rid of their metabolic waste products. The air which is exhaled from animal lungs contains a gaseous excretory product — carbon dioxide. However, the word excretion is more frequently used to describe the removal of waste products which contain nitrogen. These products result from the use of proteins and the breakdown of body cells. Nitrogen-containing excretory products include ammonia, urea and uric acid.

Nitrogenous excretory products must therefore be regularly removed from the enclosures in which amphibians and reptiles are kept. Cleanliness is very important in the maintenance of healthy livestock.

Although there are three common forms of nitrogenous excretory product, the main type produced by an animal is closely related to the availability of water where that animal lives. Conser-

vation of water is a major factor in the colonisation of land, for example, by amphibians after their metamorphosis. Consequently, to save water, the type and the solubility of nitrogenous excretory products might be changed.

Frog and toad tadpoles excrete a high percentage of their nitrogenous waste as toxic ammonia. This is very soluble, and so, it can be easily 'washed away' in the environment inhabited by free-swimming tadpoles. However, after metamorphosis, amphibians excrete less ammonia and much more urea. Urea is not as toxic as ammonia; this is important because adult amphibians have reduced access to water, compared with their tadpoles.

There are some exceptions to this trend. For example, African Clawed Toads (*Xenopus laevis*) remain aquatic after metamorphosis and continue to excrete ammonia. If their chosen ponds dry up, or if the toads are kept on land for a short time, then these amphibians behave like other frogs and toads and produce urea. But, unlike most other frogs and toads, for example the Common Frog (*Rana temporaria*) and the Common Toad (*Bufo bufo*), there is a reversal on return to water. *Xenopus* toads then excrete ammonia again.

Reptile waste products

Reptiles also excrete a range of nitrogenous waste products, and, again, the type of material produced is closely related to the availability of water in the environment.

Crocodiles, for example, choose to live close to water. They normally excrete large amounts of soluble ammonia and are described as being AMMONOTELIC. But, if crocodiles are kept out of water, they excrete urea at first, and then uric acid.

Lizard and snake eggs are mostly laid in dry conditions, but they store water inside their shell and its membranes. There is, obviously, little opportunity for the nitrogenous waste produced by the developing embryo to be lost through the shell.

Thus, the waste is retained inside most lizard and snake eggs until they hatch. Nitrogenous waste is contained in a sac formed

by a membrane called the allantois, where it is stored as gelatinous uric acid. This is relatively insoluble and has low toxicity.

Animals (including embryos) which excrete uric acid are called URICOTELIC. This type of excretion may continue throughout life if the reptile lives in an environment with limited water, such as, for example, a desert. The Texas Horned Lizard (*Phrynosoma cornutum*) lives in the dry, sunny plateau country of Kansas, Arizona and northern Mexico and conserves water by excreting a solid ball of uric acid.

However, not all reptiles live in such arid conditions, and some even lay eggs in moist habitats. Marine turtles, for instance, lay their eggs in damp sand. With the availability of external water from the surrounding sand, the storage of nitrogenous waste as insoluble uric acid is not necessary. Developing turtles excrete nitrogenous waste as soluble urea. This is less toxic than ammonia and slowly diffuses out of the egg through the leathery shell.

Animals which excrete urea are described as UREOTELIC. Adult marine turtles and most aquatic freshwater terrapins, excrete soluble urea and ammonia. Water is the main feature of the environment where these Chelonia live, so, soluble waste products are quickly dispersed.

Analysis of the eggs from the Black Racer (*Colester constrictor constrictor*), a snake from the north-eastern United States of America, has shown that this reptile actually produces three types of nitrogenous waste during the course of embryonic development. Ammonia is excreted at first and is probably lost as gas. After eleven days, urea is excreted and this accounts for about 60% of the nitrogenous waste produced during incubation. After 50 days, uric acid is the main excretory product.

The release of faeces is often referred to as excretion. Faecal material mainly consists of undigested food. Their removal should either be called defecation or egestion, but definitely not excretion. Excretion is the removal of waste material which has actually been produced by a living organism.

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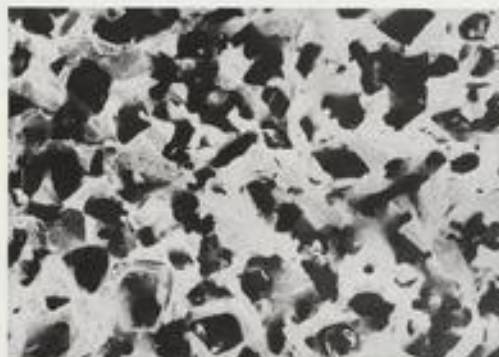
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MEXICO

THE LIVEBEARER TRAIL — PART 2

For the second part of their Mexican adventure into livebearer country, Derek Lambert and his mother, Pat, went in search of Goodeids . . . with resounding success
(Photographs by the author)

We were heading for my favourite part of Mexico. While the natural beauty and splendour of Catemaco and Chiapas will always be remembered, it is to the area around Patzcuaro that I keep returning.

Lago de Patzcuaro is a large lake covering an area of 36 sq miles. At an altitude of 6725ft it lies amid pine-clad hills and extinct volcanoes. I had visited this area three times previously, so a number of very important habitats were already known to me.

Laguna de Zacapu

The first and most important was Laguna de Zacapu. We stumbled on this lake two years ago when we were searching for the Goodeid livebearer, *Zoogoneticus quitzeensis*; instead of finding that species we discovered a *Skiffia* — a Sawfin Goodeid — (still being investigated) and *Hubbsina turneri* — Turner's Sailfin Goodeid — which was thought by some European scientists to be extinct. The *Skiffia* has been established in captivity but the *Hubbsina turneri* has defied all attempts to domesticate it.

This year we had made provision for a full day at Zacapu to undertake a detailed study of this unique habitat. The fishing was good and we soon had our quota of *Hubbsina*. Indeed, it seemed like every fish in the lake wanted to jump into our nets! In previous years we had always caught large numbers of fish here, but never in the variety that we did this time. *Xenotoca variata* — the Jewelled Goodeid — and *Goodea atripinnis* — the Black-finned Goodeid — were there in profusion; so were *Zoogoneticus quitzeensis* and *Poeciliopsis infans*. Even the previously rare *Skiffia* was widespread.

However, the real icing on the cake, so to speak, was a reasonable collection of an *Allotoca* species, one of the Bumblebee Goodeids. I am familiar with the six known species of this genus, but this one does not seem to be any of these. Time will tell if we have come across a new species, or just a colour morph of a known one.

Of all the families of livebearers, Goodeids are one of the most difficult to identify because, say, a *Xenotoca variata* from Zacapu, may look totally different from one collected in Lago de Cuitzeo.

Careful observations of the *Hubbsina* showed that they live near the bottom of the lake, flitting from stone to stone in a goby-like manner. The lake bottom is rocky, overlaid with mud, with patches of reeds and aquatic plants. In general, when we caught one *Hubbsina*, we would catch two or three, which leads to the conclusion they are a shoaling fish, at least, when young.

The temperature factor

When we arrived at Zacapu it was 10.30am and the water temperature was only 58°F (c14.5°C). Indeed, it did not seem to warm up at all while we were there. Here, I believe, we have the source of many problems with Goodeids. By keeping them at normal aquarium temperatures we are burning them out. What we really seem to be dealing with, here, are coldwater livebearers!

On our way back from Zacapu we stopped at a river near the town of Jose Carrillo Arriaga. This was a wonderful habitat, with large patches of plants and a slow-moving current. Just the place to find masses of fish. This proved to be the case, with *Allotoca dugesi* — the Golden Bumblebee — being caught in profusion.

We had collected this species in 1987 from a pond near the town of Quiroga and each year we have returned to see how the population is doing. In 1988 we found no *Allotoca dugesi* at all; it seemed the *Goodea atripinnis* had taken over as the dominant species. This year though, the Golden Bumblebee Goodeid has returned in force. This new river habitat was interesting because the fish not only had very good colour, but many were also much larger than I had seen before.

Rancho El Molino

Our other main habitat was Rancho El Molino. This is the home of *Skiffia lermae*, *Goodea atripinnis*, *Allotoca dugesi*, *Allotoca*



Top, Laguna de Zacapu — a most important Goodeid locality.

Top right upper, *Allotoca dugesi* (the Golden Bumblebee Goodeid) was found in a number of localities. The specimen in the photograph is an adult male.

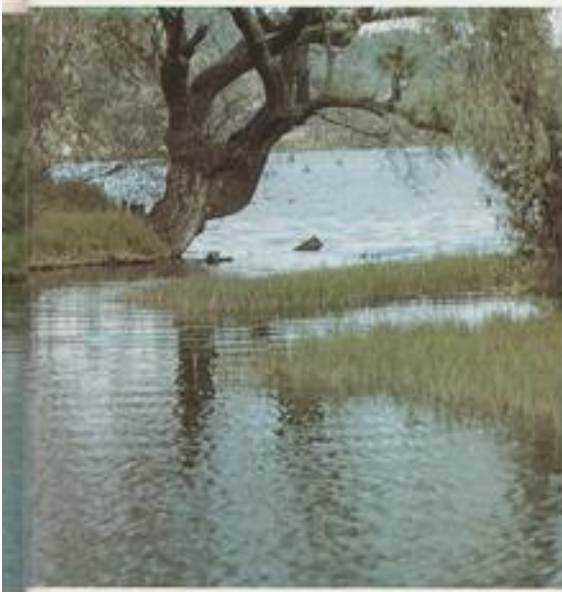
Top right lower, this *Skiffia* (Sawfin Goodeid) is probably a new species.

Above left, *Hubbsina turneri* (Turner's Sailfin Goodeid) was thought by some to be extinct. The specimen in the photograph is an adult female.

Above right, an *Allotoca* (Bumblebee Goodeid) collected at Lago Zacapu — possibly a new species or a hitherto unknown colour morph of a known one.

Right, despite several collections from the wild, *Skiffia lermae* (the Hooded Sawfin Goodeid) has proved difficult to establish in captivity.

Far right, Lago Manor in Chapultepec Park (Mexico City) — we found *Amarillos* (*Girardinichthys viviparus*) at this location.



diaz and about 100 women doing their washing! The road(?) down to the ranch is little more than a dirt track, with pot-holes 5ft across and 2ft deep. On average, it takes us 45 minutes to cover the 5.2 Km from the main road to the pond. Still, the trek is worth it. So far, this is the only habitat I have been able to find with *Skiffia lermæ* — the Hooded Sawfin Goodeid — in abundance.

Despite being collected on numerous occasions by both American and German teams, it was only in 1987 that this species was bred for the first time in captivity. Since then, a few healthy broods have been born, but most of these young have been males. Even in the wild, males seem to outnumber the females by about 2 to 1. We needed to find out three things: Where in the pond do they live? What do they eat, and what is the water like?

Sitting by the side of a pond watching fish in their natural habitat is one of the most rewarding experiences any serious aquarist can indulge in. Pat was the first to notice how the *Skiffia lermæ* browsed on algae in large groups. Careful fishing of these groups found them to be made up almost exclusively of males, with the occasional female which had just dropped fry. Hunting round the edges of the pond in the plants, gravid females and fry were found. It seems females remain in the shoals only when they are not pregnant.

The water temperature here was 65°F (c 18°C), the warmest we found in this region. However, during the summers of '87 and '88, we found this location to be the coldest — again, about 65°. Obviously, the spring water which feeds this pond is at a constant temperature. Fishing and serious observations done, we could sit in the sun and enjoy the pleasant surroundings of this, our favourite habitat.

Atlaconulco

We had time only for two further locations before leaving Mexico. The first was at the town of Atlaconulco on our way back to Mexico City. This is in the heart of *Girardinichthys multiradiatus*'s — the Golden Sailfin Goodeid's — range. This is another of the problem Goodeids which has been collected on many occasions but has never really been

established in the hobby for any great length of time.

Again, we found the water temperature to be quite cool and the fish living in large groups concentrated around the roots of floating plants.

Car chaos

We were now on our way back to Mexico City with the intention of returning the car to the airport late in the afternoon. We were approximately 35 Km from our destination when I noticed that the battery light had come on. Just as I was saying to Pat, "I wonder why the battery . . .", blue smoke started pouring from the engine.

In the end we contacted the car hire company to bring us a new car. Three hours later, a Green Angel van pulled up to see if they could help. Next, a police car arrived, then a Mexican family and, finally, two men from the car hire firm. From just the two of us, we had a total of twelve people standing around this knackered car.

Finally, we got the luggage transferred. This included a 3ft trunk which sat on the back seat. When we tried to start the new car, the battery would not even turn the engine over. No problem though, as the car hire men had a new battery with them. The trunk came out, so too did the back seat and, finally, the battery could be reached. The engine was duly started, the back seat returned and the trunk replaced. It was done without tools and far too fast for the batteries to have been exchanged, so I turned the engine off. We were back to square one! The trunk came out, the back seat came out and so did the battery this time. We finally arrived back in Mexico City at midnight. I enjoyed the 'discussion' with the car hire firm, especially when we got a £100 reduction on the car. We expect this to be just a down payment!

Chapultepec Park

Our final habitat was in Chapultepec Park. There are three lakes in the park which are the home of *Girardinichthys viviparus* — the Amarillo, or Black Sailfin Goodeid — another problem species. Almost every team which visits Mexico collects this species (we were no exception) and, while it will breed in

captivity, we don't seem to be able to get beyond the second or third generation. It is as though we are missing some vital element.

We spent several hours walking round the lakes. Each is pea-green in colour, with a high pH reading (9.0 in the largest lake in 1982 — Manfred Meyer's test result — and 8.4 in Lago Manor in 1989). No fish can be observed in these lakes because of the colour of the water. However, they are teeming with life, as just one swipe with the net proves. The algae are particularly thick by the concrete banks and small crustaceans are abundant.

All the information we have gathered on this trip has helped us understand our fish a little better. Livebearers have, for a long time, been stereotyped as hard, alkaline water fish which like high temperatures. As you can see from our tests, these conditions are rarely met with in the wild.

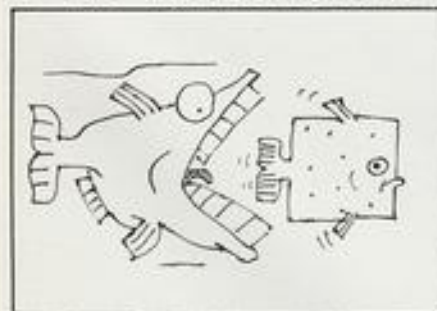
Both Pat and I would like to take this opportunity of expressing our thanks to Jim Chambers, Jim Langhammer, Dr Robert Rush Miller, Manfred Meyer and Colin Vernon for all their help. Our final word of thanks goes to all those anonymous Mexicans who helped keep us on the road, and also to the car hire company for providing us with such a wonderful piece of junk!

RESULTS OF WATER TESTS

Habitat	pH	GH	KH
Zacapu	7.4	4.0	4.0
Jose Carrillo Arriaga	7.5	5.0	4.0
Rancho el Molino	7.4	4.0	4.0
Atlaconulco	7.0	8.0	7.0
Lago Manor	8.4	5.5	5.5

Derek and Pat Lambert are founder members of *Viviparus* — the Livebearer Information Service. For further details of this organisation contact Nigel Hunter, Public Relations Officer, 60 Barry Way, Brighton Hill, Basingstoke, Hants. Tel: 0256 471568.

FRED THE PIRANHA.



BY PETER MCGEDOUGH

les New Titles

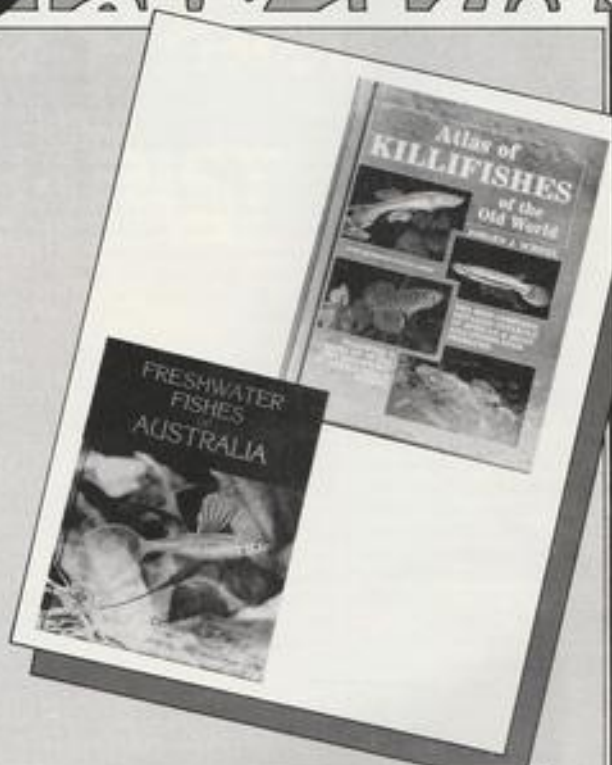
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Koi Talk



By John Cuvelier

Barometric Koi

It has long been a belief among the more experienced Koi-keepers that the primary function of anyone who undertakes to participate in the hobby is that of being a 'water keeper', a title which embraces a multitude of different facets of the business of caring for the environment in which our fish exist. We all know how quickly water conditions can change according to outside influences, this having been borne out very frequently during this past, exceptional winter with all its storms, etc.

One particular external influence upon conditions within a pool which has interested me on and off for some time, but which, as far as I know, has never been researched to any degree, is that of barometric pressure. During the months of summer, when a storm is threatening, we are all familiar with the way our fish tend to hover near the surface. I have always assumed that this behaviour was due to oxygen starvation, thanks to the high humidity, etc, of the atmo-

sphere, the fact that the barometric pressure also usually falls at these times just not having registered with me.

However, during the awful storms in January and February this year (which wreaked such havoc across the country), barometric pressure very much came to the fore.

My Koi spend the whole of the winter in their underwater shelter, rarely venturing out in daylight, although they have been known to pop in and out after dark for a look around. This pattern was quite dramatically altered during the storms, with every fish swimming around in an agitated manner in the hours preceding the outbreak of the storm of 25 January.

As can be seen from the accompanying barograph chart, the atmospheric pressure fell very steeply during the morning, reaching a low at 1 pm. This was an unusually rapid fall which I feel was sensed by my Koi. If the very heavy rain which came later had been falling, I might have blamed that for their activity but, in fact, the torrential rain came much later during the storm. It is a matter which I intend to give closer attention to in the future.

Flood fatalities

If you can bear it a little longer, I'd like to tell you how we fared throughout this difficult period. Like many other people, we suffered damaged fencing, trees blown down and general mayhem in the garden. Fortunately, the floodwater stopped rising a couple of inches below the house threshold.

However, for the first time

during our time at our present address, the floodwater rose high enough to pour into the pool from the surrounding ground, resulting, by the following morning, in the death of two Koi (needless to say, one of my best included), one can only assume from poisoning by the run off with all its nasties entrained! The rest of our fish were also looking shell-shocked but have, since, appeared to have recovered.

My sympathies go out to those poor souls whose pools and homes were completely flooded and who must have suffered catastrophic losses. Nature can be very unkind at times, and, if we can believe what the boffins keep telling us, who knows what is around the corner?

Beware false starts

And now, at last, some good news! Our tortoise, who we've had for more than twenty years, announced that winter was over, by waking from hibernation somewhat early (mid-February). That didn't mean I could go out and feed my fish, as it merely signalled that the winter had, up to that point, been milder than usual.

Every year which passes seems to bring stories of Koi-keepers having been caught out by what appears to be an early spring, but then turns out to be a flash in the pan. Don't be tempted to start feeding your fish just because the sun comes out for the odd couple of days. You could well be signing their death warrants! The great majority of pools will contain sufficient natural food to satisfy any early appetites without causing any risk through undigested 'stodge'.

U/V reassurance

I read an article elsewhere

recently in which the writer warned of the 'dangers(?)' inherent in the use of U/V sterilisers in domestic fish pools, stating that the use of these devices harmed the bacteria in filters.

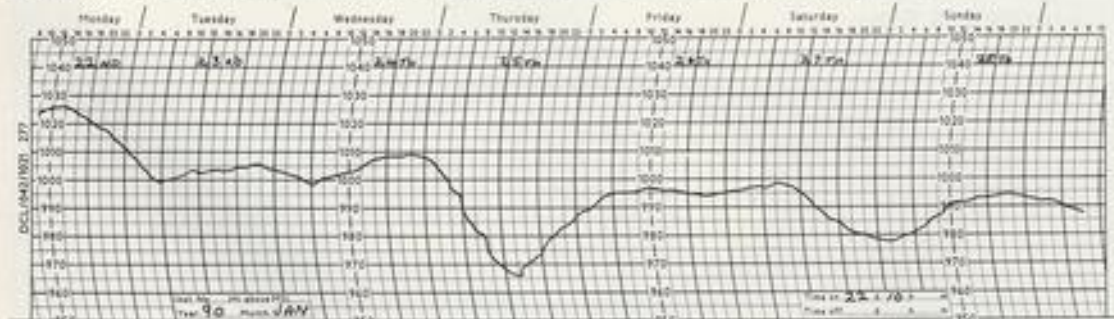
Just to put the record straight, ultra-violet light will only attack bacteria, organisms, call them what you will, in water which passes through the rays, i.e. around the quartz tube surrounding the light sources. There is absolutely no residual effect upon the water following its exposure, so you can carry on using U/V sterilisers without worry and enjoy the undoubted efficiency of these devices in destroying algal spores, one cause of green water.

Incidentally, we have a friend nearby who has had a unit fitted for three years and he's still on the original tube, which works perfectly well, as confirmed by a deliberately late switch-on last year. At least, it saves a bit of cash, in addition to relieving him of the inevitable anxiety felt when handling that fragile quartz sleeve!

Fibromix details

I had the usual input of phone calls and letters following my piece about my neighbour's pool in the February issue, all of which bemoaned the fact that no one seemed to have heard of Fibromix!

It is difficult when something is just not advertised in the appropriate journals, the excuse being that this product is primarily intended for the 'heavy' construction industry. Perhaps it will help if we, once again, publish the address to contact. It's Fibromix Ltd, Clifton Hall, Ashbourne, Derby DE6 2GL. Tel 0335 42265. Mr D Davies is the man to ask for, a mine of help and information on anything connected with concrete.

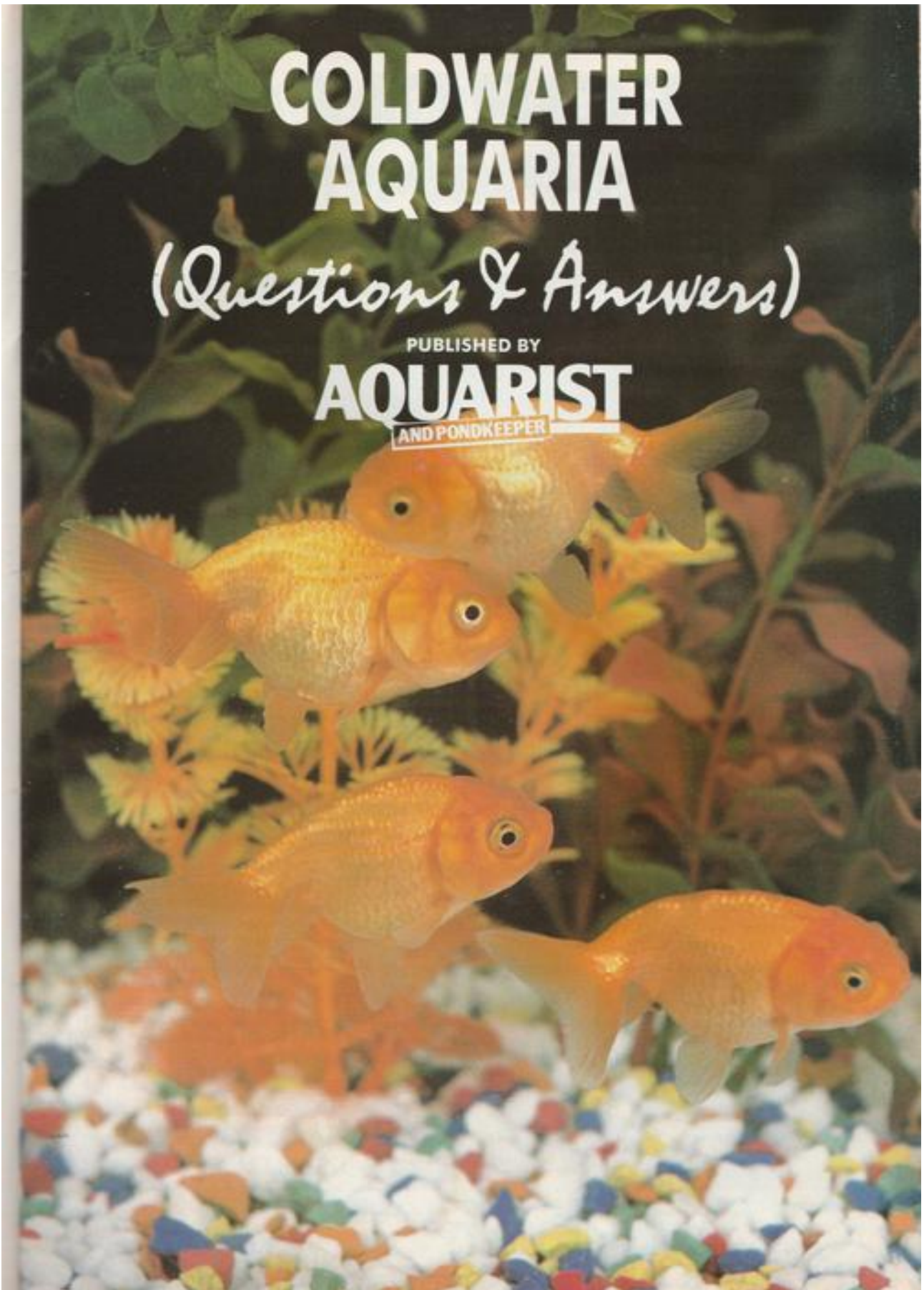


COLDWATER AQUARIA

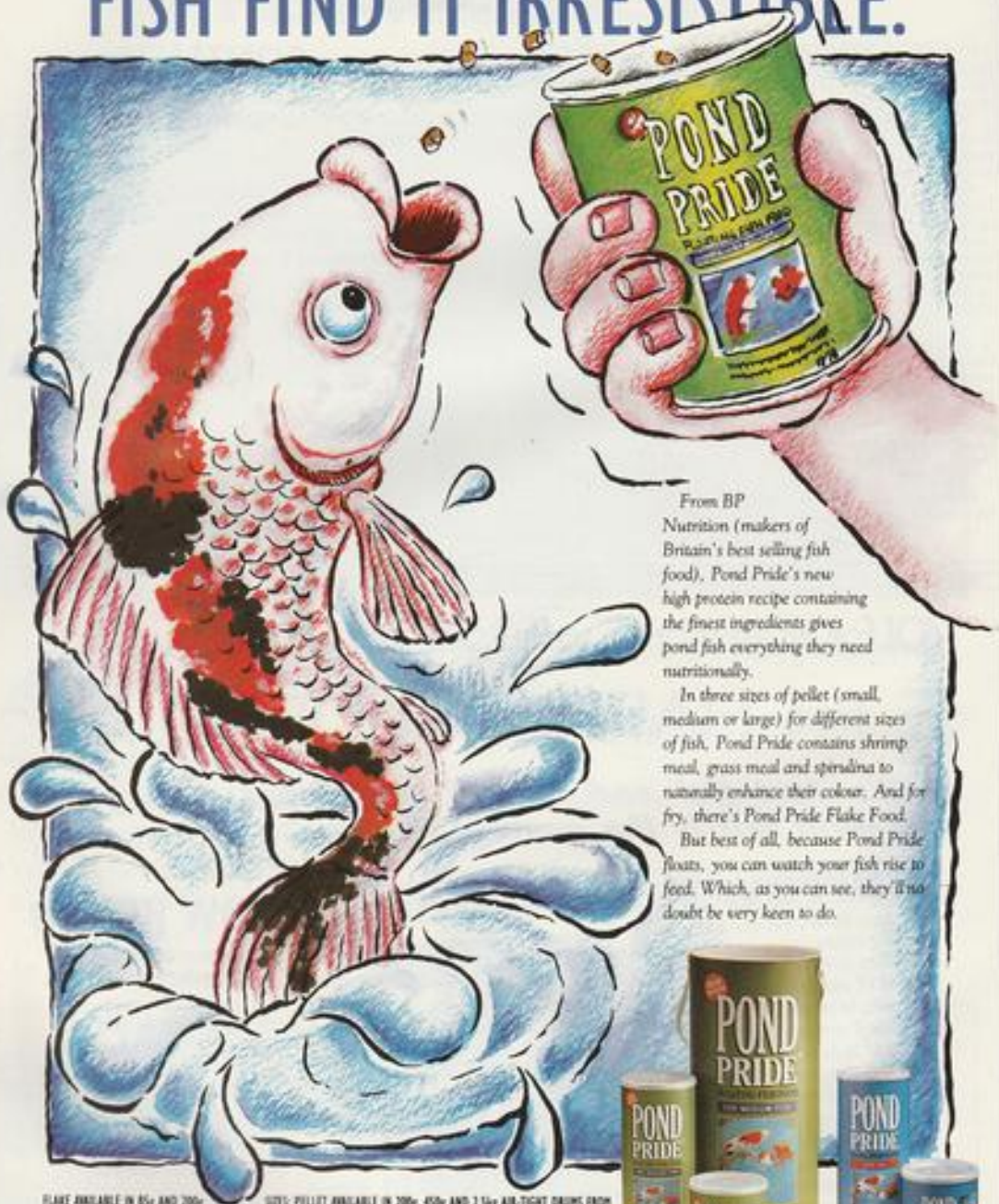
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THE GOLDFISH AQUARIUM, LIGHTING, OVERHEATING, PLANT MANAGEMENT, FILTRATION, DECORATIONS

by Dick Mills



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The aquarium

Q Although goldfish aren't much bigger than some tropicals, I've been told I need a much bigger tank for them. Why is this?

A The reason is simply to satisfy the fishes' oxygen requirements. Even though the colder water will hold more oxygen than that for tropicals, the goldfish also has a greater need for oxygen. One fundamental difference between goldfish and tropicals is that the former have no stomach, and so cannot rest up digesting their food after a large meal.

Food passes from the mouth and gullet straight to the gut, so in order to maintain its 'fuel intake' a goldfish must feed continuously and all this effort takes up oxygen. Add to this all the other life-forms (and decomposing actions) occurring in the tank, and you can see that a great deal of oxygen is required.

To satisfy this need, a large water-to-air surface area must be provided, hence a large tank; one larger than 90cm (3ft) long is

recommended. It is likely that the filtration system will provide adequate water circulation, thus assisting oxygen uptake and carbon dioxide disposal at the water surface, although additional separate aeration may be needed at other times (see below).

Q Which is better, a shallow or a deep tank?

A It makes no difference how shallow or deep the water is, as the bulk of oxygen replenishment occurs at the water surface.

However, you might bear in mind water depths when considering what type of goldfish you wish to keep. For varieties that are best viewed from the side (Comets, Fantails, Veiltails, Orandas, ie those with flowing fins and/or hood and eye developments) a deeper aquarium is better. Fishes with physical characteristics best seen from above include the Tosakin, Celestial, Bubble-eye and, perhaps, the dorsal-fin-less Lionhead. One other point, you will need more powerful airpumps and lighting for deep tanks.



Growing plants in pots which can then be buried in the gravel will help overcome uprooting problems.



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Lighting

Q *If I have my goldfish aquarium where it receives direct sunlight, will it also need artificial lighting?*

A Probably not, but you will certainly find that such a position brings plenty of other problems. In summer, the water temperature may well rise quite high, resulting in oxygen deficiency and fish gasping at the surface. You may also be prevented from seeing the fish or plants by the dense growths of green algae on the tank glass, or by 'pea-soup' coloration of the water.

It will be better for all concerned (including the fishkeeper) to have the tank in a position where the lighting and any external influences likely to affect water temperatures can be better controlled.

Overheating

Q *If we get a summer like we had last year, how can I prevent my coldwater aquarium from overheating?*

A The first danger from rising water temperatures is falling oxygen levels, and the immediate step to take is to increase aeration as much as possible. Secondly, siphon out some water (as if doing a partial water change) and float a sealed plastic bag of ice cubes in the aquarium to lower the temperature over a couple of hours or so (the reason for removing some water first is to prevent overflows when putting in the plastic bag of ice cubes). It might be practicable to replace the removed water when it has cooled down, although there isn't generally much room in the family fridge for buckets of 'too-warm' aquarium water!

As a further precaution against rising temperatures, shade the tank from direct sunshine, either by placing some polystyrene tiles around it, or by pulling the room curtains.

Plant management

Q *Whenever I see goldfish for sale, they are usually in a tank with a mass of floating plants. Are there suitable rooted species available for the aquarium?*

A You must remember that your dealer is all for ease of catching fish without the hindrance of a nicely-planted tank, hence the usual floating plants which give the fish some sense of security or shade in the display tanks. But this can all change once you get your fish home.

Most aquatic shops stock good selections of aquatic rooted and floating plants but do make sure any you choose are suitable for the coldwater aquarium. See **Selection of Fish and Plants** by John Dawes elsewhere in this Supplement for a list of suitable coldwater aquarium plants.

Q *How can I stop my goldfish from uprooting, and sometimes eating, the aquarium plants?*

A Because of their constantly-foraging activities, goldfish have little respect for



Aquarium decorations range from whimsical to purely functional ones — the choice is enormous.

aquarium plants. Where rooted plants are used, you can deter their gardening habits by putting some suitably-sized pebbles around the base of the plants. Alternatively, the plants can be cultivated in small pots which are then buried in the substrate. Planting a background of plants behind a separating sheet of glass might be seen as taking precautions a little too far.

As for eating plants, close observation will

show that it is only the fine-leaved plants that suffer. Fishes apparently nibbling at stout-leaved species may well be after minute aquatic life on the leaves, as opposed to the leaves themselves.

You should find that, providing the lighting and water conditions are correct, the plants will re-grow faster than the fish can eat them. Don't forget to give the fish some vegetable food material from time to time



Slow-moving varieties such as Pearlscales must not be forced to have to fight against strong currents such as those produced by some of the larger powerfilters.

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too; this will also diminish their likely demands on aquarium plants.

Filtration

Q What type of filter is best for a goldfish aquarium?

A A simple answer might well be — the one that keeps the water cleanest — but there are other considerations to be examined.

Many of the more fancy varieties of goldfish are slow-moving, their globe-shaped bodies making them inefficient swimmers. Strong water currents set up by a powerful filtration system would therefore not be suitable for these. Also, the direction of the water flow can be critical — horizontal being preferred to vertical, a point to bear in mind when fitting that spraybar.

Where internal power filters or powerheads are used, the strong water current effect can be lessened by turning the filter output or powerhead so that the returning water is directed into the corner of the aquarium first, then being deflected more gently around the edges of the tank. After all, who wants plants permanently leaning over, too?

Again, I have already mentioned goldfishes' penchant for digging, and although the low-maintenance undergravel filter may well suit the fishkeeper, it should be protected against exposure by the foraging fishes by the installation of a Gravel Tidy fitted a couple of inches above the filter plate, with a further layer of gravel on top.

Remember, too, that a regular siphoning out of sub-gravel sludge via the airlift/powerhead tube is very beneficial, as is the regular use of a Gravel Washer. Still regarding biological filtration methods, it may be that the more 'cleaner' action of a power-filter-assisted reverse flow system is



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In addition to essential pieces of equipment such as airpumps and filters, many manufacturers also produce a range of very useful accessories like siphons, long-handled tongs, 'vacuum' cleaners (air-operated) and gravel cleaners.

better in order that the delicate fin membranes do not become congested due to dirty water.

Simple internal box-filters are not really efficient enough for the goldfish aquarium, unless you get more pleasure in cleaning them out than in watching the fish!

Make sure your filters are serviced regularly; there is simply no point in allowing the filter to collect all the toxic materials to the best of its ability, only for them to sit in the ever-passing aquarium water stream for months on end from then on!

Floss and carbon will lose their efficiencies eventually and must be changed. Replace floss on a proportional basis (and rinse it in aquarium water to maintain any biological action it may have developed). With remotely-sited external power filters, cleaning the hoses of algal deposits will reduce friction losses and help to keep the water flow at its optimum values: about two to three times the tank capacity per hour is about right.

Decorations

Q Will rockwork and wood be suitable decorations in a goldfish aquarium?

A To some people's eyes, the use of such natural materials is much better than resin-moulded aquatic ornaments, complete with coloured gravels. Of course, any rocks used must be 'safe', ie, they must not be soluble in water, nor contain any metallic ores which might upset the water chemistry.

Similarly, any wood chosen for aquarium decoration should be long-dead. Bogwood and petrified woods are quite safe, while others collected from riverbanks, etc should be boiled in many changes of water, followed by much soaking to render them well waterlogged and prevent them from floating (although tying them down to the undergravel filter-plate is but one way to stop this tendency). Sealing the wood with polyurethane paint will also stop the tannins from leaching out to discolour the water.

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Heavily stocked tanks will require good aeration and filtration, and regular partial water changes.

Water Chemistry

Q How important is water chemistry to coldwater aquarium fish?

A It is important to avoid fluctuating water temperatures, although room temperature is fine for most of the commonly-kept coldwater aquarium fish species. Adequate aeration and regular partial water changes (see below) are also important.

Water hardness and pH are, perhaps, less important to most coldwater fish species, although extreme and/or fluctuating values are probably best avoided. Certainly, a stable pH anywhere between 6 and 8 and water hardness values up to 25° dH, should be no problem for most species.

When an aquarium is set up for the first time, it will go through the usual settling-in period, and this also applies to coldwater aquaria. As the filters become mature, quite high levels of ammonia and nitrite may be achieved. Many coldwater fish are quite tolerant of nitrite and even ammonia, but normal new tank precautions of avoiding adding too

many fish too soon, avoiding overfeeding, and carrying out slightly larger-than-usual partial water changes (perhaps 25% each week rather than each month) all apply.

Since most aquarists will rely on tapwater to fill their tanks, the use of good-quality tapwater conditioner at all times is recommended. Water testing kits should also be regarded as essential by all aquarists (tropical, coldwater and marine).

Goldfish bowls

Q Can goldfish be kept successfully in a goldfish bowl?

A Undoubtedly, the simplest way to keep goldfish is in a bowl or a small aquarium, both of which are now available in a range of shapes and sizes. A wide-necked bowl or small aquarium is preferable to the old-fashioned glass globe which has only a very narrow opening. Unless a globe is only half-filled with water, there will be a very small surface area of water exposed to the atmosphere for gaseous exchange.

Setting up a goldfish bowl or small plastic aquarium is very straightforward. Rinse out the bowl in clean water and then put in a layer of washed gravel and a small bunch of aquatic plants, a plastic plant or, perhaps, an ornament.

The bowl is then ready for filling with tapwater conditioned with a good-quality aquarium tapwater treatment. Such tapwater treatment is vital to reduce the levels of chlorine, other disinfectants and heavy metals such as copper. The tapwater can then be brought to room temperature by adding a little hot water from a kettle (avoiding direct contact with the glass, of course!).

The bowl is now ready to receive the goldfish. Having brought these home from the local aquarium shop in their small (covered or wrapped) plastic bag, this plastic bag should be floated in the bowl for fifteen to twenty minutes to allow the temperatures to equalise. Then the fish can be gently released into their new home.

Since filters are not usually used in a goldfish bowl, it will require regular cleaning,



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

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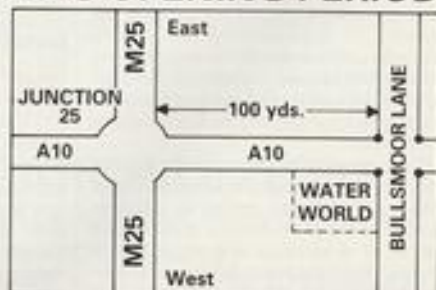


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perhaps every two to four weeks, or more frequently. In fact, very small bowls should probably be cleaned out each week.

The best way to clean a bowl or small aquarium is to transfer the fish and a little of the old water to a clean, detergent-free bucket first. Then rinse the bowl, its gravel and all the ornaments in clean water, taking care not to scratch the sides of the plastic bowl or tank. Now the bowl can be refilled with conditioned tapwater at room temperature and the goldfish carefully reintroduced.

Other suitable species

Q What other fish species can be kept in a coldwater aquarium?

A Some of the more hardy species of tropical aquarium fish can be kept with small goldfish, and these include some of the livebearers, such as Guppies and Platies, White Cloud Mountain Minnows and Medaka. Increasing numbers of North American fish are now also available in the trade, including some quite attractive shiners and minnows.

Since one or two of the above-mentioned fish species are likely to suffer if the water temperature falls too low, such an aquarium is best set up in a room with relatively stable temperatures.

It is, of course, important to avoid mixing fish of very different sizes, and even small predatory fish should be avoided completely. Various coldwater catfish are offered for sale and these can quickly dispose of quite a large number of fish which are kept in the same aquarium.

Naturally, some native species of freshwater fish can be kept in the home aquarium, although some of these do suffer if water temperatures get too high; they also rely on quite vigorous aeration if they are to thrive. The ubiquitous Stickleback, although very tolerant of a range of aquarium conditions, is rather aggressive, particularly at breeding time, and will tend to nip the fins of slower moving ornamental species. Finally, of course, some of the small freshwater lobsters and crayfish can be kept in an indoor coldwater aquarium, but take care that these do not attack particularly slow-moving fancy varieties of goldfish.

Fuller details of a selection of species for coldwater aquaria are provided by John Dawes elsewhere in this Supplement.

Quarantine

Q Should coldwater fish be quarantined?

A Naturally, when fish from a number of different sources are used to stock an aquarium, the risk of introducing diseases is a real one. Quarantining new fish in a separate tank for three or four weeks is a good idea, although somewhat troublesome for an aquarist with only a single coldwater aquarium in his or her home.

In this situation, it is possible to introduce new fish direct into the stocked tank, although an especially close watch must be kept for any outbreaks of disease which may ensue; prompt treatment is, of course, vital in such cases. A preventive course of a broad-spectrum anti-parasite treatment, immediate following the addition of new fish, may be a good idea in this situation.



A range of coldwater fish can be obtained from most aquarium shops: Orfe are, however, best suited to a garden pond.

Stocking level

Q What is the maximum safe stocking level for a coldwater aquarium?

A As a rough guide, about 150 sq cm (24 sq in) of water surface area should be allowed for each 2.5 cm (1 in) of fish length, excluding the tail fin.

Newly-established aquaria should be stocked at considerably less than this rate, with the stocking level built up gradually over a period of weeks as the filter system matures. In addition, experienced aquarists may find that they can stock at significantly higher levels than those mentioned above, particularly with good filtration and aeration and regular partial water changes.

It should be emphasised that, even with very efficient filtration, regular partial water changes of about 25% of the tank volume each month or so are still very important in the maintenance of ideal conditions within the coldwater aquarium.

Growing plants

Q Is it possible to grow plants in a coldwater aquarium?

A Various factors affect plant growth in the aquarium, including adequate lighting. As a rough guide, it is important to allow 15 to 25 watts of fluorescent lighting per 12 in (30 cm)

length of aquarium. Tanks less than 24 in (60 cm) in length will require less light than this, and tanks deeper than 18 in (45 cm) will require slightly more.

The light should be left on for about twelve hours per day, and any fluorescent tubes should be renewed about every nine months or so, since the intensity of the light they produce will decrease with time. Where two tubes are used, it is sometimes a good idea to use a combination of one cool fluorescent tube and one GroLux type tube which, in combination, will produce quite attractive effects.

Having established sufficient lighting above the tank, it is possible to grow plants, even in a coldwater goldfish aquarium. Although goldfish and some other coldwater fish can be rather disruptive in a planted tank, the following plants can be used to some effect: Hornwort (*Ceratophyllum demersum*), Pondweed, (*Egeria densa*), Willow Moss (*Fossilsium aegyptiaca*), Millfoil (*Myriophyllum* sp.), Arrowhead (*Sagittaria* sp.) and Vallis (*Vallisneria* sp.) (See PLANT CHART in John Dawes' article elsewhere in this Supplement for further details).

If the tank is particularly warm, it may be possible to grow a greater range of plants, such as many of those which are normally associated with a tropical aquarium.



Ulcer Disease is one of a range of common coldwater fish diseases. Whereas most diseases can be successfully treated using remedies from an aquarium shop, Ulcer Disease requires antibiotics from a vet.

Feeding and maintenance

Q How often should I feed the fish in my coldwater aquarium?

A As a rough guide, fish in a coldwater aquarium should be fed two to four times a day, with as much food as is consumed within a few minutes.

If the aquarium is situated in an unheated room, the appetites of the fish will wane as room temperatures decrease during the autumn and winter. Similarly, their appetites will be particularly vigorous during the warm summer months.

Good-quality flaked food, with the occasional use of some safe livefood, such as small or chopped earthworms, is a good, easily-provided diet for many species of coldwater fish, including goldfish.

Naturally, the biggest mistake that most newcomers to the hobby make is overfeeding, where uneaten food accumulates in the tank and then precipitates water quality and, even disease problems. Overfeeding must be avoided at all costs.

Q How do I look after my aquarium once it's set up?

A Maintaining an aquarium of coldwater fish is very simple. All that is required is a tank, a cover, a little gravel, some rocks, artificial plants, an air pump and a filter — and a few fish. A rather more elaborate system would include artificial lighting, a greater depth of gravel and real live plants, although these are by no means essential for coldwater fishkeeping.

The tank should be sited where it does not receive too much natural sunlight, and away from draughts, room heaters, etc. Since a coldwater aquarium does not require a heater-thermostat (like in a tropical aquarium), it may be more affected by fluctuations in room temperature. Therefore, it should be sited where these fluctuations are small.

Any stable piece of furniture will act as a stand for the tank, but remember that each cubic foot of water is equivalent to over 6 gallons (27 litres) and that this weighs about 60 pounds (27Kg). It is a good idea to site the tank on a base of polystyrene ceiling tiles. These will even out any slight irregularities in the tank or desk (or table) top and provide firm, even support. Alternatively, an aquarium stand may be used.

After this, regular partial water changes (see earlier question on Goldfish Bowls), adequate stocking levels and correct feeding (see above), should ensure relatively trouble-free maintenance.

Health

Q What is the cause of swimbladder problems in goldfish, and can they be treated?

A Swimbladder disorders can usually be recognised by the inability of the affected fish to maintain its position in the aquarium. It either floats to the surface, or sinks to the bottom. In less severe cases, the fish may swim with a pronounced list.

Sudden changes in temperature are often cited as a cause of swimbladder disorders. Fancy Goldfish seem particularly prone to this problem, and this may be related to the deformed shape of the swimbladder in the

more fancy varieties. The condition does not appear to be infectious.

There is no reliable cure for this problem, although keeping the fish in shallow water, maintained a few degrees warmer than the aquarium, sometimes offers some respite. Naturally, fish showing symptoms of swimbladder disorder should not be used for breeding, and fish that are no longer able to feed should be painlessly and humanely destroyed.

Q Does Fish Pox affect goldfish in the coldwater aquarium?

A Fish Pox is a problem which frequently affects Koi, but may also affect goldfish and some other coldwater fish in the aquarium, from time to time. The symptoms are a white, pinkish, or, even, grey waxy growth on the skin and fins; the growth tends to appear, develop and then disappear, perhaps to recur at a later date.

The growth is produced by a viral infection in the cells of the fish's body. Infection may lie dormant for many months but, unfortunately, we do not fully understand what triggers off viral multiplication and the characteristic Pox symptoms.

However, Fish Pox does not appear to be very infectious and does not seem to pass easily between fish. The disease rarely, if ever, causes serious problems. It is unsightly, rather than dangerous, and aquarists must learn to put up with it for the time being, since there is no reliable treatment.

Q What other diseases are likely to affect coldwater fish?

A Fish can suffer from a wide variety of diseases, but only a few are encountered on a more or less regular basis. The most common of these are listed, along with some symptoms and treatments, in the accompanying chart.

Q Are there any special things which I need to bear in mind when treating fish?

A Some further points to note when treating fish for disease include:

- 1 Calculate volume of any tanks or ponds carefully. Length x height x width (all cm), divided by 1000 = volume in litres. Deduct 10% from this for gravel, etc. (if present).
- 2 Turn off filtration over activated carbon during treatment. Ensure adequate aeration.
- 3 Do not overcrowd fish during treatment. Do not treat fish in galvanised containers.
- 4 Always try a remedy out on one or two individuals before treating a whole batch of delicate or expensive fish.
- 5 Excessive amounts of organic matter will reduce the activity of most remedies.
- 6 Never mix remedies unless you know it is safe to do so. A 50-75% water change and filtration over activated carbon for 12-24 hours should remove most active ingredients.
- 7 If you are in any doubt about the diagnosis and treatment of a disease of your fish, contact a local vet or fish health specialist.



SOME COMMON FISH DISEASES

Symptoms	Disease	Treatment
White-grey cotton wool-like growths on skin and fins.	Fungus (<i>Saprolegnia</i> , etc).	Add recommended dose of a proprietary Fungus treatment.
White pimples on skin and fins.	White-spot (<i>Ichthyophthirius</i> parasite).	Add recommended dose of a proprietary White-spot treatment to tank.
Yellow velvety appearance to skin, rapid gill movements.	Velvet Disease related to infection by <i>Oodinium</i> parasite.	Add recommended dose of Velvet remedy.
Fin Rot, Tail Rot.	Often a localised bacterial infection.	Add recommended dose of a General Fish Tonic.
Ulcers, red vent, reddening at base of fins, etc.	Generalised bacterial septicaemia.	Isolate affected fish, contact a local vet and attempt antibiotic therapy.
Folded fins, shimmying, rapid gill movements, reddened areas of body.	Various bacterial or parasite infections.	Add recommended dose of a General Fish Tonic.
Slimy grey coating to skin, rapid gill movements, scratching against rocks.	External parasite infestation.	Add recommended dose of General Fish Tonic.

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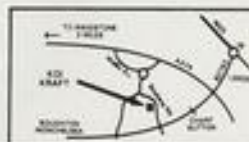


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SELECTION OF FISH AND PLANTS

JOHN DAWES (Editor — *Aquarist & Pondkeeper*)

Q What fish, other than goldfish, can be considered suitable for anyone wishing to set up a coldwater aquarium?

A Nowadays, the selection of coldwater fish which are regularly available, both during, and outside, the coldwater season, is quite extensive. It is therefore quite possible to set up a coldwater community aquarium following the same general guidelines laid down for tropical set-ups, but reducing the stocking level as indicated in **Chris Andrews'** article elsewhere in this Supplement.

Compatibility considerations are also, obviously, important. I have therefore indicated special requirements (where these apply) in the selection of species that follows. Fish such as Orfe (*Leuciscus idus*), and Tench (*Tinca tinca*), have been omitted because they are best regarded as pond, rather than aquarium fish. Common Minnows (*Phoxinus phoxinus*), Bullheads/Miller's Thumb (*Cottus gobio*), Sticklebacks (*Gasterosteus, Pungitius* sp) and some other well-known species, are not normally available as aquarium fish and, for this reason, have also been excluded.

CYPRINIDS, (Cyprinidae)

Carp/Koi (*Cyprinus carpio*)

Geographical distribution: Originally from the regions around the Black Sea and the Aegean basins (particularly the Danube), this species has been introduced into coun-

tries all over the tropical and temperate areas of the world, largely as a food fish. Koi are highly coloured varieties of the species. They are not found in nature and represent the only type of *C. carpio* kept in any significant numbers by hobbyists.

Size: Up to about 39 in (1 metre) in well-maintained ponds — much smaller than this in aquaria.

Water preferences: Will tolerate a wide range of water conditions and temperatures but will experience stress during prolonged periods at high temperatures (around 28°C/82°F and above).

Diet: Koi are omnivorous, which means that they will eat both animal and plant-based foods. Both must, therefore, be provided. Since only small specimens are suitable for aquaria, and these are invariably immature, growing individuals, the diet should contain a fairly high concentration of protein (about 40% — adults require less). There are numerous high-quality commercial foods which have been specifically developed for Koi.

Breeding: Koi require large ponds (pools) for breeding. Provided with the right conditions, they will spawn in a similar fashion to goldfish. Aquaria are totally unsuitable for breeding purposes.

Additional information: Koi, like goldfish, are very efficient water foulers. Therefore, despite their undoubted hardiness, a good filtration system is essential. In addition, the large size to which Koi can grow, dictates that only very small or juvenile specimens can be adequately catered for in most aquaria.



Only young Koi specimens can be adequately catered for in aquaria.

Fathead Minnow/Red Minnow/Rainbow Dace (*Pimephales promelas*)

Geographical distribution: North America.

Size: Around 10 cm (c. 4 in).

Water preferences: Not critical. Wide temperature range tolerated.

Diet: All foods.

Breeding: Males are distinguished by their fatter heads and by a notch on the front edge of the dorsal fin. They develop conspicuous 'pimples' (nuptial tubercles) on the snout during the breeding season. Eggs are laid on the underside of floating leaves from late spring onwards.



Fathead Minnows are almost exclusively available in the golden cultivated form.

Additional information: This species is now almost exclusively available in the golden form. It is a very active, hardy, shoaler which can disturb more sedate fish, even though it is not an aggressive species.

White Cloud Mountain Minnow (*Tanichthys albonubes*)

Geographical distribution: China, around Canton, and Hong Kong (aquarium-raised variety).

Size: Around 4.5 cm (1.75 in).



The White Cloud Mountain Minnow can be kept both in coldwater and tropical set-ups.

Water preferences: Not critical. Temperature range: Very wide, from below 15°C (50°F) during winter to normal, but not excessive, tropical temperatures in summer.

Diet: All foods.

Breeding: Quite an easy egg-scattering species.

Additional information: Even now, there is still some confusion over the naming of this species which arises out of the existence of two colour variants (some say two subspecies): one with light edges to the dorsal and anal fins, from Canton, and another with red edges — apparently from Hong Kong. (See Weitzman and Chan in the American scientific journal *Copeia*, 1966, No. 2.) For a time, there was also a long-finned variety.

Bitterling (*Rhodeus amarus*)

Geographical distribution: Europe, with the following notable exceptions: Spain, Portugal, southern France, Italy, northern Finland, Sweden, Ireland, Scotland, Wales and the Balkans. Introduced into some parts of England.

Size: Around 9 cm (c. 3.5 in).

Water preferences: Not critical, but prolonged tropical temperatures must be avoided. (See Breeding).

Diet: All foods, particularly livefoods, but also eat vegetation in the wild.

Breeding: Bitterling require the presence of a freshwater mussel for spawning purposes. Eggs are deposited within the inhalant siphon of the mussel by means of an extended ovipositor (egg-laying tube).

The male then releases sperm around the same opening and these are taken in by the mussel in its incoming water current. The eggs are, therefore, fertilised inside the mussel, where they remain until they hatch two or three weeks later.

Chances of spawning success are improved if the pair is subjected to a period of cool temperatures, i.e. around 10°C (50°F).

Additional information: Although Bitterlings have been well-known among European aquarists for many years, doubts still appear to remain concerning their correct scientific name. Some books use *R. amarus*, while others use *R. sericeus*. Still others use *R. sericeus amarus* or *R. amarus sericeus*.

According to Wheeler (1985), the current



Confusion still reigns regarding the exact scientific name of the Bitterling — a beautiful, interesting and highly desirable fish for the coldwater aquarium.

valid name is *R. amarus* (though he himself used *R. sericeus* in an earlier publication) and *R. amarus sericeus* should be reserved for a separate population of Bitterlings, the subspecies found in northern China.

Gudgeon (*Gobio gobio*)

Geographical distribution: Widely distributed in Europe, except for the extreme north and the coastal rivers of the Adriatic.

Size: Up to around 20 cm (8 in), but usually smaller.

Water preferences: Highly oxygenated water is preferred. Will withstand the lower



Gudgeon are, predominantly, bottom feeders.

range of tropical temperatures, but not for long.

Diet: Livefoods preferred, to the virtual exclusion of anything else.

Breeding: An egg-scattering species which does not appear to have been spawned in aquaria.

Additional information: Numerous subspecies have been described, but the authenticity of some is questionable. Gudgeon are fast-swimming, predominantly bottom-dwelling fish, but will make mid-water forays in search of food.

Red Shiner/Red Horse Minnow/Sandpaper Shiner (*Notropis lutrensis*)

Geographical distribution: Central

North America to Mexico and west as far as California and Colorado.

Size: Around 8 cm (3.2 in).

Water preferences: Not critical, as long as temperature does not rise above 23°C (73.5°F) in summer and is kept cooler than this in winter.

Diet: Most foods, but livefoods preferred.

Breeding: Males develop deep coloration and small white pimple-like growths (called nuptial tubercles) on the gill covers and all over the head and snout. Eggs are laid in a shallow depression.

Additional information: This is a very active species which can disturb the more sedate members of the tank community.

Opaline/Moderlieschen (*Leucaspis delineatus*)

Geographical distribution: Mostly central and eastern Europe and northwards up to southern Sweden.

Size: About 12 cm (c. 4.5 in).

Water preferences: Not critical; can withstand tropical temperatures and low oxygen levels.

Diet: Will accept a range of foods, but prefers livefoods.

Breeding: Egg strips are looped around plants and are then guarded by the male. No detailed reports of aquarium spawnings are available yet.

Additional information: This fairly recent introduction to the coldwater hobby



Red Shiners are lively, attractive fish which can unsettle timid tankmates. This is a prize-winning male produced by Ekkwill Tropical Fish Farm in Florida.

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is fast gaining popularity in Europe.



Recent years have seen the introduction of a number of 'new' species of coldwater fish, including the Opaline, or Moderlieschen.

Pale Chub/Zacco (*Zacco platypus*)

Geographical distribution: Far East.

Size: Around 18 cm (c. 7 in).

Water preferences: Not critical in terms of pH, but well-aerated, filtered conditions are preferred.

Diet: All foods.

Breeding: The sexes are quite easy to differentiate, for males have a longer anal fin than females. They also develop nuptial tubercles, in a similar way to many other coldwater cyprinids. No reports of successful aquarium spawnings are yet available.

Additional information: *Z. platypus* is a relatively recent import into Europe from Japan. It is a fast-swimming fish with excellent jumping ability. A good aquarium cover is, therefore, essential.



The Zacco, or Pale Chubb, is a recent introduction which is gaining popularity.

SUNFISHES (Centrarchidae)

Pumpkinseed/Sunfish (*Lepomis gibbosus*)

Geographical distribution: North America, from Maine to Florida and as far as the Mississippi.



The Pumpkinseed is the most popular of all the Sunfishes.

Size: Around 15 cm (6 in).

Water preferences: Clean, well-oxygenated water between 10-22°C (50-72°F) is preferred.

Diet: Dried food accepted, but livefoods preferred.

Breeding: Males excavate a depression in the substratum to which they attract females, and in which the eggs are laid. Males are also responsible for guarding the eggs.

Additional information: Pumpkinseeds are best kept on their own, even though they are not generally too aggressive. Other larger Sunfishes include:

Bluegill — *L. macrochirus*
Orange-spotted Sunfish — *L. megalotis*
Long-eared Sunfish — *L. megalotis*
Flier — *Centrarchus macropterus*

Diet: All foods, particularly livefoods.

Breeding: Eggs are scattered among fine-leaved vegetation and hatch out in 3 or 4 days.

Additional information: *E. evergladesi* males are quite aggressive, despite their small size. Dense clumps of vegetation should be provided for this fish which should be kept in a species tank, ie not a community tank. Other Pigmy Sunfishes include: Black-banded Sunfish — *Enneacanthus (Mesogomistius) chaetodon*, Diamond or Banded Sunfish — *E. obesus* and Blue-spotted Sunfish — *E. gloriosus*.



Pigmy Sunfish are small, colourful, and very interesting.

MEDAKAS/RICEFISHES (Oryziidae/ Oryziatidae)

Geisha Girl/Japanese Medaka/Rice Fish (*Oryzias latipes*)

Geographical distribution: Japan.

Size: Around 4 cm (1.5 in).

Water preferences: Neutral conditions, with minor fluctuations on either side. Temperature: Extremely wide range tolerated.



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The Medaka is lively, but peaceful, and well worth a try.

from under 15°C (59°F) to above 28°C (82°F).

Diet: Most foods.

Breeding: Females carry fertilised eggs attached to their genital aperture for a time after mating, later depositing them among fine-leaved vegetation.

Additional information: Several varieties of *O. latipes* are available, including the wild-type, a golden one and an 'unreliable/inconsistent' red which is rarely seen. Other species also found in aquaria are *O. celebensis* and *O. jayakensis*.

KILLIFISHES (Cyprinodontidae)

American Flagfish (*Jordanella floridae*)

Geographical distribution: Florida, Yucatán and southwards to Belize.

Size: About 6 cm (2.5 in).

Water preferences: Not critical. Temperature: 19-25°C (66-76°F).

Diet: All foods, but diet must include a regular vegetable component.

Breeding: This is an unusual species in that it can use two reproductive strategies: (i) egg-scattering among fine-leaved vegetation; and (ii) egg-deposition in a depression in the bottom. Parental duties are carried out by the male.

Additional information: Male *J. floridae* are aggressive, particularly towards other males at spawning time.



LAURANCE PERKINS

American Flagfish males are aggressive towards each other.

CATFISH (Ictaluridae)

Spotted/Channel Catfish (*Ictalurus punctatus*)

Geographical distribution: Widely dis-

tributed in eastern North America and southwards as far as northern Mexico.

Size: Up to 1.2 m (c. 4 ft).

Water preferences: Not critical. Cool temperatures preferred, but will tolerate lower tropical temperatures.

Diet: Large livefoods, such as earthworms, and meat-based foods.

Breeding: No aquarium spawnings have been reported.

Additional information: Owing to the large size of this species (as well as predatory habits), only juvenile specimens are suitable for the 'average' coldwater aquarium. *I. punctatus* is available in wild-type and albino forms.

Other species also available are *I. (Ameiurus) melas*, the Black Bullhead and *I. (Ameiurus) nebulosus*, the Brown Bullhead. Both are predatory.



MORTY GIBBY

All Channel and Bullhead Catfish are predatory — and large.

LOACHES (Cobitidae)

Weather/Pond Loach (*Misgurnus fossilis*)

Geographical distribution: Eastern and central Europe.

Size: Up to 35 cm (c. 14 in), but usually much smaller.



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Water preferences: Can tolerate a wide range of water and temperature conditions.

Diet: All foods, particularly bottom-dwelling livefoods.

Breeding: Has only rarely bred in aquaria. The male twists his body around the female's and the pair then rise to the surface, where eggs are scattered among vegetation.

Additional information: This species is famous for its reaction to a drop in barometric pressure (as experienced before a storm). At such times, it becomes particularly active, hence its ability to 'predict' the weather. The substratum of a Weather Loach tank should be fine enough to allow for this species' burrowing activities.



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majority of hobbyists first encounter the pleasurable pursuit of fishkeeping. The Common Goldfish makes an ideal pond fish (it is suitable for aquaria as well, of course), and will live for several years (I have heard of goldfish reaching 15 years and more!) while growing to a size of around 15in (38cm). (I have a London Shubunkin which is around 12 years old and is not put to shame alongside a handful of Koi.)

Similar in shape and size to the Common Goldfish is the London Shubunkin, which is a 'calico' variety sporting an overall light blue hue and dabbled with 'jewelled' scales of orange, red, brown and black. A similar type of pond goldfish is the Bristol Shubunkin, which has a distinctive 'B'-shaped caudal fin, developed, along with other specific characteristics of body-shape, finnage, and colouring, by specialist breeders over the past thirty years or so.

Turning to the round-bodied varieties, a good starting point is the Oranda. This is a highly-popular Fancy Goldfish variety, normally blood-orange in colour, with long flowing finnage and a distinctive fleshy 'hood'. It is because of the long finnage that it is preferable to keep such varieties in an aquarium, rather than a pond, as extremes of temperature can damage the rays of the finnage which, in turn, can introduce disease to the fish.

Such a fish as the Oranda deserves pride of place in an indoor aquarium. My own (and only) indoor aquarium, situated in my lounge, features one very large and very proud Oranda, dominating the room with its



Hamanishiki have bodies like Pearlscales, but with two 'bubbles' on the forehead.



A golden/orange Rancho may look similar — at first glance — to an Oranda. However, Ranchos don't have a dorsal (back) fin. In addition, they have arched backs, and very small caudal (tail) fins.

resplendent shape, colour and deportment. Such splendour would not really be appreciated in a pond environment, so perfectly appointed is this fish for viewing from the side.

One type of Oranda which is perfectly adapted for this type of viewing, and which has fans all over the world, is the very distinctively marked Redcap.

Additionally, admirable types of Fancy Goldfish for the aquarium are the Rancho and the Ryukin, which display quite different characteristics, and are equally popular among Goldfish enthusiasts.

The Rancho, otherwise referred to as the 'Lionhead' or 'Bramblehead', is a particularly regal fish, blood-orange in colouring and sporting two major characteristics: complete lack of a dorsal fin and an Oranda-type hood growth.

It has been said that, once you keep Lionheads, you will forever keep Lionheads, and I wouldn't disagree with that. Despite their short, round bodies and stubby finnage, the Lionheads always appear to be first to any food, and my own Lionheads appear to be quite inquisitive whenever I need to place a hand in the aquarium for regular maintenance.

The Ryukin, in my opinion, is the Angel Fish of the coldwater aquarium. Slender in width, yet with a round profile, the Ryukin is graced with long flowing finnage, paired and forked caudal fins, and a high dorsal fin, much like a sail.

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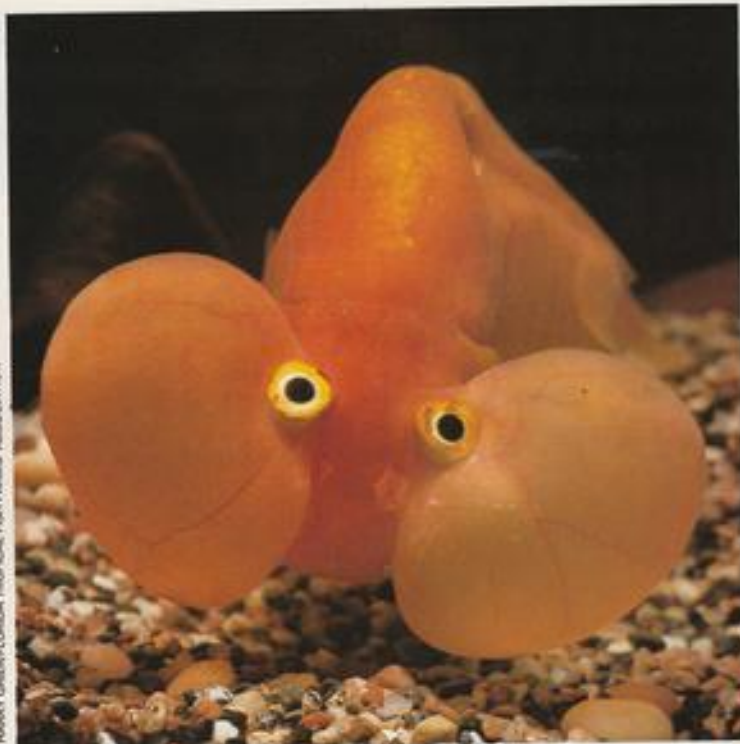


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The delicate fluid-filled 'bubbles' of the appropriately-named Bubble-eye are beautifully illustrated in this photograph of a top-quality Florida-raised specimen.

the Ryukin's humped-back appearance (a trait which, unfortunately, some breeders have inadvertently introduced into some other varieties of Fancy Goldfish).

Colouring of the Ryukin is usually red and white or calico, as described for the Shubunkin (above), although golden varieties can be found.

Other favourites worthy of a place in any Fancy Goldfish aquarium are the 'old stalwarts', the Fantail and the Moor, the latter now available in a range of 'Butterfly' varieties.

Veiltails are also available in large numbers, but quantity must not be confused with quality. Really good Veiltails are hard to find these days.

'New' types

Q What other types of 'different' Goldfish could I keep?

A New and fancy varieties of Goldfish are being introduced, seemingly, by the week, from Hong Kong and Singapore, providing a vast choice of colour, shape and finnage to suit every taste.

One of my particular favourites for the aquarium is the Hamanishiki (pronounced Han-an-ish-key). This is very similar to the traditional Pearlscale in appearance featuring an almost perfectly round body, rather like a golf-ball, with convex scales and short finnage. With the Hamanishiki, the 'forehead' of the fish sports two attractive 'bubbles', which develop considerably as the fish reaches maturity.

A further favourite of mine is a long-bodied variety which is suitable for either the pond or the aquarium, the Jikin (pronounced gee-kinn). This is one of the few long-bodied Goldfish varieties to feature a paired caudal fin, and this is one of the most important features of the Jikin. The Jikin is white in colour (most have a pink sheen); while the finnage only is orange. The only



Ryukins have very high backs, particularly when fully grown.

other position of orange colouring is on the lips, which gives a 'lipstick' appearance.

The finnage of the Jikin is short, and it is the caudal fin which provides one of its greatest attractions (for breeders, this presents its greatest challenge), being symmetrically forked, almost perpendicular to the dorsal line, and square cut.

Bubble-eyes

Q Can I keep Bubble-eye Goldfish in an aquarium with decorations and other fish without fear of the bubbles becoming damaged?

A The Bubble-eye is one goldfish variety which provokes the most response from people who are viewing Fancy Goldfish for the first time. Unlike many of the 'fancy' varieties of goldfish, the Bubble-eye has a long body and no dorsal fin. Particularly distinctive is a pair of inflated bubbles on the 'cheeks' of the fish.

In an appropriate indoor setting, and when viewed, preferably from above, the Bubble-eye can be quite attractive. There are several colour forms, ranging from common gold to lemon, calico, and even jet black.

One of the main concerns for the newcomer regarding the Bubble-eye, is potential damage to the bubbles. I would advise that one errs on the side of caution and, in common with keeping any fish, avoid any sharp objects in the aquarium which could pierce the bubble.

Should a bubble become damaged, it will deflate. The bubble, itself, contains only fluid, and the area of skin under the bubble is not generally susceptible to disease. However, care should be taken to ensure that disease does not enter the wound where the bubble is punctured.

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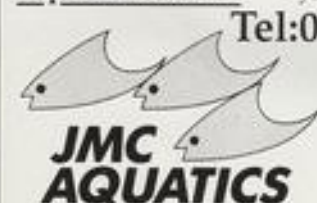
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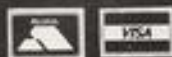


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SEXING AND BREEDING GOLDFISH

by Pauline Hodgkinson

Q How old do goldfish have to be before they can breed?

A Generally speaking, goldfish mature sexually when they are about two years old, but some individuals may mature much earlier. In fact, I have noticed that there is some degree of variance between fish from different strains. I, myself, have had female Lionheads breed at only 10 months old, with males from the same strain coming into spawning condition at around 12 months. Males, however, usually mature at a much earlier age than females.

phenomenon often mistake these pimples for White Spot, and I well remember many years ago a fish actually being disqualified from competition in an Open Show because the judge wrongly believed it was suffering from White Spot!

Rare as it might be, I have personally witnessed at least one female that developed a fine set of breeding pimples on her pectoral and pelvic fins, though, as I said, this is quite rare.

Females, on the whole, have a much thinner first ray in their pectoral fins, and, when carrying eggs, will be rather plumper

on their left side. In smaller females, this is more evident when viewed from above.

When selecting younger fish, the task of sexing them is rather more of a hit and miss business, but if careful observation is made, it is often possible to detect the male's slightly serrated edge of the first ray of his pectoral fins where the pimples or breeding tubercles will eventually develop.

The shape of the anal vent is also a give-away, though more difficult for the less experienced fishkeeper to differentiate.

Q How many eggs do goldfish lay?

A This can vary a great deal, but generally falls somewhere in the region of a thousand eggs, though large females may release many thousands. However, not all the eggs will be fertilised, and the number which are will obviously vary in each spawning.

Often, after a spawning, when the eggs begin to change colour, the fertile ones range from pale amber to almost translucent, while the infertile ones become opaque and white. The impression that can be created is that, possibly, the entire spawning is infertile, and the temptation is often felt, to disregard the whole lot. It really is wiser to resist this thought, because first impressions are almost always misleading. Later, when the tiny black eyes appear in the fertilised eggs, it is always a great relief to discover that, surprisingly enough, and in spite of earlier fears, there are many more emerging fry than we could ever have expected.

During the period when the fry are in the egg, strong aeration should be used to circulate water over them, keeping the water well-oxygenated and the eggs free of debris, thus helping to encourage the fry to hatch. Once they begin to leave the eggs, the aeration should be decreased so that the tiny fish are not battered against the current.

Q How often do goldfish breed?

A This, again, can vary from fish to fish, and from season to season. Some females may spawn twice, or even three times, during the breeding season.

One of my own female Fantails actually spawned four times, with only a period of two to three weeks between each spawning. She was quite a small fish, but she laid about a thousand eggs at each spawning and appeared to have been completely stripped of all her eggs on each occasion.

Some females are capable of breeding every season until they are quite old; others, it seems, breed only once, then never come into condition again.

Males generally come into breeding condition more quickly than females, and are often quite capable, when in the peak of condition, of joining in a chase and fertilising the eggs throughout the breeding season. Another point to bear in mind is that the size



Not all these young Fantails have ideal characteristics. Nonetheless, they are strong, colourful and healthy, all desirable features in any fish.

Ideally, fish are better chosen for breeding when they are at least 2 years old. The characteristics which will determine whether they are good enough to be parents or not will have revealed themselves by this stage. Faults which you would not like to be carried through to subsequent generations will also be more obvious in mature fish.

Q How do I sex goldfish?

A It is relatively easy to sex adult goldfish, though somewhat difficult when attempting to sex youngsters.

The male develops small, white, pimple-like growths on the leading edge of his pectoral fins. When in absolute, prime and peak breeding condition, these will increase to such an extent that they double, or even treble, the thickness of the first ray of these fins. At this point, the pimples also develop on the gill plates; they have also been known to appear on the leading ray of the pelvic fins as well.

Those fishkeepers not familiar with this



Healthy young Pearscales beginning to show the characteristic responsible for their well-deserved common name.

of the male in no way indicates the amount of milt he is likely to release.

Q Which variety of goldfish should a beginner choose for breeding purposes?

A It really is a matter of personal choice, although there are a few points to consider before making your final decision. Though the same methods are used whichever type you breed, it is the culling which makes the more exotic varieties perhaps the wiser choice for the novice.

Fancy Goldfish are creations made by man, and, like any other creature where man has changed its form from that of the original ancestors, nature will, in each subsequent generation, try to reverse the process. Those types of goldfish which are further removed from the original (Common Goldfish) are usually easier to cull, since many turn out to be poor examples of the type, as Mother Nature regains her hold on the species.

Culling is really the key to many aspects of successful goldfish breeding. Not only does it procure the finer specimens which, in their turn, may perpetuate the line, but it also removes those individuals of little value, and which are occupying valuable food and space best used to rear the better fish.

Unless you have unlimited space in which to raise your youngsters (and who among us hobbyists, is so fortunate?), it will soon become obvious that limited space will make it impossible to rear all the fish.

Things will very soon begin to go wrong if the babies are not given enough space to grow and develop properly. If one of the exotic types is bred, faults are more easily and quickly discovered. These, therefore, can be removed, allowing extra space, and food, for the better specimens.



Both the gill-cover tubercles and thickened front edge of the pectoral fin are clearly visible in this male Bristol Shubunkin.

Q Where can I obtain fish to breed from?

A As hobbyists with limited space, we really ought to attempt to breed the best possible quality individuals we can, simply because breeding goldfish requires time, trouble and patience, not to mention expense. Taking all this into consideration, it is obvious that it is pointless to rear just anything.

Crossing the varieties is another pointless

exercise as few, if any, of the results are of any value, either as ornamental subjects, or as future breeding stock. All that is accomplished is the undoing of work which may have taken decades to achieve.

Ending up with even a few good-quality specimens which are well-developed, show proper characteristics, are well-grown and in tip-top condition, makes all the efforts involved well worthwhile.

Choosing the best fish with which to produce good-quality youngsters requires good judgement, quite a bit of time and



PALLINE HODGKINSON

An excellent Calico Fantail female.

trouble, some expense and just a smattering of good luck thrown in. In the past, we have all complained about the quality of imports, but I must admit that in the last couple of years I, personally, have witnessed quite an improvement in many of the fancy fish offered for sale. Perhaps, the people responsible for importing our fish have, at last, taken heed of what the customer really wants, and are now demanding from their suppliers that the quality must improve if the increased interest in ornamental fish is to continue.

A few aquatic retailers also stock home-bred goldfish which are usually more expensive than the imports. These fish are often supplied by semi-professional breeders or hobbyists, who are limited to the number of fish they can produce. Their overheads are considerably higher per fish produced, with ever-escalating prices of heating which, in this country, is necessary to bring on baby fish, while livefoods add additional, substantial costs to the total amount.

Visiting annual specialist goldfish shows which take place, usually from August through to October, also offers the chance to meet breeders and acquire some of their surplus stock. It is also usually possible to find most varieties offered for sale in the Classified Adverts section in our magazine.

Q What should I look for when choosing breeding stock?

A A pair should be chosen with the view that they complement each other. In this way, they will, hopefully, improve each other's weak points, while strengthening the good ones. One fish may have excellent colour, while the other may be less colourful but may excel in body and finnage shape.

Take time to search the available sources for the variety and type you want. Never be tempted to buy fish which you consider to be poor specimens from a poor or mediocre batch. The results of such a choice cannot be anything other than poor or mediocre.

The fish we choose should be as near to our ideal as possible, and those with serious faults must be rejected since it is possible that these faults will be bred into the subsequent generations. Inspect the quality of the batch of fish where your selected fish will come from. If the overall look of these fish is

good and they have the body and finnage shape which you would like to see in the young fish you hope to produce in the future, then go ahead and make your choice.

If I were choosing, say, Lionheads, I would (after studying the group of fish which were available) probably choose youngsters, as I would prefer to purchase a few good young fish, rather than one or two adults. I would take into consideration, colour, body and finnage shape. An important thing for me to note would be the number of individuals with twin, paired caudal fins which were completely divided. If most, or all, the fish had webbed tails, I would then assume that this fault would be common in future generations.

I would hope to see good, smooth, rounded broad backs, though I would not necessarily choose the fish with the best body shape, rather those with the widest heads and better hood development. By this I would hope to continue with the broad head characteristic which tends to develop superior hood growth within the offspring, and by having seen evidence that this line was capable of producing fish with paired caudal fins and good body shape, I would hope that my selection would bring me all I might expect from carefully selected breeding stock.

However, as I have been breeding Lionheads for many years, I would have to be cautious about introducing new blood by way of my new acquisitions, since introducing inferior breeding stock into a good established line, can ruin many years of work. Therefore, I would breed at least two generations of my new stock before I could be reasonably happy that they have the gene make-up to complement and improve the quality of the fish my own line is capable of.

Q What equipment do I need for breeding my fish?

A As I discussed earlier, space to rear the fry is vital, so we really need several aquaria not less than 36 x 12 x 12 in (90 x 30 x 30 cm) even for a relatively small number of fry.

After about ten days, the fry must be moved from the tank where they were born into an aquarium where the water has been allowed to stand for about 48 hours and is at the same temperature as the water they have left. The first tank must be cleaned thoroughly to remove the infertile eggs which will have begun to putrefy by now. To attempt to remove infertile eggs directly after spawning has taken place really is impracticable. The first tank can then be refilled with the water to be brought back into service at a later date.

When the baby fish are about two weeks old, depending on the number of fish, of course, they will need to be divided up into other aquaria to allow them more space. Besides, not only do restricted living conditions cause stunted growth, they also cause stress, and it is very difficult to maintain and control good water quality in such tanks. Yet, this is vital if the fish are to survive, let alone, thrive. Poor conditions causes ill health, with outbreaks of disease likely to cause great losses.

Of course, not everyone can hope to install all the ideal equipment, but, to be successful — and by that I mean to rear your selected fish for the spawning, rather than those few which are strong enough to have survived — then, at least, two rearing aquaria are necessary. A pump to operate the air-stone, a heater with which to maintain the fish at a temperature around 70-72°F (21-22°C), nets, siphon tube, shallow white dishes (used to move fry from tank to tank, and when culling), plastic sweet jars in which to hatch Brine Shrimp (which form the second stage of the feeding programme for the youngsters), and a good magnifying glass to inspect the fry when they are quite small (in order to begin an early cull) are among the other essentials.

One thing I should include are spawning mops. These can be of any type of dye-fast, soft material, such as strands of net curtain, or strips of those soft plastic or raffia vegetable bags begged from your local greengrocer. I usually weight the base of a clump of stranded vegetable bags with glass marbles, securing a few corks to the opposite end to ensure that they float. The fish can then swim through the spawning medium with no risk of injuring themselves, even in the most enthusiastic chase.

A few years ago, pan scrubs were a popular spawning medium for goldfish breeders to use. However, they are, I think, made of rather a hard material which could (I am sure) rub off mucus from the body of the fish, doing them no good at all.

Q What type of food should I give to my fish to bring them into breeding condition?

A Concentrated feeding, offering a good, varied diet with plenty of livefoods to trigger the hormones which dictate the breeding



This young Lionhead shows excellent features which indicate that it might develop into a prize-winning specimen.

instincts of the fish, must be provided. Fish have seasons like other creatures and, often, a female is stimulated into 'coming into season' simply by a change in her diet, surroundings, or a change of company.

But, in order to make sure the fish are in the best of health, and that the roe and milt they produce are in the best condition, the parents need to be in top condition themselves. Therefore, the food they eat must contain all the vitamins and minerals they need. Finely chopped earthworms, live *Daphnia*, white worms and blood worms, as well as a good-quality flake, even porridge, are eagerly accepted and apparently enjoyed by the fish.

Q What temperatures do goldfish prefer to spawn in?

A Goldfish will spawn in a range of water temperatures between 55° and 72°F (13-22°C), though something between 60° and 65°F (15.5-18°C) appears to be the ideal, according to my records.

Usually, the fish give an indication of their intended spawning a few days before the actual mating with, perhaps, the occasional lazy chase, but with interest quickly disappearing. When the time is right, during the evening, the male will begin to make short bursts of a chase to show his interest in the female. As the evening progresses the chase will continue, the male showing increased interest. Usually, the pursuit will continue throughout the night, with the occasional rest period.

Early morning will find the fish at their most active, when the female will, at last, begin to shed her eggs and the male his milt. The union often continues until noon, with the fish taking short rests from time to time.

When you are satisfied that the spawning



These two-day-old goldfish fry have virtually consumed their yolk sacs and are nearly ready for their first feed.

is completed, you must remove the parents to a separate tank, otherwise they will begin to feed on the eggs. Remember to check that the temperatures are the same in both tanks.

The adults should be given food, for after so much activity, they are usually quite hungry. If the spawning took place at natural temperatures (or even if a heater was used to maintain a water temperature just below 70°F [21°C]) then this should be increased slightly to 70-72°F (21-22°C). This temperature should be maintained until the baby fish are about 1 1/2 inches (c 4 cm) body size. Then, natural conditions are better, so that the fish can become 'hardened off' to gain stamina for the cooler temperatures of autumn and winter.

Q What should I feed to my young fish?

A The fry will not need to be fed for the first 48 hours. Liquid food, such as Liquifyr, is the first food fry will usually be able to consume. This is suitable for the next couple of days.

Newly-hatched Brine Shrimp are small enough for the next stage and can be fed for a few days, after which small *Daphnia* can be given. Young goldfish can consume vast amounts of *Daphnia*, so it is well worth exploring local ponds in the hope of finding these crustacea, as nothing seems to promote the same growth rate in young fish.

There are, of course, other substitutes, like commercially made fry foods, or mashed white worms, which may be given once the babies are about 1/2 inch (2 cm) body size. As the fish grow, new foods can be introduced: flake and freeze-fried foods are excellent.

As soon as it is possible to siphon the floor of the aquarium without sucking up tiny fry, this activity should be started and repeated every day. All the frequent feeds produce a lot of waste, so, to keep the water in good condition, daily maintenance is a must.

Q When should I begin to cull the fry?

A Basically, as soon as faults become visible. An experienced breeder may be able to begin when the fry are about two weeks old, and here is where the strong magnifying glass comes in useful.

If the fish of the twin-tail types, the first fault to sort for is this characteristic. By taking a few fish in a shallow dish, and looking down on them, the single tails are quite easy to spot.

If the variety is one of the dorsal-less types, such as Lionheads, those fish with spikes or partial dorsal fins are also easy to see. As the fish grow, it will be easier to see if the tails are webbed; these too can be removed.

Continue to cull the fry by reducing their numbers systematically until only the very best remain. Those culled of a reasonable size may be offered to friends, or exchanged for goods at your local pet shop. If they are of excellent quality, some aquatic stores may even offer to buy them from you.

The essential ingredients for successful goldfish rearing are good water quality, the correct foods, space and warmth. If any of these things are absent, then you cannot hope to be successful.

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Letters

Cultured collections

I noticed in the November 1989 issue of *Aquarist & Pondkeeper* (Herpetology Matters) that the address information you have for the Culture Collection of Algae and Protozoa is out of date. We have had a few changes in recent years, as detailed below.

CCAP originally stood for

The Culture Centre of Algae and Protozoa, based in Cambridge. In 1986 the collection was re-housed at two sites. The acronym CCAP was retained, but the name changed to The Culture Collection of Algae and Protozoa. Protozoa and freshwater algae were transferred to the Freshwater Biological Association, Ambleside (FBA — now the Institute of Freshwater Ecology). Marine

algae were transferred to The Scottish Marine Biological Association, Oban (SMBA — now Dunstaffnage Marine Laboratory).

The situation now is as follows:

General enquiries and specific enquiries and orders relating to protozoa and freshwater algae should be addressed to:

Ms Jean Tompkins,
Administrative Officer, Culture Collection of Algae and Protozoa, Institute of Freshwater Ecology, The Windermere Laboratory, Far Sawrey, Ambleside, Cumbria LA 22 0LP. Telephone (096 62) 2468/9, Fax (096 62) 6914,

Telex 94070416 — WIND G.

Enquiries and orders relating to marine algae should be addressed to:

Mr Michael Turner, Culture Collection of Algae and Protozoa, Dunstaffnage Marine Laboratory, PO Box 3, Oban, Argyll PA34 4AD, Scotland. Tel (0631) 62244, Fax (0631) 65518, Telex 776216 MARLAB-G.

I hope that your readers will find the above of some assistance.

Jean Tompkins (Ms)
Administration Officer
CCAP

Water Lily Root Rot (Can you help?)

We are currently investigating this serious disease as a project linked with Philip Swindells of Wycliffe Hall, home of the National Water Lily Collection. Root Rot is a disease that affects Lily rhizomes (often referred to as tubers), turning them into a jelly-like mass and, eventually, killing them. It is also highly infectious and can spread very quickly through a collection.

We obviously need both affected stock and data for our research, so if any *A & P* readers could supply us with infected material and/or information summarising their experience of the problem, we would be most grateful.

Correspondence and specimens should be sent to me:

Dr J I Bentley,
Science Laboratories,
Askham Bryan College of
Agriculture & Horticulture,
York, YO2 3PR.

Thank you.



In recent years, some Water Lilies have been suffering from a very serious disease which has reached almost epidemic proportions in certain areas. A research programme is now underway to solve the problem, but assistance from *A & P* readers is required.

Aula Verlag books

In the January issue of the *Aquarist & Pondkeeper*, you reviewed **The Freshwater Fishes of Europe: Volume 9 — Threatened Fishes**, and gave an address in Germany.

Although I should stress we are not exclusive dealers or distributors for Aula Verlag, this book can be ordered from us. We have stock currently 'in transit' from Germany.

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Not-so-Exclusive Sunfishes

I read the letter entitled **Exclusive Sunfishes** in the January edition of *A & P* with some interest, particularly as I have been keeping Centrarchid fishes for a number of years. Over the period, I have provided myself with adequate literature covering these interesting subjects for the home aquarium and I would be delighted to assist your correspondent in any way I can.

Pauline Hodgkinson mentions that she has been unable to find a book which deals exclusively with this family; such a book does exist (I have a copy). Admittedly, it is highly technical and, in some places, difficult to understand. However, the information within its covers is considerable but, unfortunately, the book is not illustrated. Other books I possess are to the contrary and, in most cases, the pictures are accurate; one cannot argue with photographs.

The particularly informative book I have in mind is the **Handbook of Freshwater Fishery Biology, Volume 2** by Kenneth D. Carlander which deals with Centrarchidae (the Sunfishes) and nothing else. Its pages number up to 431 and it is published by the Iowa State University Press, Ames, Iowa. There is, however, one big drawback: I purchased this book in April 1980, so I would have no knowledge as to if it is still in print.

If it is not, if (s)he were to write to me personally, I could provide him/her with a good list of books covering the subject. I know for a fact that some of them are still in print.

Vernon Hunt,
Widley, Hants.

Editor's note:

Any *A & P* readers who are interested in taking up Vernon Hunt's offer of assistance should write to him c/o *A & P*. I will be only too pleased to pass on any letters.

John Dawes



The Pumpkinseed — there are some books, albeit only a few, which deal exclusively with the Sunfishes, the family to which this species belongs.

Flooded with disappointment

When one reflects on just how many natural history films and documentaries appear on our screens these days, it's very puzzling and, indeed, frustrating, to find that fish coverage is very limited. Oh, the coral reef doesn't do too badly, and the migration of the salmon has been pretty well covered, but, let's face it, even in this enlightened age, the vast majority of people are, basically, still in the dark as to the diversity of life — especially fish life — that exists beneath the waves.

I therefore agree almost entirely with David Sands' comments published in *Reflections* (A & P, February issue) that the BBC's programme *The Flooded Forest* fell way short of doing justice to this unique region. However, I say 'almost', because my particular interest has always been with 'Disc Characins' and I, for one, was mesmerised to see the many different varieties of these fishes behaving in the wild exactly as my own collection.

This apart, the programme, on the whole, was disappointing. Where were all the cichlids? And as for David Sands and other catfish enthusiasts, you have my sympathy. But, perhaps we should look upon the programme with optimism; it's a start at least.

So, maybe next time. . . .

Paul Hardy
Handsworth
Sheffield

Andy Horton on Andy Horton



Over the past year, I have had numerous letters asking me how I got started in the hobby of keeping British sea life in aquaria. I am also regularly asked about my attitude to conservation. Here, then, is a sum-

mary of my involvement, background and views.

I was just sitting at home one day, looked out of the porthole, and there they were, the first inhabitants of my marine aquaria, swimming around in their thousands around the boat in which I lived. Eventually, curiosity compelled me to capture some of the more common fish fry, usually referred collectively as 'whitebair', and place them in a bucket, and, soon after, an aquarium, just to discover what species they were. The large shoals consisted of Sand Smelt, and juvenile Bass and Grey Mullet. The year was 1979, and, at the time, I was unaware that marine fish could be kept successfully in aquaria.

First steps

I must thank Steve Barker, now from Lancing, who introduced me to the world of the seashore. I have lived beside the sea all my life, but I was still amazed to discover a world that exceeded my expectations. The most interesting species come from rocky shores, with which the Sussex coast is not particularly favoured. However, where there are the remnants of chalk cliffs, or where an artificial rocky habitat has been created by man's activities, the common species — Beadlet Anemones, Blennies, several species of Gobies, Butterfish, Hermit Crabs and the ubiquitous Shore Crab — were quickly discovered. Later, with more experience, the species list was considerably extended. Soon, one tank turned into half a dozen.

I had started in winter, and the summers of the early 1980s were cold. At the time I was using an undergravel filtration system with diaphragm air pumps, and real seawater obtained by the bucket method from over the edge of the boat.

Problems

Initially, the major problem was predation of one species upon another, especially the voracious Bullhead (Sea Scorpion), which would gobble up any smaller fish. Later, other problems occurred. Encouraged by my initial success, I believed that many of these could be overcome.

However, obtaining reliable information on keeping the various fish and invertebrates was very difficult. It also soon

became apparent that high temperatures during the summer were causing the demise of the coldwater species.

Writings

To cut a long story short, I was a writer before I became an aquarist, so, in the absence of anyone else writing on the subject (at the time there would have been some expert marine biologists who could have done a better job), I started a series of articles, beginning in 1982, with *Terror of the Rock Pool* in *Aquarist & Pondkeeper*, expounding the virtues of the Bullhead in the aquarium.

In 1986, after John Dawes had taken the reins as editor, I decided to get to grips with the problem comprehensively. To this extent, I was aided by the expansion of the aquarium industry, and the marketing of products, especially the powerheads, and artificial salt mixes, which made marine fishkeeping possible for anyone willing to take elaborate care over his/her aquarium. Also, many books on the hobby were published. (*The Interpet Guide to Marine Aquariums* by Dick Mills [Salamander] is a recommended starting guide.)

Seashore world

I find the marine world, and the discovery of the seashore, to be the most fascinating, and compelling, part of the wildlife kingdom. It is also often ignored by terrestrial naturalists. This seems absolutely ridiculous for a nation surrounded on all sides by sea, and with 6,095 miles of coastline, not including 942 islands!

Reactions are mixed, generally favourable, varying from awe and wonder to knowledgeable interest. But then, there are the 'experts', who, after being presented by incontrovertible photographic evidence of sea anemones, refuse to believe that such animals exist some 100 yards away on the shore from where they are sitting. I wish they would stop referring to them as 'flowers'!

Conservation

Sometimes, I think it is a good idea that this sort of aquarist is not so popular. Although collecting for home aquaria, indistinguishable from collecting for scientific purposes, is unlikely to demude the coast of the (mostly) abundant species, certain popular areas

could be over-exploited. The pressures from fishing and pollution pale the keeping of wild animals from the shore into insignificance.

I firmly believe that an increased interest in the world of the seashore is likely to be positively beneficial, with an increased awareness of the marine world leading to demands for protection of vulnerable habitats. I would discourage unlicensed trade in British species, which, in any case, I believe is unlikely to be worthwhile.

In my writings I endeavour to present the facts in a useful way, often stressing the 'temperature' problem: 50% of the most commonly collected species will not survive in uncooled aquaria throughout the summer, e.g. Butterfish.

Aquaria

Nowadays, I keep only three or four aquaria at any one time, to view some of my favourite British species, including 14 species of Anthozoa (Sea Anemones and Corals), two species of Echinoderms (Spiny-skinned animals: Starfish and Urchins), 10 species of Crustaceans (Prawns and Crabs), several small fish, including Blennies and Gobies, plus a collection of Molluscs. A few other species are introduced on a temporary basis.

Duplicate undergravel and external filtration systems are in operation. One aquarium is fitted with a cooling unit. There are plans for a 100-gallon (450-litre) aquarium, and a digital thermostat to control the temperature in the 'cooled' aquarium precisely.

I still visit the local seashore (Brighton → Worthing, Sussex) on a regular basis, and other parts of the coast during the summer. Any interesting and original finds and observations of public interest are included in my A & P articles, with more esoteric material reserved for *Mari-News*, the journal of the British Marine Aquarists' Association.

I also present an introductory 'Slide Show' for local natural history and photographic clubs. I am always pleased to discuss aspects of the hobby and the marine world, and answer letters (SAE please), sent to me via *Aquarist & Pondkeeper*.

Andy Horton
Shoreham-by-Sea
Sussex

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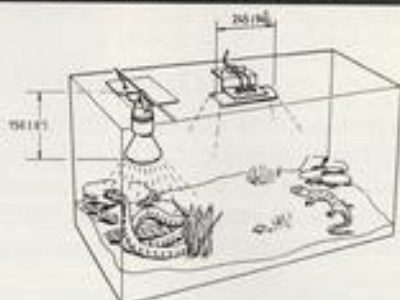


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Coldwater jottings

Stephen J. Smith



Natural cycle for successful spawning

The vagaries of the weather over the past couple of years seems to have brought its own set of problems for the cold-water fishkeeper — not least, to the Goldfish breeder. Now, one would have thought that things could not have been better, with mild winters followed by just about the best summers on record!

Far from it. Neither a mild winter, nor a hot summer, provide the coldwater breeder with any real favours. True, the apparent luxury of warm water during the growing season has much to commend it. But major problems occur when stocking levels are too high for the pond: warm water incorporates less oxygen than cool, and the result, last year, was several telephone calls from frantic fishkeepers whose fish were gasping at the surface.

The cure? Firstly, stock as few fish as possible in the pond (or aquarium); and, secondly, if you find that your fish are gasping this season, spray fresh water over the surface of the pond, directly from a hose.

"But what can be the problem with a mild winter?", I hear you ask. The answer, again, is quite simple. In common with just about every living organism, fish live by a biological 'clock'. Not only are the cycles on a daily basis, linked to day and night (light and dark), but they are also annual, linked with the seasons.

Thus, towards the end of the summer, coldwater fish take in additional food stocks to last them over the winter, when food is scarce. Because of this scarcity of food, they also lie dormant, thus consuming as little of their reserves as possible.

However, the warmer temperatures of a mild winter cause the fish to be more active, and this activity consumes much of the additional reserves taken in towards the end of the previous season. All it takes is a cold snap at around February/March and the result is a number of ailing fish, often suffering from bacterial attack, through a lowering of resistance.

A further setback of a mild winter is a reduction of the 'trigger' effect which would normally occur when spring follows a cold winter. This is much the same effect which causes trees to bud and crocuses to emerge, as well as insect life to awaken. Such insects are the diet of a brood fish as it conditions itself for spawning, triggered, again, by seasonal influences.

A 'false' mild winter is also often provided by well-intentioned fishkeepers who bring fish indoors over the colder months. In consequence, the fish may often fail to spawn or, at best, spawnings may well turn out to be infertile.

While I would agree that it might be sensible to overwinter precious specimens away from the harshness of the pond, do so where seasonal conditions of cold and minimal light will still prevail.

A greenhouse makes ideal winter quarters, where the hobbyist can attend to the responsibilities of husbandry, themselves protected by wind and rain, as well as the fish. The fish will undergo their natural metabolism and, at the onset of spring, conditioning can be assisted with the introduction of finely-chopped red earthworms.

Subsequently, spawning can be undertaken within the same greenhouse as the weather becomes warmer, and the parent fish returned to (newly-cleaned) ponds for the summer, once spawning is completed.

Danger in overfeeding

A further potential hazard at this time of the year is the temptation to commence feeding a little too vigorously. The mild weather has resulted in the majority of pond fish patrolling their waters near the surface, apparently on the lookout for food.

And this is exactly the case! However, the temptation to throw in a handful of pellets or flake should be resisted at this stage. True, the fish are looking for food, and will initially take quite readily to your 'treat' — and could die as a consequence.

As reflected above, the onset of spring brings an awakening of plant, animal, and insect life. The fish are beginning to condition themselves for their first spawnings and are, thus, actively taking advantage of the odd insect which strays into, or onto, the pond surface.

However, the fish will take only what food they need and will be digested fairly quickly (few people realise that Goldfish and related species have no stomach in which food can be stored and digested, but a long gut within which food is digested as it passes).

The introduction of your food 'treat' will result in either, or both, of two consequences:

- 1 Any food taken will lie in the gut and, with the onset of the cool night, or worse, a cold snap, will begin to decay; or

- 2 Uneaten food will sink to the bottom of the pond and decay there, causing inevitable pollution problems.

So, by far the kindest 'treat' at around this time of the year, is to leave well enough alone, stand back from the pond and enjoy your fish taking their time at nature's table.

Tailpiece

Already, the show season is upon us, with the return of the favourite events around the country and the introduction of some new shows for coldwater enthusiasts.

I have heard talk of the first Open Show held by the Isle of Wight Aquarist Society to be held sometime over the summer. This is a bold venture which deserves every success. I hope to bring you further news when the date is confirmed.

In the meantime, a large contingent of coldwater entries is anticipated at Cannock and District Aquatic Society's Open Show and auction, held on **Sunday 20 May** at Avon Road Community Centre in Cannock. Further details and show schedules are available from P. Griffiths, 10 Medway Walk, Brownhills, West Midlands (Telephone: 0543 371924).

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Spotlight

BACOPA IN THE AQUARIUM

Expert guidance from Arend van den Nieuwenhuizen on how to tell the various species apart, and on how to grow them successfully in aquaria.

(Photograph of *Bacopa caroliniana* by the author)

The genus *Bacopa* belongs to the Scrophulariaceae which contains some 100 species and is found in tropical and subtropical areas worldwide. As far as I know, only four species have been more or less successfully cultivated in the aquarium hobby — *B. caroliniana* (Walter) Robinson (synonym *B. amplexicaulis* (Pursh) Wettstein), *B. crenata* (Beauvois) Hepper, *B. monnieri* (Linnaeus) Wettstein, and *B. rotundifolia* (Pursh) Michaux Wettstein.

According to Prof Dr de Wit there are two other species which may, perhaps, be cultivated in the aquarium, given favourable conditions, namely *B. floribunda*, which derives from, inter alia, Java (Indonesia), and *B. procumbens*, which is distributed over the tropical regions of the Americas and in Java. But, unfortunately, there is not a single report in the aquarium literature on experiences with these, so we must restrict ourselves to the four other species named above.

Bacopa crenata

Of these, the least known is *B. crenata*, with a single report by the plant expert Christel Kasselmann (1982). She describes how this plant was first discovered during an expedition to Tanzania, on the tiny island Mafia, which lies some 20Km from the Tanzanian mainland, where it was found in a swampy area close to the locality for the Killifish *Nothobranchius kribbianus*, which is endemic to Mafia.

During the same expedition the plant was found in a second locality on the island of Zanzibar. A few shoots were brought back but lost through incorrect culture. Fortunately, it proved easy to produce new plants from seeds which were also brought back. Three months after the seeds were sown in damp earth, the plants were large enough to be tried out in the aquarium. It became apparent that only those specimens which were subjected to high light intensity developed submerge leaves, while all the other shoots failed.

Christel Kasselmann reports that, after a year of cultivation, it can be said that *B. crenata* is suitable for the aquarium, but

grows very slowly. Unfortunately, it is consequently rarely seen in the hobby, and is unknown to the average aquarist.

Bacopa rotundifolia

The second species, likewise poorly known, is *B. rotundifolia*. This is found in the southern part of the United States, where it grows as a marsh plant with creeping stems whose upper halves eventually become vertical. As it grows and creeps, the plant develops roots at joints in the stems. Under certain (poor) cultural conditions, the leaves elongate and the plant becomes difficult to distinguish from *B. caroliniana*.

By contrast, under optimal conditions the differences are very clear. Optimal conditions, as I have been able to establish in the past during visits to plant breeders in Singapore, involve cultivation in damp or waterlogged rooting medium, high soil and air temperatures, and an iron-rich substrate. The difference between this species and *B. caroliniana* is then immediately obvious. Firstly, the leaves are clearly round, hence the common name 'Round-leaved Fat Plant', and, secondly, the white leaf veins are a striking character.

It is this feature, above all, which leads the aquarist to buy this plant when (s)he sees it at a dealer's — (s)he then places it in an aquarium without any knowledge of its requirements, and is very disappointed to discover that its culture is not easy, and the beautiful young growth dies back.

In order to avoid this, a little background information is needed. I, myself, saw this plant for the first time in the '50s in the Botanic Garden at the University of Leiden, and learned from the curator, who was also a keen aquarist, that this *Bacopa* species is really suited only to emerse cultivation as a marsh plant. But, at the end of the 1960s/beginning of the 1970s, I established that submerge culture is also possible, as long as one attends to the requirements of this plant.

Above all, it requires the highest temperature of all the *Bacopa* species cultivated in aquaria — 25-27°C (77-80°F); it also requires more light. This means that it is suited to, for example, shallow aquaria with a depth of

25-35cm (c 10-14in). In larger aquaria with a depth of 40-50cm (c 16-20in), its culture is much more difficult and more intense lighting must be provided. For example, in an aquarium of 175 x 50 x 60cm (c 70 x 20 x 24in), at least three fluorescent tubes of 58 watts are required.

If the aquarium is terraced, then this plant should be planted on a terrace. In any case, it is important that it is free-standing. The leaves of adjacent shoots should not shade each other and should not be shaded by the stems of neighbouring groups where these float along the surface, nor by floating plants.

B. rotundifolia also requires a special substrate composition — this should be loose, composed of sand and gravel, mixed with commercial laterite, or thoroughly seeded with iron. A combination of both is best, but it is necessary to experiment to find the correct dosage, which is, to some extent, dependent on water chemistry. Obviously over-dosing is to be avoided. If one neglects only one of these requirements, this plant will not go well.

Although *B. rotundifolia* grows rather slowly, it is easy to propagate. One can, if one has only a few plants, lay the lower part of a stem along the substrate and fix it in place at both ends with pieces of lead strip. Under optimal conditions, roots will form on the joints in the stem and new shoots will spring from the leaf axils. Older vertical shoots which are already well-rooted will throw new shoots, mainly from the lower part of the stem. In both cases one can remove the offshoots when they are 7-10cm (c 2.75-4in) in length. Do not pinch them out, but cut them from the main stem with a sharp razor blade. The shoots should be carefully inserted into holes in the substrate which should then be infilled. With good culture, *B. rotundifolia* will form a very striking and eye-catching group of plants in the aquarium.

Bacopa monnieri

This is also the case with the two species of *Bacopa* which have been known in the hobby for a long time, *B. monnieri* (sometimes

wrongly described as *monnieri* or *monnieri*) and *B. caroliniana*. Of the two *B. monnieri* requires somewhat less heat than *B. rotundifolia* but somewhat more than *B. caroliniana*, a fact that can be attributed to its worldwide distribution in warm climatic zones.

The long inverted oval leaves of this species are, depending on conditions, some 10-20mm (0.4-0.8in) long with a width of from 4 to almost 10mm (0.2-0.4in). The smaller and narrower the leaves, the poorer the cultural conditions. Usually this means inadequate lighting, as indicated by the elongation of the stems between joints. The thicker the leaves on the stem, then the better the lighting conditions and the more attractive the group.

With good culture, *B. monnieri* grows fairly quickly and is therefore best suited for the average aquarium with a depth of 40-45cm (16-18in). This species has a requirement for iron, although this is less than for *B. rotundifolia* and *B. caroliniana*.

An important factor is an average temperature of 24-25°C (75-77°F). This plant does better with a somewhat higher, rather

than a lower, temperature. It is also sensitive to wastes and incorrect pH. If the pH lies somewhere between 7.4 and 8.5, or higher, then action is necessary. In such cases, treatment with, inter alia, carbon dioxide, is very desirable, in conjunction with regular partial water changes. There is a variety of this species, namely *B. monnieri* var. *cuneifolia* which has somewhat broader leaves with a narrow base.

Bacopa caroliniana

The species best suited to aquarium culture is *B. caroliniana*, though it cannot be said to be an easy plant. Far from it. During the '50s and earlier, when our aquaria were poorly illuminated, it was considered difficult. In the mid-'50s, when I grew this plant in my small greenhouse under daylight conditions with plenty of sun, I established that it was a very beautiful and attractive species.

As regards requirements for water chemistry and iron (or carbon dioxide), it is

comparable with the previous species. But I must add that, in my view, if good water quality and, above all, strong illumination, are provided, the iron is less important. I grew my plants in unwashed sand or a mixture of sand, peat, and clay, with a water hardness of 2-8 GDH and a pH of 6.6. Today, however, one can no longer compare the water quality with that of yesteryear. . . .

Under strong sunlight, the leaf veins are red. Under strong artificial and spectrally balanced lighting, combined with the addition of iron, the otherwise mainly bright green leaves may become reddish. As regards temperature requirements, it must be remembered that the range of this species is mainly in the temperate climatic zones on the Atlantic coast of the central and southern USA. In the aquarium, the ideal temperature is about 22°C (c 72°F), but *B. caroliniana* does well up to 25°C (77°F) and will withstand temperatures down to about 18°C (c 64°F). It is easily propagated by cuttings. New shoots will grow on a decapitated stem, and, if there is sufficient space, will eventually form an attractive clump.

SOME USEFUL BOOKS ON AQUARIUM PLANT CULTIVATION

1. INTERPET GUIDE TO AQUARIUM PLANTS, by: Barry James. Pub: SALAMANDER.
2. THE COMPLETE BOOK OF AQUARIUM PLANTS, by: Robert Allgayer and Jacques Teton. Pub: WARD LOCK.
3. THE COMPLETE GUIDE TO WATER PLANTS, by: Helmut Mühlberg. Pub: E. P. PUBLISHING LTD.



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4th February, 1990

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News

'Aquarian' advisory service lecture tour



1990 will be an important year for Dr David Ford. As Head of the 'Aquarian' Advisory Service, he will be lecturing to aquatic clubs and societies around the country on the hobby of fishkeeping. David Ford's 1990 lecture tour looks set to follow the tremendous success of recent years during which he has given over 300 of these talks in many countries.

This year, David will be presenting a double bill lecture at each of the venues: 'Fish Nutrition', which outlines what and what not to feed fish, and 'Aquaria International, Fishkeeping around the World', a personal view of fishkeeping in sixteen different countries.

If you are interested in joining David and his hosts for an evening of fun, lectures and discussions, he can be found on

the following dates, lecturing at shows and meetings. All the host societies and clubs will be delighted to welcome newcomers and members alike (if you are not a member of your local society, here is an excellent opportunity for you to meet the members and join the club).

1 April: Catfish Association Convention, Wigan Pier. Further details from Mrs D Hodges, 46 Victory Road, Blackpool.

23 and 24 June: Association of Aquarists Fishkeeping Show, Sandown Racecourse.

9 August: Scarborough Aquarist Society. Details from Scarborough and District Aquarist Society, Racecourse Road, East Ayton, Scarborough.

2 October: Great Yarmouth Aquarist Society. Details from Great Yarmouth and District Aquarist Society, 153 Northgate Street, Great Yarmouth.

27 and 28 October: British Aquarist Festival, Manchester, at 'Bowlers'. Further details from Alan Darby, 1 Perrin St, Hyde, Cheshire SK14 1LE.

10 and 11 November: Pontins Holiday Camp, Weston Super Mare. Federation of British Aquarists' Aquatic Festival. Further details from Mike Clarke, Interpet Ltd, Vincent Lane, Dorking, Surrey.

For further information please contact: Emily Phelps Brown, The Grayling Company, 4 Bedford Square, London WC1B 3RA. Tel: 01 255 2424.

Obituary — Mike Chivers

Blagdon Water Gardens regrets to announce the death of their Chairman Mike Chivers on 3 February 1990.

Mike founded Blagdon Water Gardens in 1964. At that time the company was a retail water garden centre operating in his back garden. This expanded rapidly and Blagdon became the major wholesaler of water garden products for the

SW. Very soon Blagdon introduced its own brands of pool liners, pumps and statuary, all of which have now reached national market leader status. One of Mike's many achievements was to instigate the manufacture in the UK of the Henri Studio stone statuary range.

Now, with the acquisition of KFS Germany, Blagdon is probably the largest manufacturer of water garden products in the world — a fine tribute to a great character.

Shark alert at the Yorkshire Museum!

Just when you thought it was safe to go back in the Museum . . . the Yorkshire Museum brings you **Monsters of the Deep!** This major exhibition runs from Easter to Christmas 1990 and will appeal to children, families and holiday-makers, as well as people with a special interest in marine life and science.

Visitors to the exhibition at Museum Gardens, York, will become underwater explorers as they take a journey 10,000 leagues under the sea. **Monsters of the Deep** will bring an underwater world to life within the walls of the Museum. Life-size models, museum specimens and live creatures, such as sharks and octopus, will combine with special audio-visual effect to create the compelling illusion of walking along the sea bed.

Aquarium Fishkeeping Exhibition 1990

The Aquarium Fishkeeping Exhibition is, once again, being held at Sandown Park on **Saturday and Sunday, 23-24 June, 1990.** The format will be similar to previous shows, with club-decorated stands, and all types of equipment and fish for sale, catering for the person with either just a goldfish, a pond, or a single aquarium, or the hobbyist with a number of

Man's own relationship with the sea will also be examined. Modern submersibles and underwater exploration on display will illustrate advances in marine research and its importance in investigating conservation issues. This exhibition will show how we can all help make sure that the monsters of the deep which thrill us today don't become extinct species of tomorrow.

Opening hours: Mon-Sat 10 am-5 pm; Sun 1 pm-5 pm. Last admission 4.30 pm. **Tickets:** Adults £1.80; children & OAP's £1.00; family £4.50. Special rates for parties. North Yorkshire schools free. Ticket price covers entrance to the Roman, Viking & Medieval Galleries, which remain open throughout this special exhibition. Further information from: **Clare Mathias, Linton House, 92 Front Street, Sowerby, York YO7 1JJ. Tel: 0845 22159.**

tanks and/or ponds.

Personalities from within the hobby — available to discuss any problems you may have — will form a special feature of this year's event, while the **Big and Beautiful** display will, no doubt, attract thousands of visitors once more.

The Aquarium Fishkeeping Exhibition 1990 is promoted and staged by Aquarists Ltd, on behalf of the Association of Aquarists. For further details, ring: 0256 29998, 0256 22545 or 0705 474404.

Aquaria & Watergardens '90 update

The latest news from the organisers of **Aquaria and Watergardens '90** is that the show is coming along swimmingly(!). Over 75% of the space has been reserved, sold, or otherwise committed, and the lecture schedule is, reportedly, looking very good.

The lectures are both for the trade and public. They are all free and are being held in superb, purpose-built theatres, situated on the mezzanine above the new Hall 6 at the NEC.

Advance tickets are now being sold, at the special discounted rate of £2.25 adults (on the day rate: £2.50); £1.25 for children under 14 (£1.50) and £6 (£6.50) for families. The family ticket includes two adults, two children and copy of the

show guide.

All, or as many, of the art competition entries as possible will be exhibited during the show, including the winning entries, of course. The crèche will be open throughout the exhibition for the under-sevens and Ferdie-dee the Clown will provide entertainment for all children in the play area.

The exhibition will also be host to the "biggest-ever-yet" trophy being presented for the FBAS British Open, sponsored by Interpet.

For more information contact: **Concept Conferences and Exhibitions Limited, 27 Brandreth Avenue, Dunstable, Bedfordshire LU5 4JP. Tel 0582 601456.**

MORE NEWS ON PAGE 104

Books

The Freshwater Fishes of Europe

Vol. 1, Part II

General Introduction to Fishes;

Acipenseriformes

Edited by: Juijai Holcik

Published by: AULA-Verlag

Price: DM 236*

ISBN: 3-89104-431-3

*See AULA-Verlag Books on Letters Page in this issue of *Aquarist & Pondkeeper* for further details.

General Introduction to Fishes; Acipenseriformes is a sister volume to **Threatened Fishes** which we reviewed in the January 1990 issue of *Aquarist & Pondkeeper*. Like **Threatened Fishes**, it is also extremely comprehensive and authoritative.

As the title indicates, there are two sections to this 467-page volume, Part A consisting of a **General Introduction to Fishes** (147 pages), while Part B takes a close look at the **Acipenseriformes**, the Sturgeons.

Everything from morphology to reproduction, ecology, conservation, zoogeography, distribution, history, and, even, palaeontology (fossil history) comes under close scrutiny in Part A. If you've ever wondered what a 'heterocercal' caudal fin looks like, it's here. So is the Weberian apparatus found in catfish and other related fishes. So are instructions on how to go about measuring a fish, and how freshwater fish relate to their environment, including the roles played by temperature, oxygen and water movement in streams, lakes and reservoirs.

Threats to native fish populations arising from pollution, land and water use, introduction of exotic species, and hybridisations are also discussed, as is the role of captive-breeding programmes and fisheries.

The final section consists of a **Key to Families of European Freshwater Fishes** which is as easy to use as it's comprehensive.

All in all, Part A is excellent, in my view, and could have formed a most worthwhile publication in its own right, particularly if a selection of good-quality colour and black-and-white photographs were to have been brought in to supplement the well-executed line drawings and maps.

The closest most of us ever come to a representative of the **Acipenseriformes** (Part B) is the occasional Sterlet (*Acipenser ruthenus*) — almost exclusively sold for cold-water aquaria — or genuine Caviar on toast!

If there was ever a question about Sturgeons that you've always wanted to ask... but never dared to... you'll find it here. Quite simply, this part of the book is a real masterpiece, albeit a disturbing one (in that so many of the species are now known to be under serious threat).

Every entry contains the English/French/German/Russian names for each species, in addition to its current valid scientific name,

plus all the known synonyms, locations of the holotype (where known), etymology (derivation of the scientific name), description, morphology, karyotype (chromosome complement), protein specificity, osteological characteristics, sexual dimorphism, variations, age and size variability, taxonomic remarks, subspecies, hybrids, distribution, introductions, ecology (including habitat, migrations, hardiness, feeding habits, longevity, growth and population dynamics), reproductive biology (maturity, gonads, spawn, spawning period, spawning sites, mating habits, spawning habits and early ontogeny [development]), important parasites and diseases and, finally(!), economic importance and literature.

Having waded through all this, there can't be much else that can possibly spring to mind; well, at least, not without a great deal of thought! A further added, and very welcome, bonus is that the text, while being crammed with relevant data is, nevertheless, very readable.

General Introduction to Fishes; Acipenseriformes must be regarded as essential reading for all ichthyologists, students and researchers. It could also be profitably consulted by anyone who is interested enough, and determined enough, to go 'below the scales' and discover just how fish are put together and behave.

If the considerable cover price puts you off (and it might!), it would be worthwhile encouraging your local library to obtain a copy.

John Dawes

The Macdonald Encyclopedia of Amphibians and Reptiles

By: Massimo Capula, with photographs by

Giuseppe Mazza

Published by: Macdonald

Price: £9.95

ISBN: 9 780356 188133

Amphibians and Reptiles is the latest in Macdonald's ever-expanding series of small (19 x 11.5cm), colourful, reasonably-priced encyclopaedias.

It is compact, concise and well-presented, and constitutes an easy-to-follow, quick reference guide to more than 200 species from all over the world. Its overall cover size also makes it an ideal travelling companion for on-the-spot identification.

The photographs are uniformly good and the text perfectly adequate, though not exhaustive. In fact, if there is a criticism of this otherwise very good book, it must be on the 'non-exhaustive' nature of its coverage.

Any book, almost by definition, is 'non-exhaustive', and this one is no exception. Having said this, though, some omissions are easier to accept than others. Therefore, while I have no trouble in accepting the inclusion of some lesser-known species, such as the Greater Siren (*Siren lacertina*), or the Ceylonese Caecilian (*Ichthyophis glanis*) — indeed, I welcome these — I find it

Amphibians and Reptiles



somewhat more difficult to fathom out omissions like the Natterjack Toad (*Bufo calamita*), or the Palmate Newt (*Triturus helveticus*), or some of the *Dendrobates* Poison Arrow Frogs, such as the popular 'golden' species, *D. auratus*, or — a real surprise, this one — the Marsh Frog (*Rana ridibunda*).

On the reptile front, the Blue-tongued Skink (*Tiliqua scincoides*) is beautifully illustrated; yet, this is the only species featured — no mention is made either of the 'other' Blue-tongue (*T. gigas*), or the equally impressive Pink-tongue (*T. gerrardii*).

Other notable absences include some of the single-sex lizards such as *Cnemidophorus neomexicanus* and *Lacerta unisexualis* (see **Julian Sims' Herpetology Matters — A & P**, November 1989). Out of the 30 or so species of Rattlesnakes, 27 *Crotalus* and three *Sistrurus*, only two warrant mention: *C. adamantus* — the Eastern Diamondback Rattlesnake — and *S. catenatus* — the Massasauga or Swamp Rattler.

These, and other, omissions are probably the result of having to deal with amphibians and reptiles in the same volume. In my opinion, this approach should be discontinued by publishers as soon as possible. Whenever they are considered together, neither is given the coverage it rightly deserves. Why lump them together in the first place? Is it more logical to adopt this approach with these two major groups than, say, with fish and amphibians, or fish and reptiles? I think not.

These criticisms notwithstanding, **Amphibians and Reptiles** represents a valiant, and commendably successful, attempt by the author to present an overall, competently packaged picture of a sizeable selection of species from all over the world.

I would therefore warmly recommend this book to all herpetologists, especially since the inclusion of an extensive bibliography, consisting of **General Works**, **Works on Various Groups of Amphibians and Reptiles**, and **Works on Amphibians and Reptiles of Various Geographical Areas**, will help overcome the shortcomings that have resulted from attempting to squeeze a quart into a pint pot.

John Dawes

News from the societies

Hounslow and District Aquarist Society

AGM News: The Chairman, R Allum, thanked the members of the outgoing committee for their cooperation at all the society's events throughout the previous year. The Open Show had, once again, been highly successful, with over 300 entries benched. The society's outings to wildlife areas and fish breeding establishments had also proved popular and very enjoyable.

The following members were elected to serve on the 1990 committee:-

Chairman, R Allum;
Secretary, R Nelhams;
Treasurer, K Marriott;
Show Secretary, T Butler;
Newsletter Editor, A Con-

stantene;
Librarian, P Anderson;
Trophy Secretary, T Wilson;
Floor Members, P Cairn and D Wallace;
P.R.O./Press Officer, Mrs R Brewer;
Social Secretary, Mrs D Marriott.

The meetings are held at St Stephens Church Hall, Parkside Road, Hounslow, on alternate Wednesdays. All enquiries to the Secretary, R Nelhams, 35 Exceford Avenue, Ashford, Middlesex.

Macclesfield Aquarium Society

The 1990 committee positions for the above society were filled as follows at the AGM held on 10 January:-

Chairman, K Lawn, 29 St

Johns Road, Macclesfield;
Vice Chairman, T Jackson, 38 Thirlemere, Macclesfield;
Secretary, Mrs K Hayter, 96 Galsworth Road, Macclesfield;
Show Secretary, Mrs J Lawn, 29 St Johns Road, Macclesfield;
Treasurer, Mrs S Macdonald, 74 Thornton Avenue, Macclesfield.

Strood and District Aquarist Society

Current committee posts for the above society are as follows:-

Chairman, Peter Cottell;
Secretary, John Pell;
Treasurer, Alan Best;
Show Secretary, Andy Kelford.

All correspondence and enquiries should be addressed to John Pell (Secretary), 44

Lakewood Drive, Gillingham, Kent ME8 0NS. Tel Medway 389362.

Invitation to Societies

All aquarium clubs in the UK and Ireland are invited to apply to **Water Features Publications**, on their club letterhead, to receive a free gift suitable for a club raffle or Open Show prize (worth over £20, and limited to first 50 clubs that apply).

Additionally, if your club is holding an Open Show this year, **Water Features Publications** will award a prize voucher to every entry placed 1st, 2nd and 3rd in every class.

Write, giving the date of the Show, and the name of both club and Show Secretary, to **Water Features Publications Ltd., FREEPOST 490, Redbourn, St Albans, Herts., AL3 7BR.** Even the postage is **FREE!**

Diary dates

Oldham & District Aquarist Society

The 1990 Oldham & District Aquarist Society Open Show will be held at Werneth Park, Frederick Street, Oldham on **Easter Sunday 15 April**. Further information and show schedules can be obtained from Arnold Chadwick, Show Secretary, 9 Bronville Close, Chadderton, Oldham. Tel. 061 652 6207.

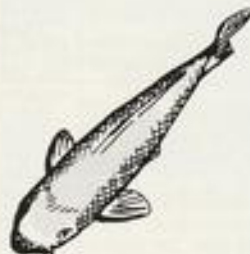
Kirkcaldy Aquarist Society

The K.A.S. annual Open Show will be held on **Sunday 22 April** at Balwearie High School, Balwearie Gardens, Kirkcaldy. Further details: Peter Symington, Show Manager, 60 Colonsay Street, Perth PH1 3TU. Tel. 0738 37558.

Yorkshire Koi Society

The Spring Open Show of the Y.K.S. is to be held at Harewood House, near Leeds, on **Sunday 27 May 1990**. Trade Stand details from Steve Lamb, 24 Patterdale Drive, Rawcliffe,

York, YO3 6TW. Tel: 0904 626655. Entry details from Ian Wallace, 5 Victoria Rise, Pudsey, Leeds, LS28 7SU.



The Summer Show will take place on **Monday 27 August**, again, at Harewood House. The contact addresses and 'phone no. remain the same as for the Spring Show.

Hucknall & Bulwell Aquarist Society

The above society's Open Show will take place on **Sunday 15 April**. Venue: Bulwell Youth and Community Centre, Coventry Lane, Bulwell, Nottingham. Judging will be to

FBAS rules and standards. Full details and Show Guide from the Show Secretary, Bill Pottinger, 8 Newcastle Avenue, Gedling, Notts. Telephone enquiries: c/o the Treasurer, Arnie Daniels on 0602 203672.

East Kent Aquatic Study Group

The 7th Open Show of the E.K.A.S.G. will be held on **Sunday 22 April**. For full details, contact the Secretary, Adrian Dempsey, 194 Greenhill Road, Greenhill, Herne Bay, Kent, CT6 7RS. Tel: 0227 474832.

Bishop Auckland & Wear Valley Aquarist Society

The 1990 Open Show of the above society will be held on **Sunday 8 April** at the Spectrum Leisure Complex, Willington, Co. Durham. For more details, ring John Corrigan on 0388 745674.

King's Lynn Aquarists Society

The King's Lynn A.S. Open Show will be held at the Cornhall, Tuesday Market Place, King's Lynn, on **Sunday 22 April**. Benching: 11.00 a.m. - 1.00 p.m. Judging: starts at 1.15 p.m.

Aberdare Aquarists' Society

The above society is holding its 8th Open Show on **Sunday 13 May** at the Cynon Valley Community Activities Centre, Godreaman Street, Godreaman, Nr. Aberdare. Further information available from the secretary, A. Jones, 34 Maeshyfryd, Cwmbach, Aberdare, Mid Glamorgan, CF44 0DN. Tel: 0685 878692.

British Cichlid Association

The Annual Spring Auction of the B.C.A. will be held on **Sunday 8 April**. Start: 1.00 p.m. Venue: St Ann's Church Hall, Wrenthorpe, Wakefield, Yorkshire. Non-members very welcome. Further details: Mrs Lynn Fern, 5 Winding Shot, Hemel Hempstead, Herts., HP1 3QQ. Tel: 0442 61858.

Aberdeen Aquarist Society

The 1990 A.A.S. Open Show will be held on **1 April**. Contact the Show Manager, David Gamble, 2 Shieldhill Gardens, Altens, Aberdeen, AB1 4JY, for further details.

MORE DIARY DATES ON PAGE 113

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Herne, Nr Herne Bay, Kent
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hopefully, clarify the methods used and allow interested readers to conduct similar studies on scales from their own fish (Important: see later section before doing so).

The scale was from a three-year-old Dace which measured 18.0cm from the tip of its nose to the fork of its tail (=L). The scale was then projected onto a screen and, along a simple line from the scale centre to the outer edge, the following measurements were taken:

- Scale radius (S) = 11.7cm.
- Distance from centre to first annual check (S₁) = 3.2cm.
- Distance from centre to second annual check (S₂) = 7.2cm.
- Distance from centre to third annual check (S₃) = 10.9cm.

Because we are using the ratio of the distance to the first check/scale radius, the size of the projected image is not important.

To calculate the fish length when the first annual check was formed, we used the formula described earlier, i.e. $L = \frac{S_1}{S} \times L$

$$\text{Adding the values, we get } L = \frac{3.2 \times 18.0}{11.7} = 4.9\text{cm.}$$

Therefore, when the fish produced its first annual check (aged one) it measured 4.9cm.

Repeating this calculation using the distances to the second and third annual checks, we find that the fish was 11.1cm long when the second annual check was formed, and 16.8cm long when the third check was formed.

The Dace, therefore, grew 4.9cm in its first

year, 6.2cm in its second year and 5.7cm in its third year.

Generally, the increase in length will show a steady decline as the fish ages and nears its maximum length. However, the conditions the fish has been subjected to will affect the growth in each year. For example, a very prolonged hot summer will result in much greater growth in carp and goldfish. Moving a fish to a less densely stocked pond, or to where there is more food, will also result in increased yearly growth rates, which will be apparent from the scales.

Preparing scales for examination

Having covered some of the information which can be discovered by looking at the scales of the fish, some fishkeepers may wish to have a go themselves. The procedures to use are as follows:

- 1 Remove scales from a dead fish using tweezers. It is wise to take 20-30 scales from the flank of the fish to ensure that you get some that are not regenerated. Do not remove scales from live fish, as the wound that results may become infected and kill the fish. You will also distress the fish, of course.
- 2 Place the scales in a paper envelope and mark on the envelope the details of the fish, including its fork length (see above).
- 3 Leave the envelope and scales in a dry place for 5-7 days to allow the scales to dry.
- 4 Separate the scales and place 1-5 (depending on size) between the two halves of a glass 35mm slide.

5 Close the slide and view through a projector.

Scale reading, as this process is known, is a complex, and often difficult, subject. This article has given a necessarily brief description and has used a good, clear example of a scale.

You may find that scales which you examine are very difficult to age. This may be due to the species of fish you are examining — Tench, for example, are notoriously difficult to age using the scales. It may also be due to conditions in your pond, aquarium, etc, being relatively constant, so there are no clearly defined wide and narrowly spaced rings. Still, whatever the case, 'scale reading' brings a new and interesting angle to the hobby of fishkeeping.

Further reading

Most fish biology textbooks have sections on scale reading.

The following are particularly useful, but are of a technical nature and will probably have to be ordered from a local library.

Methods for the assessment of fish production in freshwaters by T B Bagenal, published in 1978 (3rd edition) by Blackwell Scientific Publications.

The Ageing of Fish, Proceedings of an International Symposium, Edited by T B Bagenal, published in 1974 by Unwin Brothers Ltd.

News

Sole UK Distributor for Siporax

As from 1 March 1990, the sole distributor for Siporax for the UK and Ireland is:

Peter Oakes, Al Garden Aquaria, Cross Lane, Winterley, Sandbach, Cheshire CW11 0RW.

Tel. 0270 882733 or 761282.
Fax. 0270 769907.

Continuing expansion at Kenchester

Already recognised as a major tourist attraction by the Heart of England Tourist Board, and following an extremely successful summer in 1989, Hertfordshire-based Kenchester Water Gardens are expanding customer facilities again, to cope with increasing demand.

"We are already working on an adjoining three-acre site, digging ponds, and creating

landscaped facilities, such as a stream, waterfalls and attendant display areas and attractions", says Malcolm Edwards, proprietor of this rapidly expanding centre. "Last summer was tremendous for us, certainly proving that we have the mix right. All we have to do is provide more of it!"

Kenchester Water Gardens claim to be the largest and best stocked aquatic centre in the

South Midlands. The facility covers three acres — six, with the opening of the new extensions this year. There are also more than 200 tropical fish tanks, 40 tanks for coldwater fish, and a superbly landscaped outside area devoted entirely to the requirements of the serious water garden enthusiasts, including a wide selection of glass fibre ponds, fountains,

pond liners, pumps, waterfalls, selected garden furniture and stone ornaments.

Kenchester Water Gardens are open daily, accept all major credit cards, can arrange credit, and offer a mail order service. They are situated on the main A49 Hereford to Leominster road at Lyde, one mile outside Hereford. Further details available from Robin Penrice. Tel 054421-212.

Derek



I think Henrietta would like to know what the mortgage repayments over the next 6 years would be.



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MODEL AL 150 = 150 l/h, AL 250 = 250 l/h, AL 350 = 300 l/h at 20 inches of water

LIFE WITH CHARLIE . . . AND FRED AND ROSIE . . . AND FLO . . .

Proud Koi owner, Dr David Ford, Head of the 'Aquarian' Advisory Service, reveals some of his Koi-keeping secrets, to say nothing of a most 'unscientific' passion for his beloved fish!

(Photographs by the author)

KOI



My triple pond system. Note the flowerbeds — a fantastic source of insects for the Koi.

I own 15 Koi. There's Charlie and Fred, Rosie and Flo, and so on. They are more than just fish, of course! They are *real* pets. They were bought as ordinary small 10cm (4in) Koi back in '87 when the pond was installed, and have been fed on flake food (guess which one!) ever since. In the summer this is supplemented with insects and worms from the garden, but in winter it is exclusively flake food. This is easier to digest than pellets or sticks at such times, so a daily feed is given, even if the temperature is down to 5°C (41°F). Below this, the fish sink to the bottom, so nothing is offered.

The books say do not feed at 10°C (50°F) or less, but Carp Farms feed their fish down to 5°C (41°F). The fish must benefit from winter feeding because the usual springtime problems like diseases such as Spring Viraemia of Carp or Carp Pox, or parasites such as White Spot or *Lernaea*, have never struck my pond.

Originally, there were 16 but this became 15, because Jo, a Kohaku (red on white),

decided to jump out. The fish are now almost 30cm (12in) and attract every cat (including our own, Sheba, the tabby) in the neighbourhood. Cats cannot get to the fish, however, because the pond is sheer-sided . . . it is shallows that allow them to scoop out fish.

No problems with birds either, Herons don't seem to like the Yorkshire Pennines, thank goodness.

Clear water

There is no point in owning beautifully marked Koi if they cannot be seen. Over the three years since installing my triple pond system (yes, three ponds, each at different levels . . . everything goes either up or down in the Pennines!) the water remained clear because of good filtration and lots of partial water changes (via Pennine rain). That was until last year.

1989, whether as a result of the greenhouse effect or not, was the sunniest ever recorded in Yorkshire and everyone's pond — including mine — turned the colour of pea soup.

The filter was cleaned out, but it made no difference. An extra filter was added, a trickle filter in a plastic tub sited alongside the pond, but the green water persisted, as the sun beat down. Then a 15 watt UV steriliser was installed and two weeks later — clear water. These gadgets really work! The unit sits astride the external filter box and the water is pumped by a small fountain pump to the steriliser and returns via the trickle filter, topped with dimple-foam. The UV kills the algae which collect on the sheet of foam in a green-brown sludge. This is removed and washed every few months.

The instructions say that the UV tube requires replacing every 6 months; this time has not yet quite elapsed, but certainly, the water remains crystal clear. What the greenhouse effect will do this summer remains to be seen, but I have high hopes that, at least, the fish will be seen!

Nutrition

Koi, or Nishikigoi, to give them the full anglicised version of their Japanese name,

did not originate in Japan. They are Persian (now Iran, of course) Carp brought to Japan over a 1000 years ago as farmed food fish. The Japanese developed the colour forms from sports, but the original black Carp are still eaten. There are many Koi restaurants in Japan where you choose the fish to be eaten. While awaiting its preparation, you are invited to admire the coloured Koi also displayed . . . these are definitely not for eating.

As a food fish the Koi/Carp are fed a mainly vegetarian diet: wheat, grasses, rice, etc. This is because this fish is like a ruminant; it can use gut bacteria to break down plant cellulose after grinding it with pharyngeal teeth. The mouth is a complex sucking device without teeth; it is deep in the pharynx that three rows of grinding teeth are used.

The 'whiskers' are two pairs of taste organs that tell the fish if edible material is present in the mud they like to suck from the bottom. The pharynx also has a filter, like the teeth of a comb, that sifts the mud from the plankton and any other edible matter before it is ground and swallowed into a short oesophagus. There is no stomach, but a long intestine coiled twice around the abdomen; it is about five times longer than the body of the fish. This allows the long digestive processes to occur, including the bacterial breakdown of cellulose.

The enzymes in the gut can cope with animal as well as vegetarian proteins, so the fish is really an omnivore. In fact, the wild fry eat crustacea (such as *Daphnia*) after planktonic first food, and then insects, before eating plants.

Ornamental Koi are bred for their colour patterns, so colour feeding is important as the fish develop to maturity (2 years for a male, 3 years for a female). The carotenes are the important nutrients for this feeding. These occur naturally in vegetables, including many algae. Algae therefore form an important part of the growing fish's diet, but one that is eliminated by Koi-keepers such as me, with weapons like UV and filters! That is why algae are included in commercial diets for the fish, a popular one being the Mexican seaweed *Spirulina*.

Pure carotenes, such as canthaxanthin and astaxanthin, can be used in colour feeds. These are particularly effective with red and black pigments, as those that occur in Taisho-Sanke and Showas. Commercial pellets often contain these compounds.

Growth

Koi-keepers like big ones. Rates of growth are affected by many things but, obviously, the amount of feed given is important. Experience has shown that little and often is best for the fish. The daily big meal is more for carnivorous fish with a stomach to cope with it. Koi should be fed little and often.

A morning feed is best in the winter if the temperature is not actually freezing. Evening feeds are not suitable because the temperature will then be falling. Spring can bring an extra feed at mid-day, and summer can bring three daily feeds, plus tit-bits at

any time. The amount is reduced again in autumn.

What to feed is the subject of many an argument among Koi folk. The fish can cope with anything their owners can eat, be it bread, fish, shellfish, meat or offal, plus the usual aquatic foods such as earthworms, larvae, maggots etc. Some authorities swear by wheatgerm; some never use bread, but others say use brown bread. Noodles and rice are considered natural diets for what is a Japanese fish! Lettuce, spinach and corn are popular plant foods for the fish. Some owners feed only commercial diets, whether pellet, sticks or flake, and some use such foods only occasionally; others never.

Variety is always good for nutrition, so my Koi get a staple 'Aquarian' flake, plus insects

Growth varies greatly among related fry; in just 6 months sister fish can be ten-fold different in length on the same diet. Obviously, culling and screening is very important in Koi breeding.

Japanese Koi Growth Standards

AGE years	LENGTH (cm)	WEIGHT (grams)
1	10 to 20	8 to 80
2	25 to 30	200 to 400
3	35 to 40	550 to 900
5	45 to 50	1100 to 2200
10	55 to 70	2600 to 4800

The hobby

Koi-keeping is comparatively new in the UK, but it is the fastest-growing section of the market in ornamental fishes. There are



Dr David Ford carrying out essential maintenance on his pond.



When to stop feeding!

from the garden. I never use aquatic live food, such as *Tubifex* and *Daphnia*, for fear of introducing parasites. Human foods are used as a treat, and these include anything from the table, except anything containing animal fat. Fish use oils, rather than solid fats, in their metabolism because of their lower body temperatures. Animal fat will set solid in their intestines, so never feed any dairy products, fatty meat, sausages, hams, burgers, etc.

However, for maximum growth, a mix of animal and vegetable protein is ideal, and all the Japanese authorities claim this should be 60% vegetable, 40% animal. Most Koi pelleted foods are based on this recipe, sometimes with higher vegetable content for winter feeding.

national (such as the British Koi Keepers' Society) and local (such as the Midland Koi Association) clubs devoted to this fascinating fish. A&P carries many advertisements from Koi specialists, and most Water Gardens and many aquarium shops stock the fish.

If you want to join the growing ranks of Koi enthusiasts, you will need a garden pond designed from the start to give clean, clear water. If you want instructions on my pond drop me a line at the new address for the 'Aquarian' Advisory Service (SAE not required, but do give your own name and address):

'AQUARIAN' ADVISORY SERVICE,
PO BOX 67, ELLAND, WEST
YORKSHIRE HX5 0SJ

PRODUCT ROUND-UP BY DICK MILLS

Aquarium systems

The next time you see a shoal of Clownfish it might not be in a tank at all. **AQUARIUM SYSTEMS** have cleverly designed the box illustrations on their Sea-Test kits so that, when placed together on the display shelf, they link up to give an unmissable effect. But there are distinct improvements within the boxes too.

New, impermeable foil wrappings protect the dry powder reagents against light and dampness, increasing shelf-life indefinitely. A notch in each foil envelope makes for easier (and safer opening); no more looking for those scissors, just tear and pour.

An expanded range of a continuous, gradient colour is printed on new colour slide Comparators to avoid those difficult to assess 'in-between' readings. Through-the-sample viewing automatically allows for all light source variations, giving accurate readings all the time. High and low ranges for both nitrite and nitrate detection make for complete readings found in both newly set up and long established tanks, including reef tanks.

All Sea-Test test kits are calibrated for marine use, making conversion tables unnecessary. Details of all Aquarium Systems products from:

UNDERWORLD PRODUCTS, Units 1 & 2, Belton Road West, Loughborough, Leicestershire LE11 0TR (Tel: 0509 610310 Fax: 0509 610304)



The new Sea Test kits from Aquarium Systems — unmissable on any shelf.

BP NUTRITION

Look out for the BP signs at aquatic dealers and garden centres but don't expect petrol. Following up last year's launch of **BP NUTRITION's** new improved **POND PRIDE FOODS** (*Product Round-up, A & P, November '89*), this product will have a significant presence in pet trade and specialist fish magazines ready for the coming season, due to increased advertising spending.

The improved recipe is a complete high protein food which provides everything fish need for a properly balanced diet: this is ensured by a full complement of vitamins and minerals, plus shrimp meal, Spirulina and grass meal to boost natural colours.

Pond Pride comes in three pellet sizes — small, medium and large — and in three drum sizes — 200g, 450g and 2.5kg (this last one's got a sturdy carrying handle).

Suitable for all sizes of pond fish from Goldfish to Koi and Carp, it will meet all the likely requirements of ornamental fishkeepers. Pond Pride is distributed nationwide by:

KING BRITISH (Tel: 0274 573551) Further information from: Denise Mullen, **CRAWFORD HALLS PUBLIC RELATIONS**, Manchester International Office Centre, Styal Road, Manchester M22 5WB (Tel 061 436 7100)

ARMITAGES

The first of many new product range extensions planned for

1990 have been released by **ARMITAGES**, indicating their faith in the aquatic hobby with a strong commitment to new product development.

Fluorescent Skulls and Giant Landscapes are but two of the latest aquatic ornaments in the Nimrod range. A Neon Fish, Novelty Frog on a Toilet (another in a bath), Aerated Diver and Volcano and a selection of three vivid colours in the fluorescent range will make safe, colourful decorative additions to the aquarium. The Giant Landscapes, supplied in three sections, each measure 20 inches long and 9 inches tall and are made from strong, non-polluting resin-based material. The two designs feature Houses under Mountains and Castle with Bridge. Details from their Marketing Manager, Patrick Newton at:

ARMITAGE BROTHERS plc, Colwick, Nottingham NG4 2BA (Tel: 0602 614984 Fax: 0602 617496)

CYPRIO

The coming 'greenwater' season need hold no threat for

the pondkeeper wishing to see his/her fish, thanks to **CYPRIO's** research and development. Gin-clear water need not be healthy at all, as the acid-rain lakes in Scandinavia have unfortunately proven, but a well-filtered, 'previously-greenwater' pond is quite another story.

Most fishkeepers are familiar with the three types of filtration — physical (mechanical), biological and chemical — but now Cyprio has added a fourth dimension by, as you might say, shedding some light on the subject. In this case, the light is Ultra Violet, and when used in combination with the Company's **BIOZORB** or **TEAMWORK** systems, you still get the same money-back promise of clear healthy water, providing you follow the guidelines as to pond size and recommended flow rates.

The problems of using a 'physical' filter medium small enough to trap single-celled algae (the cause of green water) without frequent clogging and subsequent restrictions in water flow, simply don't need to



be considered. Cyprio's UVCs (Ultra Violet Clarifiers) act on the algal cells, causing them to amalgamate together in sufficient-size 'blobs' for a normal filter medium to trap with ease. Neither does the UVC damage the beneficial nitrifying bacteria present in all mature filters, although it does reduce the background level of bacteria in the pond itself. This is the reason for the title 'Clarifier', as opposed to the more commonly-used 'Steriliser'.

Of course, simply using any UV with any filter system won't give the same results as a combination where all the variables have been considered and catered for — water flow rates, pond size, wattage rate, contact chamber size, water turbulence within the chamber, physical length of lamp exposed to water, exposure time, etc.

Cyprio have incorporated all these factors into their UVCs and also made sure that they are both safe (electrically speaking) by virtue of robust weather-resistant housings (the housing materials not being liable to degradation by the UV rays.) Available in three sizes UVC1500, UVC3000 and UVC6000 for ponds of 1500 gallons (1500 gph flow maximum), 3000 gallons (2000 gph) and 6000 (4000 gph), prices are £79.50, £112.50 and £149.50 respectively for enclosed versions suitable for outdoor use. Basic UVC prices (for non-outdoor use) are £63.90, £90.50 and £125.00 respectively.

In addition to UVCs and filters, Cyprio also offer a wide range of specialist pond products, details of which are contained in their 1990 PRODUCT PORTFOLIO (£2.50 incl P&P); alternatively send a large SAE for separate leaflets on either UVCs, Standard or De-Luxe range filters.

CYPRIO LTD., 133 Eastgate, Deeping St James, Peterborough PE6 8RB (Tel: 0778 344502)

ROLF C. HAGEN

Three smart new FLUORESCENT LIGHTING CONTROL UNITS are now available from HAGEN. A feature of the smooth black casing is a generous top grille to dissipate the heat while in use. Each of the three units (14-15-20 watts, 25-30 watts and 40 watts)

costs the same — £14.99 — and comes complete with tube clips, fasteners and cable ties.

Recommended tubes are Aquaglo (to promote fish colours and plant growth) or Sunglo, an all-purpose tube for every type of pet or plant. The control units are designed for aquarium use, but can also be used for any type of fluorescent lighting application. Details from: **ROLF C. HAGEN LTD.**, California Drive, Whitwood Industrial Estate, Castleford, West Yorkshire WF10 5QH (Tel: 0977 556622 Fax: 0977 513465)

TETRA

Nitrate is relatively harmless to aquarium or pond organisms when compared with the much more toxic nitrite and ammonia. However, high nitrate concentrations in ponds or aquaria will prevent healthy

For example, in modern marine aquaria which contain leaf algae, sensitive invertebrates and coral fish, the control of nitrate level is essential. To provide the increased sensitivity required, the Tetra Test Nitrate Kit is twice as sensitive when used in sea water.

The Tetra Test Nitrate Kit retails at £7.75 and represents good value for money as there are sufficient reagents for 40 tests. The easy-to-follow instructions also include a useful guide of what to do after the test.

If you would like to obtain a free Tetra Information Leaflet on Testing Water Quality, please send SAE to:

TETRA INFORMATION CENTRE, Lambert Court, Chestnut Avenue, Eastleigh, Hants, SO5 3ZQ, or leave your name and address on their Leaflet Line Ansaphone Service — 0703 643339.



Sensitivity and ease-of-use are just two characteristics of Tetra's new Nitrate Test Kit.

development of aquatic fish and other life, and should therefore be avoided.

The new TETRA NITRATE TEST KIT provides a fast, easy-to-use, reliable and extremely accurate way of measuring Nitrate levels. As you would expect, it has been specifically developed for use by aquaria and pond owners, and the easy-to-read colour scales and accurate readings make the Tetra Test ideal for the hobbyist.

TECHNIFLOW

Wouldn't you know it, the latest filter bed material is made from a coarse plastic material called (wait for it) vinyl-lock matts! Two versions of this material form the heart of a new filter medium from TECHNIFLOW: the first is TECHNIFLOW MAT, an extremely lightweight, high-void-space plastic construction made in Britain from new dye-free fibres.

Offering an enormous avail-

able surface area for the attachment of aerobic bacteria, it can be used biologically in several ways: in cartridge type arrays in multichamber filters (after settlement and pre-filtration), as a double layer spiral in simpler bio-mechanical filters, or in aquarium power filters and system filters.

As a mechanical filter medium it can be used as a single sheet prefilter in single chamber pondfilters, as pump inlet strainer or as a prefilter in aquarium power filters. Its sheet form construction allows easy cutting for any filter application.

TECHNIFLOW SpaceMAT has an even more 'open' structure and is used in sandwich construction, together with Techniflow MAT, allowing excellent flow rates past the surfaces of both media.

Although designed primarily for pond filtration use, both products are available in aquarium packs but, depending on demand, this sector of the market has yet to be expanded fully. Information on all Techniflow products from:

TECHNIFLOW PRODUCTS, The Aquatic Habitat, Shurdington Road, Brockworth, Gloucestershire GL3 4PU (Tel: 0452 862791 Fax: 0542 864302)

FOOTNOTE

Owing to space restrictions, it is not always possible to elaborate fully on a specific subject, and February's *A & P's* Tropical Freshwater Aquaria Question & Answer Supplement was a case in point.

Regarding Biological Filtration (p.61), the impression may have been given that '... ceramic, or sintered glass, rings...' were one and the same. This is not the case. Sintered Glass Rings have a totally different structure (even when not viewed under the electron microscope) to ceramic rings; their open-pore configuration offer much more 'space' on which nitrifying and denitrifying bacteria can establish themselves.

We are indebted to SCHOTT-UK, manufacturers of SIPORAX filter medium, for writing to point out this very important difference.

Ah well, as I said at the beginning, it's all a question of space!

HUMP-HEADED WONDER FROM LAKE TANGANYIKA

Once rare, now popular, this large, but relatively peaceful cichlid has a great deal going for it, as British Cichlid Association member John Ferguson reveals.

(Photographs by the author)

The "Frontosa" was once a rare and unusual sight in aquarists' tanks, but today, this wonderful character from Lake Tanganyika is almost commonplace.

G. A. Boulenger first described *Cyphotilapia frontosa* way back in 1906. Now, eighty-four years later, it is here to stay.

The name *Cyphotilapia frontosa* is made up as follows:

Cypho (Greek) — meaning "humped".
tilapia — a name derived by Sir A. Smith from the word "Thalpi" which means "fish" in the language indigenous to the region around Lake Ngami, Africa.
frontosa — meaning "with a large forehead".

DESCRIPTION

Body:	Deep and rather compressed; a hump on the head, increasing with age; broad deep blue/black and white bands/stripes.
Size:	Around 35cm (c 14in)
Scales:	32-35 in a longitudinal line.
Lateral lines:	2
Fins:	Dorsal XVII-XIX/8-10, Anal III/7-8. Ventrals (pelvics) with long filament; pectorals very large; caudal rounded.
Teeth:	Outer row conical or partly bicuspid (two-pointed), inner conical or partly tricuspid (three-pointed).
Pharyngeal teeth:	All very fine, compressed, more or less bicuspid.
Mouth:	Inferior, protrusible, and large, not especially powerful.
Gill rakers:	10-12.

Coloration

Body whitish with five or six vertical black bars on the flanks, and a black bar running through the eye. Fins show a hint of blue, which varies according to the individual. In some races there can be seen a trace of yellow/gold or red in the dorsal. These markings vary from race to race.

In 1906, when *C. frontosa* was originally described, it started out in the genus *Paratilapia*, like a lot of the cichlids from this region of Africa. In 1915 Boulenger placed it in the genus *Pelmanochromis* and, as late as 1920, another eminent scientist, C. Tate Regan, placed it into what would be its final genus (so far), *Cyphotilapia*, of which it is the singular species. It is endemic (that is to say, it is found nowhere else), to Lake Tanganyika.

Although it is the only species in the genus, it has been suggested that the two forms/races (six- and seven-barred — including the "head" bar) may be closely related but separate species; in the past few years, with the exploitation of Lake Tanganyika by the tropical fish trade, several forms/races have come to light.

The most common form seen in aquaria is found along the Burundi coast. This is the six-barred variant with five stripes on the body and one on the head. The Kingoma, seven-barred variant, has six stripes through the body, a black operculum and a yellowish tinge to its dorsal. The Zambian variant has six stripes through the body and a wide nostril stripe. A fourth variant, found at Tembwe, Zaire, has been described by Professor Max Poll. This looks like the six-barred variant, but the barring does not extend down onto the belly area. A fifth variant is found at Kipili, Tanzania, and is described by Konings as looking to be a cross between the Kingoma and Zambian variants; a black gill cover and nostril stripe are its features. Most recently, an

all-white variety has been caught, but not (as yet), exported.

Natural habits

C. frontosa is fairly common in the lake, living at depths of between ten and fifty metres (33-165ft), and inhabiting rocky areas and living in schools. It is a maternal mouth-brooder, territorial, but not aggressively so, unless breeding. The females, unlike their Malawian counterparts who ascend to higher levels to release their fry, release their fry at these depths. Adults are reasonably slow and lethargic by nature, unless pursued, a fish of their adult size having little to fear. They are, in fact, locally regarded as food fish, caught on hook and line by the local fishermen; apparently, they make very good eating.

In its native habitat, *C. frontosa* is a predatory, gregarious feeder. Young specimens may feed on small soft-bodied crustaceans, whereas adults could tackle large clams, etc, but the stomach contents of wild-caught specimens contain mostly the remains of fish. These are mainly *Cyprichromis* that roam the lake in large schools above the *C. frontosa*. At dusk the *Cyprichromis* descend with the water column and at sunrise, while they are still lethargic, the *C. frontosa* pounce on them.

Transportation problems

Living at such great depths and being quite large makes "Frontosas" difficult to catch in great quantities and bring to the surface alive.



The most common type of Frontosa has five bands on the body (plus one on the head) and is found along the Burundi coast of Lake Tanganyika.

The small numbers that are caught have to go through decompression, not unlike a scuba diver, before reaching the surface.

Because of the high shipping costs it is mainly the sub-adults that are exported for the world aquarium trade. The few that are exported normally arrive, because of the vast journey by air, stressed. Some show signs of their decompression by either swimming at the surface of the importer's aquarium or being unable to swim up to the surface.

These the European dealers call either "floaters" or "sinkers". The organ that controls their swim bladder having failed the fish due to the decompression has to be treated quickly by either removing air, for the "floaters", or adding it for the "sinkers". This treatment, through a precisely placed syringe, normally restarts normal bodily functions and a lot survive their ordeal.

Aquarium care

To maintain *C. frontosa* in aquaria the water chemistry should be the same as for other Tanganyikan fish — that is, moderately to very hard and alkaline, with a pH of between 7.5-8.5. A substrate of coral sand is ideal for buffering and maintaining the pH. The temperature should be maintained at between 77-81°F (25-27°C), and regular partial water changes of approximately 20-25% carried out weekly.

C. frontosa's behaviour in the aquarium is reasonably peaceful. A pair can be housed in a relatively small tank of about four feet long

(120cms) but a six-foot aquarium (180cm) is advisable. The use of rocks is a must, as caves and other hiding places made from these provide shelter for the smaller females and juveniles to escape the attentions of the more dominant male. Make sure that the rocks are well-bedded to the substrate as "Frontosas" do an amount of digging and displaying. Two males of equal size will go through the motions of mouth-fighting, without much harm coming to either individual. More often than not, the smaller, weaker male will turn and hide from its large conspecific.



Seven-barred variants (six body bars, plus one head bar) with or without yellowish fringe on the dorsal fin are thought by some to constitute a closely related, but separate, species.

Pairing up adults *C. frontosa* seems to be a task in itself. Fortunately, nowadays, there seems to be a reasonable supply of tank-bred stock available from which to choose. The fry

are relatively expensive by comparison to other popular cichlids but when one compares an average brood of 15-20 fry from a wild female to that of a Malawian counterpart of, say, 40-80, one can see the reason.

When purchasing fry go to a reputable dealer and try to get fry from different broods so you are not breeding brother to sister. This will keep your stock up to an optimum quality. In some reported cases of breeding brother to sister the resulting progeny have exhibited defects, such as misaligned barring or blindness in one eye. This, quite obviously, makes the fry a poor proposition for sale and for prospective breeding. Interbreeding of the various races is totally inappropriate, of course, as this will only produce mongrel fry and lead to lack of distinction between the variants. Always check the origin of the stock. A good retailer will be of great help here.

Feeding is not a great problem. As I've already mentioned, this species is a predator. A few cases of this happening in the aquarium have been reported but, if fed sufficiently, this should not happen. Large flake or prepared pellet foods are eagerly taken. Livefood such as *Daphnia* and bloodworms can also be fed. The diet can also be supplemented by the introduction of such foods as whitebait, shrimp or crab meat. Be sure, when feeding, that enough food reaches the less dominant, retiring individuals. Although a relatively slow grower on this type of diet, *C. frontosa* fry should attain 5-6ins (12-15cms) in their first six months.

Captive breeding

As already stated, *C. frontosa* is a maternal mouthbrooder but, again, unlike its Malawian counterparts, there are no vast changes in coloration nor fierce tail beating and quivering by the males. Females normally hide away from the attentions of the over-eager males for the best part of the time.

However, when a female is gravid, she lets the male know by appearing in front of his territory. He then prepares a convenient site for spawning. Once prepared, the ritual commences, with the male releasing an amount of sperm at the site. The female then approaches the site and starts releasing eggs, picking them up with the sperm in a "rocking horse" style. Sporadically, the female will withdraw from the site, letting the male know that she requires more sperm, whereupon she continues to release eggs.

During this ritual the male defends his territory vigorously. Upon release of the last eggs, the female seeks cover away from her over-ambitious counterpart and he takes no further part in the upbringing of the fry.

In general the incubation period is 3-4 days. The fry then remain in their mother's buccal cavity for a further 4-4.5 weeks. On release, the fry are 7-10mm (0.3-0.4in) total length. Brood numbers vary in size, from as low as 2-3 for a small female to some 20 plus for a large one. The free-swimming fry may be fed on Brine Shrimp and crushed flakes; even larger flake is attacked ravenously.

In conclusion, *C. frontosa* are easy to keep in the aquarium, are relatively peaceful, and, if one is likely to possess a pair, relatively easy to breed. What more could you ask for?

FURTHER READING

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Should any reader wish a copy of the above BCA Information Pamphlet please send 50p and a stamped addressed envelope to: The British Cichlid Association, Brandy Hall, Bradshaw Lane, Bradshaw, Halifax, HX2 9XE.

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Continued from page 100

Bridlington & District Aquarist Society

The 17th Annual Open Show of this society will be held at Hilderthorpe Junior School, Shaftesbury Road, Bridlington, on **Sunday 27 May**. Benching: 12.00 noon - 1.45 p.m. Judging: 2.00 p.m. (prompt). For further information, contact the Show Manager, Mick Jordan, 12 Greenfield Road, Bridlington, N Humberside, YO16 4TE. Tel: 0262 674109.

I & E Aquatics Society

The I & E 1990 Open Show will be held on **6 May** in Louth. Further details, entry forms, etc., are available from the Secretary, I. Johnson, 61 Ramsgate, Louth, Lincs.

Strood & District Aquarist Society

The above society will be staging its Open Show at Meopham Village Hall on **Sunday 8 April**. For further information, contact the Secretary, John Pell, 44 Lakewood Drive, Wigmore, Gillingham, Kent, ME8 0NS. Tel: Medway 389362.

British Koi-Keepers' Society National Show - 1990

The Chairman and members of the BKKS National Show Committee for 1990 are pleased to announce that, following the tremendous success of the 1989 Show, Billing Aquadrome in Northants has once again been chosen to host the British Koi Keepers' Society 1990 Show - KOI '90. As this year marks the society's 20th Anniversary, many additional and exciting features and events are being planned in celebration of this milestone. Exhibition space has therefore been increased by over 15% and facilities for BKKS Sections, members and the general public are being enhanced. The weekend programme of entertainment and festivities will reflect the increasing popularity of and attendance at this important event in the Society's calendar.

Date: August 11-12 1990

Venue: Billing Aquadrome - Northampton

Type: Japanese Open

Benching: Friday 10 Aug. 1800hrs - 2100hrs. Saturday 11 Aug. 0800 - 1200hrs

BKKS Weekend Package

price ... £42.50 (Includes car parking, show entry, hotel accommodation, dinner/dance)
Dinner Dance only price ... £15.00



Show Entry Adults £1.00 Children/OAP 0.50p
Catalogue 0.50p

Once again the Show Committee is expecting a record entry of fish in all classes and sizes. To help in the administration and preparation at Billing, show entry forms will be freely available to Sections and members via the BKKS magazine, and entries will close at least two weeks before the show. All fish will be entered

and exhibited according to the revised show guidelines now being issued by the BKKS. With the increase in available stand space, it is hoped that most space requirements can be met this year. Stand spaces are available in 15 x 15 or 7.5 x 7.5 feet square, costing £300.00 and £175.00, respectively. Early bookings are advised to avoid possible disappointment. Further information and up-dates on events for KOI '90 will be issued on a regular basis. More details from:

Chairman: John Beattie 0604 416316

Secretary: Bob Thompson 0734 713640

Dealers/Stand: Margaret Bishop 0702 522388

Publicity: Mike Vigar 0635 47272

Tongham Aquarist Society

Tongham's 17th Annual Open Show will take place on **Sunday 20 May**. The venue will be Ash Council Recreation Hall, Ash Hill Road, Ash, Aldershot, (same as last year). Enquiries should be sent to Adrian Worley, Public Relations Officer, 10 Maple Close, Blackwater, Camberley, Surrey. GU17 0PX.

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Naturalist's notebook By Eric Hardy

Dragonfly rarities

Endangered by the reduction of peat-pools in southern England, the White-faced Dragonfly, *Leucostictia dubia*, with only 12 English haunts, has been increased at Whixall Moss in north Shropshire by digging more sphagnum pools which it prefers for egg-laying. It also occurs in the Delamere Forest of Cheshire, at Abbots Moss and the Black Lake.

Another rarity, the downy emerald, *Cordulia aenea*, breeds at 2 small meres south of Shrewsbury and one in south Cheshire. Last year's good hatch of dragonflies brought rather more than the usual number of hobby falcons which prey much upon them. One of the best ways of finding hobbies in Dorset is to find a good dragonfly valley, especially on a sunny evening.

Gecko tails . . . et al

One of the most interesting adaptations in Gecko tails is the thick, spiny tail of two nocturnal Australians, *Diplodactylus intermedius* and *D. ciliaris*, which not only use them for storing reserve food, but for squirting a sticky, poisonous substance in defence. Temperature has been shown to influence this habit, being more effective in hot weather than cold, as might be expected. Unlike most of their tribe, these geckos have tails shorter than body length.

It is well known that many lizards shed their tails to evade capture, but the Canadian Zebra-tailed Lizard, *Crotaphytus draconoides*, wags its tail as a deterrent when pursued!

Most lizards gulp their food down, but some Lacertids shake their prey to death like a dog.

Another albino Garter Snake was recently recorded in Canada, making a wide list of species which can sport this absence of pigment.

Crayfish only occasionally fall prey to the British Grass Snake, though books don't seem to list this. In Canada and most of North America, however, the Crayfish or Crawfish Snakes, *Regina*, especially Gra-

ham's Crayfish Snake of central USA, prey upon as many crayfish as frogs and salamanders. This snake does not figure as any serious menace to their numbers, though. In Asia and China, the aquatic *Bungarus fasciatus*, which has recently been bred successfully in captivity in West Germany, and its allies, also prey upon them.

Recent research and discoveries

Other subjects being researched include, in the US, how the diving Australian Snake-necked 'Turtle', *Chelonia longicollis*, maintains a stability of its physical condition by controlling the oxygen in its arteries. In Italy, the biochemical control of Common Newt courtship is being studied at Corino University, and in Belgium, the synchronisation of the spring moult of the Common Viviparous Lizard with the onset of mating.

Three workers at the reptile section of the Russian Academy of Science have new evidence of hybrid males produced from unfertile eggs of four species of Parthenogenetic Lacerta lizards: *L. rostrimaculata*, *armeniaca*, *dabli* and *ruddei*. Two new species of iguanid lizards are *Anolis pumilus* from Cuba and *Norops naufragus* from the cloud forest of Hidalgo, in Mexico, Mexico.

In the Netherlands, hybrids have been found between Common Crested and Marbled Newts. In Israel, two Haifa University biologists have found genetic differences between their common Marsh Frog, *Rana ridibunda*, and Greek populations, leading, presumably, to a new sub-species. A new genus as well as species of frog, *Pyxtonia paludicola*, is described by Channing and Boycott of the University of Western Cape, from the South-western Cape, South Africa.

The other month I mentioned considerable numbers of the huge jellyfish *Rhizostoma octopus*, in the Irish Sea in 1989: 3,047 were stranded on Walney Island at the north of Morecambe Bay at the end of October, totalling 5,500 there since late June.

Walney has a successful oyster-farm, producing spat to stock British beds elsewhere.

Low reptile and amphibian population

Britain is estimated to have only 5,000 Sand Lizards, 3,000 Smooth Snakes, 6,500 Great Crested Newts and 20,000 Natterjack Toads, according to my friend Keith Corbett's new book, *Conservation of European Reptiles and Amphibians* (Helm). In my own area, where all but the Smooth Snake exist on the Ainsdale dunes, near Southport, he considers the Sand Lizards need further protection from the uncontrolled use of cars along the foreshore up to the dunes of the NCC reserve, and even suggests the reintroduction of them at former dune-land haunts.

You can reach this haunt from the A565 Southport-Liverpool road, best from the Woodvale traffic lights, south of Ainsdale, and along Beach Road. But you will need first to acquire a permit from the NCC to bring your car through the gate on the left, shortly after crossing the railway, and to park at the centre.

There are Natterjack pools within walking distance, while others may be reached after about a mile walking from the car park at Freshfield station, ahead and over the railway-crossing and golf course, but again, a permit should be

obtained for the inner reserve.

I have found Smooth Snakes most readily on the Dorset heaths around Arne and Studland, from Swanage, again with NCC permits.

A phone call I received from Councillor Griffiths, at Crewe, in Cheshire, expressed surprise at the small number of Crested Newts and said my broadcast of it had made his decision to oppose development of ponds which contained these amphibians in the Weston Road area near Crewe Hall, unless the newts could be transferred.

Sex change

Sex-change in vertebrates is almost confined to fishes, though some birds, like domestic hens, develop an atrophied second ovary in old age and assume male features.

Most fishkeepers are aware of sex change in Mexican Sword-tails (not verified scientifically), and some wrasse. Cleaner Wrasse are all born female, the dominant female in a group changing sex and becoming a functioning male. Cuckoo Wrasse, a Mediterranean and British rock-fish, are mostly female in the UK, some changing to male, but in the Red Sea, separate males and females are born.

Clown Fishes, in contrast, are born male, while some groupers are self-fertile hermaphrodites; others born male change later to female according to the sex ratio.

Redfish, *Sebastes*, of the North Atlantic also change sex.



Many Groupers (this is the Coral Trout — *Variola fouti*) can be male and female — at the same time.

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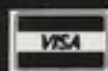
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In May, we'll be going Dutch, Brazilian, Floridian and native . . . among other things.

- On the Dutch front, **Arie de Graaf** will be completing his short 'spectacular' series on the setting up of a Dutch Aquarium.
- Brazil-wise, we have the first part of *A & P* editor **John Dawes'** latest trip into the wilds of South America.
- **Jonathan Moss** will round off our overseas three-some with his illustrated report of Florida's, rather different, Key West Aquarium.
- For our marine readers, there's **Andy Horton's** continuing series on environmental health. This time, he'll be looking at the crucial role played by correct feeding in the survival of native marines.

May is also one of our **SPOTLIGHT** months. The topic on this occasion is Goldfish (mostly fancy, but with a little bit on the more 'common' side as well). Our team of writers consists of *A & P* regulars **Pauline Hodgkinson** and **Stephen Smith**, with French-based aquarist and pondkeeper **Peter Cole** and one of the country's top Goldfish keepers and breeders, **Vic Capaldi**. Together, they've produced a mouthwatering package which will not only please the established Goldfish keeper, but may very well act as the perfect nudge for the non-committed to take the plunge.

- Koi, herpetology, marines, cartoons, letters, plus all our other regulars, will make our May issue a packed, colourful and enjoyable one designed to contain something for everyone, whatever your preference.
- Then, of course, there's our next superb giant, full-colour, **FREE** poster. The subject? Well, here's a clue: Why not 'hop' into your nearest aquatic shop or newsagent and order your May copy now? You'll not be disappointed!

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