

FEBRUARY 1994

# A & P

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## Editorial

### FISH-EYE VIEW OF THE WORLD

The night of 8 December was rough. The severe gales that blasted the UK wreaked havoc throughout the land. In our street, for example, trees were uprooted, roof tiles were blown off and houses were relentlessly pummeled by torrential rain and assorted flying objects. In our patio, heavy earthenware pots were blown over... and three chairs ended up in our main pond, looking more like a tangle of undignified white plastic scaffolding than anything else.

And what about our fish? Were they bothered by the mayhem? Not a bit! As far as they were concerned, their newly acquired plastic jungle was just perfect. For a start, it offered a whole new array of shelters which they promptly adopted without batting an eyelid (which they don't have to bat, in any case!) as if patio chairs were the most natural underwater objects you'd expect to find in a pond.

For some reason, this 'natural-to-them' but 'most-unnatural-to-me' behaviour set me thinking about other examples of 'unnatural' objects being exploited by fish for 'natural' purposes: plastic pipes that become home; sunken galleons and

treasure chests that are commandeered as nurseries; undergravel filter airlifts that act as main thoroughfares between the aquarium and the subgravel world; rubber tyres that are adopted as reefs; polystyrene tiles, clay pots, thermostats, aquarium panes, kitchen mops, scouring pads, and a whole host of other unnatural materials and surfaces that are exploited as spawning sites, and so on... Unnatural? To whom? To us, of course — not to our fish. To them, it seems that anything that they encounter underwater becomes, or is — by the very fact that it is submerged — a natural part of their world. And why not? Seems logical to me... and to them.

As humans, we regularly make the mistake of looking at the aquatic world through our own eyes, with the result that we often get things very wrong. Wouldn't it be far better if we were to approach our hobby through the eyes of a fish? Of course it would. But how do we do this? Any suggestions?

*John Dawes*

John Dawes



# NEWS • NEWS • NEWS



Dr. David Pool 'at work' during a 'Talking Fish' seminar.

## Fifth year for 'Talking Fish'

Tetra's series of **Talking Fish** seminars enters its fifth year this month, with a talk on tropical fish held at London Zoo. The full series of talks arranged for 1994 is:

**Thursday 17 February** — Tropical Fish — London Zoo  
**Thursday 19 May** — Ponds — Bournemouth University  
**Thursday 14 July** — Ponds — St William's College, York  
**Thursday 22 September** — Ponds — Loughborough University  
**Thursday 24 November** — Tropical Fish — University of Sussex, Brighton

At each 'Talking Fish' seminar, Dr David Pool, head of Tetra Information Centre, together with a guest speaker, apply their expertise to a particular fishy subject. Following an evening of conversation and film, Dr Pool then invites visitors to voice their opinions and raise questions on all aspects of the care and maintenance of healthy fish — from water conditions and feeding, to diseases and breeding.

According to Tetra, over 30 'Talking Fish' seminars have attracted over 4,000 fishkeepers from all over Britain. Tickets are £3.00 and an information pack

and refreshments are provided. For information, contact **Maureen Beart at Tetra Information Centre, Lambert Court, Chestnut Avenue, Eastleigh, Hants SO5 3ZQ. Tel: 0202 620500.**

## Top award for Alan and Margaret

Winners of the **Interpet Annual Achievement Award** for 1993 are **Alan and Margaret**



Alan and Margaret Henderson receive their Annual Achievement Award from Interpet's Dr Neville Carrington.

AS for 12 years, and both he and Margaret have been committee members for the last 10 years.

More recently, Alan has been appointed as a council member of the **Federation of British Aquatic Societies (FBAS)** and he now serves as FBAS Trophy and Brooch Officer.

## Call for increased breeding

Fishkeeping enthusiasts have been urged to increase levels of fish breeding to offset the possible future ban by the European Union on the importation of wild freshwater and marine fish.

The call came from aquarist and conservationist **Dr Herbert Axelrod** during a series of talks at **The Supreme Festival of Fishkeeping**, at Portins Sand Bay Chalet Hotel.

Dr Axelrod explained that there is now less of a problem with the Brazilian rain forests, where he has himself been active in conservation. However, hobbyists can provide a wealth of expertise about fish breeding, which could provide a valuable resource for commercial breeders.

The event attracted around 1,000 visitors, many of whom stayed on the site throughout the weekend (see last month's issue of *A&P* for a report from Linda Lewis).

## Marine seminar

The **International Marine Aquarist Association (IMAA)** is holding a special marine fishkeeping seminar at Chester Zoo on **Sunday 20 March**.

Several speakers will present a varied programme of topics throughout the day, and there will also be the opportunity to walk round the zoo and to visit the aquarium.

A free guided tour behind the scenes at the aquarium is being offered to the first 100 people to book their tickets in advance, and a number of trade and advice stands are also expected to be situated adjacent to the lecture theatre.

The AGM of the International Marine Aquarist Association will also be held during the day, and will be open to members only. Tickets for the event provide access to the zoo and the aquarium, as well as the seminar, and

# NEWS • NEWS • NEWS

are priced at £8.00 on the day for non-association members, (£7.00 if booked in advance). Tickets for association members are £6.00 on the day (£5.00). Those for children under 12 and OAPs are £3.00 on the day (£2.00).

For further information, please contact **Colin Grist, 41 Redcliffe Street, Cheddar, Somerset BS27 3PA.**

## National Pet Week

**National Pet Week (April 30 to May 8)** is celebrating its sixth year and, according to the organisers, hundreds of fun pet-related events are being held around the UK.

However, **News Desk** is not aware of any fishkeeping events having taken place last year, and the hobby has been conspicuous by its absence in previous years. So, how about contacting the organisers to see what your society can do to make sure that the aquatic hobby is represented this year?

The aim of National Pet Week is to promote responsible pet ownership and involves all the UK's major pet charities and

animal welfare organisations, along with pet lovers and their pets.

"Every year, the enthusiasm of pet lovers for National Pet Week continues to grow," remarked **Bradley Viner**, chairman of NPW. "Thousands of people were involved in over 500 events held in 1993 and, this year, even more will be getting involved in the fun."

The theme for NPW 1994 is **Healthy Pets, Healthy People** and, although the emphasis is on fun, each event does promote at least one of the more serious objectives:

- 1 To promote responsible pet ownership;
- 2 To make people aware of the benefits of pets;
- 3 To raise awareness of working animals;
- 4 To increase public awareness of the services available from professionals involved with pet animals.

Among the events which are planned for this year are dog and cat shows, dogathons, bazaars, parades, sponsored walks, veterinary practice open days, roadshows, and celebrity appearances.

For further information or help

with organising competitions and events, contact **Karen Bessant** or **Jo Rizzo, The Grayling**

**Company, 4 Bedford Square, London WC1B 3RA. Tel: 071-255 1100. Fax: 071-631 0602.**



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# WRITEBACK

## BIOPLAST LETTER OF THE MONTH

### More than San Salvador

I read with a great deal of interest the article in the December issue of *Aquarist & Pondkeeper* on **Cyanide-Free San Salvador**. As an aquarist, I can hold up my hand and say very clearly that the use of cyanide anywhere to catch fish is appalling. Does that make me feel any better, though? I'm sorry, it doesn't. Does joining Ocean Voice International or the ACN Conservation Group (also based in Canada) make me feel better? No it doesn't.

There are several reasons for this. For example, it is important to teach divers to use nets instead of cyanide, but it's too late to save the reefs. It's not just about San Salvador, of course, it's about all the other man-made disasters like Lake Victoria or the Blind Cave Fish in Mexico.

Yet, fish catchers in Brazil and in the Philippines have to eat. Can we therefore complain when they cut down trees or build roads with coral when they cannot catch fish?



Education is the key factor and, in this respect, London Zoo — for example — has received three substantial donations that will secure its future for some time, so it can now look ahead with confidence. Brian Harris, Dr. Jo Gipps — both of London Zoo — and others have taken a good look at the future — how to educate the public on issues of conservation, taking an active part in world-wide projects. Brian and I have also already discussed plans for the Aquarium, and we are talking with the Philippines Government to look at ways in which we can put something back. So, for instance, the dead reefs at San Salvador could become natural fish farms, with fish catchers becoming fish farmers, using selective breeding of chosen species.

Peter Newman,  
Chairman — the Mini Reef Society

Peter Newman's contribution is our BioPlast letter of the month. A package consisting of £30 worth of BioPlast products will soon be on its way to help with the society's numerous planned projects.

### Cruel unnatural selection

I would like to comment on the letter from Bill Ramsden in *Write Back* in the December 1993 issue of *A&P*.

Mr Ramsden is quite correct in stating that mutations are the expression of what is already in the genes. But, he fails to mention that the majority of mutations are 'undesirable' as far as Mother Nature is concerned, and fail to survive for long in the wild state.

They may well occur, though they are less likely, as the natural gene pool is normally large. Inbreeding in a small captive population significantly increases the likelihood of both parents carrying a particular recessive gene, provided that recessive is present in a founder member of the population. It is extremely unlikely that any of the mutations nurtured by aquarists could ever become established in the wild, even if they occurred in the first place.

The capacity to mutate allows a species to 'adapt' to changing conditions: those individuals that possess a beneficial adaptation can out-compete those which don't, and pass on their particular gene pattern to new generations. The elephant's trunk that Bill Ramsden refers to, gives it an advantage in feeding and drinking in its natural environment. But it is hard to imagine a scenario in which a Bubble-eye Goldfish would do better than one with normal optics.

What we do is seize upon any mutation and 'fix' it, usually by reinforcing the pattern of recessive genes by back-crossing to the parents or by brother-sister matings. In nature,

even if a mutation does not place the organism at a terminal disadvantage, it is unlikely that the line-breeding necessary to fix it would occur for even a single generation, let alone the several usually required. So the mutation disappears in the next generation, whether or not the mutant survives and breeds.

It is a specious argument to say that Goldfish breeders provide optimum conditions to ensure a happy life for mutated forms. A Bubble-eye requires a tank without a substrate or other furnishing which might cause damage. How many of us would like to live out our lives in a small bare room? I would as soon not be short-sighted — but, at least, my eyes point in the right direction, so I can see where I am going.

We spend a fortune in trying to correct — and, more recently, prevent — deformity and disability in our own species — yet, for some inexplicable reason, some people regard it as acceptable, or even desirable, to create deformities in other creatures.

I can live with colour mutations, as they do not, with the possible exception of albinism (poor eyesight and excessive sensitivity to light), cause any discomfort or disadvantage in the secure environment offered by the aquarium. But to create mutations which prevent a fish from functioning properly — and I include deformities of fins and skeleton which impede swimming, as well as distortions of the eyes — is, to my mind, cruel.

To attempt to obviate the effects of such physical disadvantages by use of an unnatural environment is simply to add psychological cruelty to the charge list.

Mary Bailey

## Tropical—food for thought?



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# MY FAVOURITE FISH:



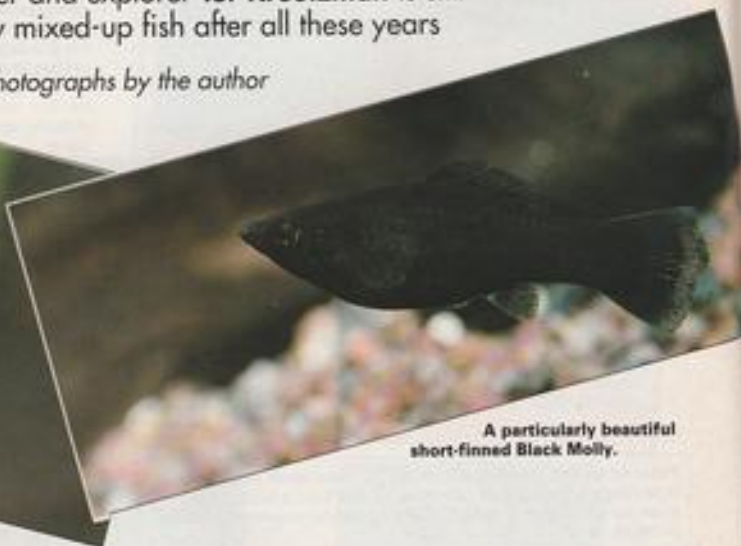
## The Black Molly

Finnish aquarist, writer and explorer **Tor Kreutzman** is still in love with a pretty mixed-up fish after all these years

*Photographs by the author*



Black Mollies come in several fin configurations. This is a Lyretail.



A particularly beautiful short-finned Black Molly.

**A**fter keeping tropical fish for nearly 30 years, it's hard to decide what species is the best one, or my favourite. Over time, my most popular species has varied, but there is one which will always stay in my mind: the Black Molly. How is this possible? Why this fish? It is not colourful, it is not difficult to breed ... and it is definitely not rare.

The Mollies of the genus *Poecilia* still worry the scientists, and this is part of their attraction, as far as I am concerned. For example, what is a Black Molly?

Most Mollies seem to come to this world with a good lot of melanistic ('black') genes. Therefore, they often have dark spots on their sides. From individuals

with these spots, breeders have developed completely black fish, so that the Mollies of today are of mixed origin.

### Early ambitions

For me, it all started a long time ago. I was about 12 or 13 years old and had inherited a fishkeeping tradition from my older brother. That is, he gave me his tank when he changed from fish to girls!

I soon found out that, at that time, there was some interest in the pet shops in buying fish from hobbyists. As I also had inherited a very strong strain of almost completely Black Mollies, I made some

calculations. Suddenly, I knew I had found a way to become rich!

My Black Mollies were breeding all by themselves, without any real attention from me. The tank contained about 120 litres (26 gallons) and was heavily planted. Nothing else was needed. The good Black Molly mothers gave birth to lots of small fry. There were no ugly creatures hunting the new-born babies either, and if the bigger cousins looked too hungry, the small ones could hide in the plants.

The tank was lit by two bulbs, which seemed sufficient. The plants grew, and I was happy to have well-growing *Cryptocorynes* all over the bottom of the tank.

My only concern was how to get



**Sailfin Mollies ... but which species? Or are they mixed?**

enough food for the small ones. At that time, there was only one brand of flakes in the shops, so I had to use that. I was not sure about how nutritious it was, so I also tried to get *Daphnia* for my babies. Their diet also consisted of oat meal porridge and algae and, sometimes, when we had fish for dinner, they would get some fresh roe.

This diet was probably sufficient because the breeding programme was a small success. When I think about it now, I am sure that all the algae the Mollies had to eat was what really got them growing. They kept the tank clean of algae and got their share of fresh food at the same time.

## Grey v true black

When I had enough Mollies of the right size, I would take them to my local shop. The shopkeeper was an elderly man who knew lots about fishkeeping. He was always interested in buying my Mollies, but we never really agreed on the price. He always paid me less if I brought him speckled fish, but for pure-black fish, he would pay more.

The price for the whole lot dropped if there was one fish with grey on its sides. I tried to explain that the strains with some grey in them were actually better, more colourful and stronger. I soon understood that it was better business to bring him fewer fish, but only completely black ones, than more fish, but with grey specimens.

Before selling my Mollies, I had to cull those that were not completely black and thus sell only 'true' Black Mollies.

## Alcoholic trade

Sometimes I noticed that the shopkeeper did not really see if there were any individuals in the glass jar I brought my goods in. This happened especially on Friday afternoons or Saturdays, when there was a slight smell of drinking around him! Those days, he could not see clearly.

As I believed that his way of deciding whether my Mollies were of different price categories was totally unfair, I decided that it would be reasonable if I could get him to pay more for my fish, regardless of their colour.

I therefore started to check his condition before I brought him fish. It soon



**One of the newer varieties: a Golden Sailfin Balloon Molly.**

became very easy for me to smell whether it was a business day or not. If the smell was correct, I rushed home and netted the fish and counted them. Then I hurried to the shop and when he took the jar and held it up towards the light to see the quality, I had some difficulty keeping still. I was always afraid that he would notice how nervous I was.

Sometimes he asked me if the fish were good, or if the whole lot was totally black, and I answered hesitatingly that there were sometimes a few individuals with some, very little, grey on them. If he could see that no such fish were present, I would get a better price, and he then sold them for a better price himself, even though there were sometimes a few less

beautiful individuals in the batch.

The exchanges developed into a sort of game in the years we 'were in business'. He never complained of the quality, and we did business for quite a long time.

## Modern-day problems

Nowadays, I still sometimes stop and think about these very special fish. You don't seem to find such Mollies any more. The ones sold today seem to be real problems. They need high temperatures and salt in the water. They develop shimmies all the time and, very often, seem to have internal parasites.

To get modern-day Mollies really going

**A mixed Molly population photographed at a farm near to Johore in southern Malaysia.**





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you must give them very special conditions. Having said this, we now also find beautiful Mollies in a great variety of colours. They can be yellow or green and can have spots all over their body, or exciting mixtures of all the colours. They are all beautiful and interesting, and they all like some algae in their diet.

I therefore believe that the Mollies of today can give the serious aquarist the same happy moments the old "pure" Black Mollies once gave me.

## In science

The problems that hobbyist have in identifying Mollies are nothing compared to those the experts experience.

Today, the Guppy and some other livebearers belong to the same *Poecilia* genus as the Mollies. Therefore, the differences of yesteryear, with the Guppy belonging to the *Lebistes* and the Mollies to *Mollinnesia*, are not valid any longer.

We hobbyists still speak of the Mollies meaning those that were formerly in the genus *Mollinnesia*.

Today, we have three Molly species that are of interest for the aquarist. These are: *Poecilia sphenops* (the Black Molly), *P. latipinna* (the Sailfin Molly) and *P. velifera* (the Yucatán Sailfin Molly).

**1** *Poecilia sphenops* is found from Mexico, down to Colombia. It was first imported into Europe by Umlauff of

Hamburg, Germany in 1899. The black form, the Black Molly, came some years later, in the early 1900's.

The Black Molly was originally developed by interbreeding from the mottled fish that were brought from nature. *P. sphenops* is a peaceful and long-lived fish for community tanks.

The black form does not exist in nature, so this is one of the few species where hobbyists do not recognise the original wild form; they only know the cultivated forms.

**2** *Poecilia latipinna* has become quite popular among hobbyists in recent years, since breeding in the Far East took off. It is found in the southern parts of the United States, all the way from Mexico to Texas. This is also the reason why this species is so adaptable to aquarium conditions.

It lives in the Rio Grande and also seems to go out into the sea. In an aquarium, the Sailfin can be adapted even to marine conditions.

*P. latipinna* is a big fish; it can reach a length of 12 cm (c. 4.7 in) in nature.

**3** *Poecilia velifera* looks very much like *P. latipinna*. Males in both species develop the big dorsal fin, the sailfin, which has given them their popular name of Sailfin Mollies in various languages.

*Velifera* is even bigger than *P. latipinna* and was long considered to be a giant form of it. The females can reach 18 cm (c. 7 in) and the males 15 cm (6 in).

The differences between the two species are not many, but by counting the rays in the dorsal (back) fin, you can find that *P. latipinna* has 18-19 dorsal rays, and *P. velifera* only has 13-16 dorsal rays. This is, of course, only true when dealing with wild-caught fish.

The colour variations in these species are considerable, and when breeders have interbred these fish, they have added further to the confusion. The Mollies sold in the shops today are hardly one thing or the other; they are almost, in every case, a mixture of all these beautiful fish. This is also the reason why their dorsal fin ray count does not necessarily tell us what species we have.

We have gained many different variations from the industrious fish farms in the Far East and many of these are certainly real beauties. What we have lost is the strength and hardness these fish show in their natural environment. Nevertheless, they can easily adapt to most water conditions, and all eat almost anything and do well on it.

Some farmers spoil the quality of these fish by breeding them in marine water and feeding them with whatever seems to be on hand. The fish live and breed in these conditions, but then hobbyists end up getting fish that expect salt in their water . . . and are heavily inbred. Let us hope that we have pure strains of these beautiful fish in the future. They are certainly worth it!



# CONFESSIONS OF A FISH WIDOW

## The Curse of the Kissing Gouramis

Marilyn Apps recalls bygone Brighton and the haunting 'Candyfloss Fish' she found there.

**W**e decided to take the children to Brighton for a holiday. This was in the halcyon days 'Before Fish', when all our problems boiled down to two joyfully simplistic questions: one — How many candyfloss could the children consume without being sick? And: two — Would they allow us to take a pushchair into Brighton Pavilion?

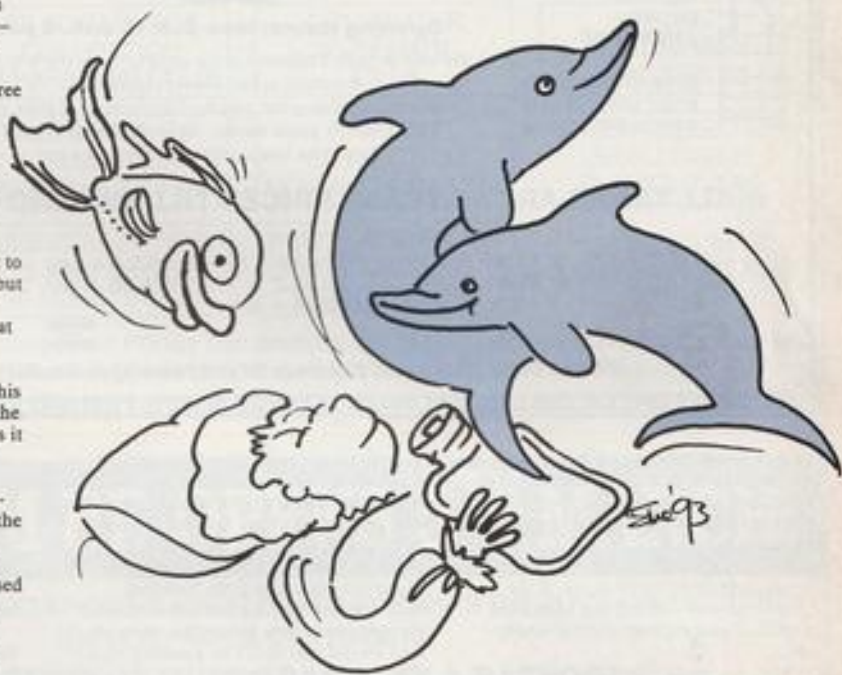
The answers to these were: one — Three and a quarter, and two — No!

So we went to Brighton Aquarium instead. A mistake equivalent to about eleven and three quarters on the Richter scale of holiday mistakes!

Brighton Aquarium in those bygone days was a dark cavernous place buried beneath the promenade (totally different to what it's like today). Entrance was free, but if you wanted to visit the Dolphinarium you had to pay. The payment kiosk was at the farthest end of the labyrinthine aquarium.

My eldest daughter Jane, who was at this time about five years old, wanted to see the dolphins — under the mistaken belief, as it turns out, that they were donkeys! The youngest daughter (18 months old, pushchair-bound and just started on candyfloss number four) wanted to play on the nudist beach.

My husband wanted to see the fish. (I suppose at this point I should have realised my husband's potential obsession with fishkeeping. After all, what man in his right mind forgoes a visit to the nudist beach in favour of looking at a lot of old fish! And old they were. But I digress.)



### Eventful arrival

We started to enter the Aquarium. Jane screamed. Kate screamed. My husband walked in totally unaware that World War Three was about to begin.

Jane was afraid of the dark. Kate wanted to go on the beach. Jane wanted to see the dolphins. Kate had eaten three and a quarter candyflosses. Jane had spotted the donkeys beyond the nudist beach. Kate was sick!

I would pass on my tips for cleaning the regurgitated remains of three and a quarter candyflosses, two sticks of rock, an ice-cream and a digestive biscuit from the doorway of an Aquarium — if I had any. But as I haven't, I would suggest you do as I did:

Walk rapidly into Aquarium wheeling screaming daughter in pushchair.

Drag another screaming daughter into Aquarium by anorak hood. Pretend glut-

nous mess in the doorway was made by some other screaming child in another pushchair.

Round up husband, who is staring dreamily into the murky waters of a fishtank.

Leave husband in charge of screaming anorak hood and screaming sticky pushchair. Storm off in direction of Dolphinarium. Pretend you are childless. Pretend you are not even married!

### Candyfloss curse

Halfway to the Dolphinarium, I stopped. The darkness in the Aquarium tunnel closed in around me.

I looked round uneasily. No-one was about — but something was watching me. My eyes grew used to the gloom. A hun-

dred pairs of eyes stared out at me from a wall of glass. A hundred pairs of candyfloss-pink bodies stood motionless, mouth to mouth against the glass.

I turned to run, my heart pounding. A black figure swooped out of the darkness.

"Just a minute!" he roared. "Is this yours?" He pushed towards me a blue pushchair, striped incongruously pink.

"We don't look after no perambulators in this Aquarium! Take it with you!"

The attendant jabbed a grimy finger over his shoulder indicating the distant doorway of the Dolphinarium, and marched off, leaving me feeling like a very stupid mother who was not even capable of looking after a pushchair, let alone two young children.

I crept away into the Dolphinarium, muttering impotently to the walls.

I paused in the doorway and looked



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back. The candyfloss-pink fish were opening and closing their mouths in synchronised, silent chanting. I knew then that the Curse of the Kissing Gouramis was upon me.

I found my husband and two daughters sitting happily in the back row of the Dolphinarium — after I had lugged my pushchair past eighteen tiers of empty seats.

"Oh, you needn't have dragged that all the way up here," my husband said, with a knowing little smile. "I left it with the attendant out in the Aquarium!"

It was as well that the show started at that point, otherwise I fancy my husband's already sartorial little beachside number would have been topped off with a natty little blue and pink kiss-me-quick pushchair hat!

### Attendant from Hell

I enjoyed the dolphins tremendously, I liked the way they smiled as their sleek black bodies arabesqued and somersaulted across their sparkling blue pool. It quite took away the pain of an anorak hood screaming for her donkeys and a pushchair wanting another candyfloss.

The dolphins couldn't quite erase, however, those haunting eyes, those kissing mouths, those sugar-pink bodies.

Two weeks later, when I was finally talking to my husband again after the 'Aquarium Incident', I casually broached

the subject of the Kissing Gouramis, or Candyfloss Fish, as I now thought of them.

My husband, glad of a chance to speak at last, prattled on about 'bubble nests' and 'labyrinth organs' and 'fighting fish'. It seems he had been brainwashed by the Aquarium Attendant from Hell into believing that keeping fish was a harmless enough, cheap little hobby that every sane man should take up. (Yes! Looking back this is where it all started!)

"But why did they have so many of those Candyfloss Fish?" I asked, finally managing to break into his flow of gibberish.

"I don't really know," my husband said, screwing up his face in that way I knew so well to mean 'But I shall certainly make it my business to find out.'

"The Aquarium attendant said that he thought it was a shame that the Aquarium had been allowed to become somewhat run down, and that Eugenius Birch would be spinning in his grave."

"Who?"

### 1873 Gouramis

"Eugenius Birch. He was the famous Victorian architect who designed the Aquarium. It was actually opened in 1873 you know. I should think those kissing fish were their original stock then. Come to Brighton Aquarium and see the hundred-year-old Gouramis, kissing by candlelight!"

"They're Anabantoids, you know."

"Well, I wish she'd take them back then! They frightened the life out of me!"

"Anabantoids — not Anabantoid's(!)" — my husband said, putting on his world-famous patronising persona, "Particularly Kissing Gouramis have huge spawns!"

"Don't be filthy," I said. "The children could be listening!"

"No! No! No! The Gouramis lay lots of eggs. You know, I expect that's why Brighton Aquarium have so many of those Kissing Gouramis."

"You mean they can't get anything else to grow? I don't think those Go-ramis were kissing at all. I think they were giving each other mouth-to-mouth resuscitation after the Aquarium Attendant from Hell had decided to play 'How many fish can you get in a tank before they all drown'."

I walked away before my husband could give me any more really rivetting fish facts.

### Last Laugh

The Gouramis had the last laugh, however. That night I dreamed I was swimming in a sparkling blue pool with dolphins dancing round my feet. Then the water changed from blue to pink. It grew sticky. Glutinous. The dolphins laughed and ran away. I was drowning in a vat of candyfloss. A pink fish swam up and started to give me the kiss of life.

I awoke soaking and shivering, with the perished pink hot-water bottle suctioned to my face!

# COLDWATER

## JOTTINGS

BY  
STEPHEN  
J. SMITH



### SOAPBOX

#### Two-second memory fish

From time to time in these columns, I am able to reflect upon the media coverage which arises, all too rarely, about the coldwater hobby, with, naturally, particular focus on the Goldfish. As the world's most popular pet, it is surprising that the Goldfish does not achieve greater publicity, so I was delighted to encounter a feature in the Daily Mail entitled **The Golden Gills**.

However, two aspects occur to me in reflecting upon the content of this feature:

- 1 Thank goodness the Goldfish does not receive much general publicity. If this is the best that the general media can come up with; and
  - 2 if this is the best that the media can come up with, then, surely, hobbyists in general could do more to raise the profile of what seems always to be perceived as that most 'humble' of fish.
- Regular readers will be aware that, over the years, I have committed no little endeavour in supporting the Goldfish in particular, and the coldwater hobby in general, by introducing them to an otherwise unaware public. It would appear, as far as the Daily Mail's article is concerned, that I have been sowing my seeds upon story ground.
- Where on earth did the researchers get their material from? Among the so-called 'facts' presented to 1.7 million readers, was "... the average Goldfish has a memory span of two seconds." Try telling that to the scores of young Goldfish in my hobbyist's rearing establishment which, without exception, flock to be fed every time I pass them.
- Here's another 'Goldfish fact' presented by the article: "There are now more than 125 recognised breeds of Goldfish, everything from your fairground fish-in-a-bag Shubunkin to **exotic and specially-bred Koi...**" (my emphasis!). Perhaps I should leave comment on that one to my specialist Koi colleagues at A&P.
- OK, so I fully realise that not everything to be said about the Goldfish can be said in a feature covering just two-thirds of the page of a tabloid newspaper. But, come on you guys, get it right. And if you don't know, you only have to ask.



get cold again. So, any food which the fish will have consumed will not be properly digested (many fishkeepers are unaware that Goldfish and other carp-related species do not have a stomach as such, but merely digest food as it passes along the gut).

Undigested food spells trouble, whether in the gut of a dormant fish, or uneaten at the bottom of the pond. Either way, toxins will be released by the rotting food, causing stress-related diseases and, probably, eventual death to the fish.

### Mid-winter tips

February is always unpredictable with regard to the weather. At this time last year, the climate at my home (in the Midlands of Britain) was fairly mild, apart from a light sprinkling of snow which lasted one day at the most. However, in previous years, I have known the whole of the month to be one complete ice-up throughout the full 28 days (we have even had temperatures of minus 27°C!).

The precautions which you undertook in preparation for winter (you did, didn't you ...?) should be continued at least until the end of the month, or even well into March. If you have covers installed over your pond, keep them on. The layer of air trapped between pond cover and water surface will help to keep temperatures up by a degree or

two, and will probably be enough to avoid any ice forming.

If you don't have pond covers, then a layer of ice will have formed on severely cold days. Please don't be tempted to remove this: the shock waves caused by breaking the ice could kill your fish. If the ice is thick, then one way of tackling the problem (there are others) is to drill a hole in one corner, big enough to insert a hose into. If you then siphon a small amount of water through the hole, this will lower the water level beneath the ice, creating a layer of air.

Thus, the water will be able to 'breathe' (ie exchange gases with the atmosphere), while the 'ceiling' of ice will, itself, provide the same insulating effect as pond covers.

If the month turns out to be as mild as last year, please do not be tempted to feed your fish as they begin to stir at the sight of a little sunshine. Such 'warmth' will only be minimal and it will soon

### PHOTO-JOTTING/One of the Best: The Moor

The colouring and deportment of the Moor gives this variety a 'regal' appearance. Despite its all-over soot-black colouring and its distinctive telescope eyes, the Moor is, in fact, a Goldfish (*Carassius auratus*). Often mistakenly referred to as 'Black Moor', this is an ideal aquarium variety (its dark colouring and

Veiltail-like finnage — except in Butterfly Moors — making it impractical for the pond).

Some people become concerned when the underbelly of their Moors turn bronze; this is merely a sign of age, and I have even heard of some Moors turning to the orange colour of their traditional counterparts.



The Moor (this is a Butterfly Moor) is one of the most fascinating Goldfish varieties, its main characteristics being an all-over jet-black colouring, veiltail-type or Fantail-type finnage, and protruding 'telescope' eyes.

BILLY WHITESIDE

# KOI CALENDAR

By  
DAVID TWIGG

## THANKS x THREE

### 1 Water conservation tip

My thanks this month to **Brian Dicker**. Brian lives in Jersey and we first met a couple of years ago when Brian brought his family (Hello, Liz & boys) here for the BKKS National Show. Anyway, having read my December column, Brian decided to give a me a ring. I will pass his water conservation tip on to you all.

When installing pipes from waste outlets of vortex or other filter chambers, arrange for a short length of clear pipework to be inserted close to the valve. The reason? Well, as soon as you see that the dirty foul water passing the clear section runs clean, you can close the tap without wasting more of that precious pond water that is absolutely necessary.

### 2 "Cheeky"

My thanks also go to **Mick Fahey**, who kindly wrote to me in response to my request for news of similar problems to those experienced by me with my Kohaku "Cheeky" (see *Koi Calendar* — November (possibly egg binding) '93). I hope your Koi is progressing well Mick.



My very egg bound (?) Swollen Kohaku, "Cheeky" ... sadly, no longer with us!

### 3 Koi clubs

And thirdly, my thanks go to the five people who rang me this month for information about their nearest Koi Club. I hope that, by now, they have found out just how trendy and helpful these clubs can be.

Any Koi group (in the world!) not yet given a mention in this column is welcome to write to me with details of their club and its meetings. We will do our best to publicise your activities.

## Jobs for the month

Brrrr... winter is well and truly with us. At the time of writing, gale force winds, with gusts up to 80 mph are blowing outside my window. My fish house, constructed of wooden frames around polycarbonate sheeting and roofed with polythene sheeting, seems to be standing up OK. It is erected annually to minimise the heat loss from my pond and, as I heat water with electricity, to minimise my heating bill also.

The bill, however, will fall this month because my pond temperature is allowed to drop

below the normal feeding temperature for roughly eight weeks starting in the middle of January and ending middle March. This is my way of giving my Koi a winter (much argued about in many quarters) and, hopefully, a chance to ingest any unlied eggs and to burn off some excess body fat which has been put on during the summer feeding period.

As you may know, I have recently passed on a few Koi to good homes so as to reduce the load on my filter system. I will not therefore be buying any of the newly imported Koi which are coming into the country at this time of year. I am, however, going on a trip to visit some dealers in the South East of



My annual weather shelter.

England with **The Heart of England Koi Society** and look forward to seeing some lovely new Koi.

## WHAT'S ON IN FEBRUARY

- 1 — **Yorkshire Section BKKS**. Speaker is **Anne Telford** from **AllClear Water Purifiers**. The Holme Leas Inn, Osett, Nr Wakefield. Contact **Fred Harston** on 0226 722576.
- 2 — **Leicestershire Koi Society**, the British Shoe Corporation Social Club, Leicester. Speaker is **Steve Carey** on **Back to Basics**. Contact **Pip Ostell** on 0533 609707 or **Kevin Luckman** on 0455 250413.
- 3 — **North Wales Koi Club**. Video evening, 7.45 pm, David Bryant Bowling Centre, Fifth Beach, Prestatyn. Contact **Roy Clayton** on 0745 889745.

— **The Potteries & District Section BKKS**. Monthly meeting, The Thistleberry Hotel, Newcastle-U-Lyme. Contact **Ivan Rwtaschew** on 0782 45864.

8 — **Nottingham & District Section BKKS**. Subject is **Cypril Filters**; at The Western Club, Derby Road, Nottingham at 8pm. Contact **Shirley Hind** on 0602 810923.

9 — **South Hants Section BKKS**. Guest speaker is **Helen Bentley**. 8pm, Denmead Church Hall, Hambledon Road, Denmead, Hants. Contact **George Rooney** on 0420 473169.

— **Merseyside Section BKKS**. Speaker is **Charles Harris** of **Purity on Tap**, Millbrook Manor Restaurant, Knowsley Village. Contact **Robbie** on 051 549 2001.

12 — **Heart of England Koi Society**. Speaker is **Frank Prince-Iales** on **Water Quality**. Meeting in Warwick. Contact me on 0926 495213.

13 — **Mid-Somerset Section BKKS**. West Monkton Village Hall. Speaker is **Garry Pritchard**, Chairman BKKS, on **Selecting, buying and growing Koi**. Contact **Alan Purnell** on 0458 72132.

— **Central Section BKKS**. T.P. Riley Community Centre, Blowich. Contact **Sue Finney** on 021 747 2733.

— **Northern Koi Club**. Ann Telford talks about **Water Purifiers**. All Souls Church, Salford. Contact **Tony McCann** on 061 794 1958.

14 — **Northampton Section BKKS**. Speaker is **Greg Peck**. Meet 8pm at the **Saints Social Club**. Contact **John Byles** on 0604 718648.

16 — **Crouch Valley Section BKKS**. Speaking on **Breeders of Japan** is **Ray Talbot** of **The Real McKoi**. Meeting in London, Essex. Contact **Ron Parlour** on 0277 840863.

22 — **Hull Koi Section BKKS**. Monthly meeting at 7.45pm, The Telephone Club, South Church Side, Hull. Contact **Chris Kernan** on 0482 493652.

## 1994 Shows

30 April & 1 May — **International Koi Show**, Telford Exhibition Centre. Contact **DJ's Koi** on 0922 493290.

29/30 May — **South Hants Open Show**. Contact **George Rooney** on 0420 473169.

**Merseyside Section BKKS Open Show** at Camphill. Contact **Phil Adamson** on 051 220 2970.

30 May — **Avon Section BKKS Closed Show**. Part of the **North Somerset Show** at Ashton Court, Bristol. Contact **Dave Knowles** on 0454 774676.

5 June — **Crouch Valley Section BKKS Open Show**. Contact **Ron Parlour** on 0277 840863.

18/19 June — **Lea Valley & Harlow Section BKKS**

**Closed Show**, Crews Hill, Enfield. Contact **Barry Ford** on 0279 419101.

23/26 June — **Baltimore in '94**, A Seminar organised by the **Mid-Atlantic Koi Club**.

The Seminar comprises lectures and 'how-to' demonstrations, world class speakers, dealers' fair and a Pond tour. For more information contact **Burt Ballou** or **Wayne Orchard** in the USA on 0101 714 839 1836 or 0101 703 680 2663 respectively.

14 August — **Koi '94** at **Billing Aquadome**. Contact **Lou Jackson** on 03224 63689.

25 September — **Crouch Valley Section BKKS Closed Show and BBQ**. Contact **Ron Parlour** on 0277 840860.

# QUESTION TIME

Having problems? Send your queries to our panel of experts who will be pleased to be of service. Each 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 an S.A.E. and addressed to: Question Time, Aquarist & Pondkeeper, 9 Tufton Street, Ashford, Kent TN23 1QN. Herpetology, Julian Sims. Kol, John Cuvelier. Tropical, Dr David Ford. Coldwater, Pauline Hodgkinson. Plants, Barry James. Marine, Gordon Kay.

## MARINE



### Water change chore

Doing a 25% water change every month in my 120-gallon aquarium is a real chore. I therefore regularly succumb to temptation and either do it late, or miss it altogether. I'd be glad of your comments.

Regular readers know how important I feel regular water changes to be. You are placing your entire collection at risk every time you either skip or defer the task.

However, the solution to your problem is simple. Try performing small water changes each week. They will be easier and will be better for your aquarium than one 25% change every month anyway.

I use 1 kilo of salt every week, which gives me 7 gallons or so. This means that I change around 30% of water over a month. An added bonus of the little-but-often approach is that

**If being housed with more timid species, potentially aggressive species like the Yellow Tang, should be introduced last.**

when changing such small proportions, you can safely ignore the rules about aerating water for 24 hours.

### Planned intros

My planned stock for my new 42 x 15 x 18in tank is, in order of introduction:

2 Clarkii Clownfish, 2 Yellow Tang, 1 Blue-cheeked Goby, 1 Flame Angel, 1 Boxing Shrimp.

Could I add any more fish at, say, six-week intervals? Could I also add an anemone?

I would prefer to see the most potentially pugnacious species of fish added last. Therefore, add the Yellow Tang last.

It would be best not to add any more fish, even when the filters are fully matured. However, you can add invertebrates without any problems — within reason.

You will, however, need to wait until the aquarium has been running for a year to achieve your full stock.

## PLANTS



### Fast-growing Spadeleaf

I recently bought a pot of Spade-leaf Plants (*Gymnocoronis spilanthoides*). It is a pretty plant but grows very fast. It has now emerged from the water and is growing parallel with the cover glass. What do I do now?

Simply cut off the top 8in (20cm) of the plant. Then trim off the first two sets of leaves from the cut end, and replant it in the tank.

The older portion can be further cut down to within 3in (c 7.5cm) of the gravel. Both the cuttings and the old stems will produce new growth. You can do this several times until the plant weakens, when it should be replaced by fresh stock.

**Submerged form of the Spade-leaf Plant.**



BARRY JAMES

### Bogwood origins

Where does bogwood come from, and what is so special about it?

Bogwood is the heartwood of hardwood trees, the outer layers of bark and softer tissues having decayed and disappeared.

What is left has been preserved, often for hundreds of years, by various means. Sometimes, the trees have been preserved by saltwater due to a change of sea level. Sometimes, the area becomes a bog or swamp, and the wood is preserved by becoming impregnated by vegetable acids. Occasionally, it is a combination of both.

**'Harvested' bogwood ready for shipment from an exporter's premises in Malaysia.**



BARRY JAMES



LAURENCE E. PERKINS



## KOI

### Disappointing pump

I recently bought a pump rated at 450 gallons per hour for my 550-gallon Koi pool. Although it only needs to raise the water by 3ft, it is only managing 160 gph through my pool filter.

I am, of course, bitterly disappointed at the gap between the stated power of the pump, and what it is actually capable of delivery.

What can I do? I would welcome your views, particularly since I found it impossible to obtain clear water conditions last season (the water was always green), and there's always ammonia, and nitrite in the water.

Your problem is by no means uncommon and can be simply explained. When a pump is marketed, the pumping data are based upon a given pump delivering through an 'open end'. Thus, when an artificial head in the shape of such things as pipework, spraybars, venturis etc. are attached, the pump output falls drastically.

There are two suggestions I can offer which may alleviate the problem to a degree. Firstly, ensure the pipework is as large a diameter as possible, bearing in mind that if a pipe diameter is doubled, the capacity increases four-fold. Secondly, you must ensure that the foam filter pads are frequently cleaned, as these are notorious for reducing the

flow, particularly when 'green' water is being pumped.

From the capacity of your pool, I get the impression that it is fairly shallow. If this is so, then you will have difficulty in maintaining clear water. The trouble is that a patch of shallow water responds too quickly to the many environmental changes which occur in any 24-hour cycle; such things as a very hot and sunny day will cause an algal explosion within a couple of hours. Have you considered covering the pool for part of the day, perhaps when you are not at home?

With a capacity of only 550 gallons, I would consider it inadvisable to increase your stocking rate unless you can improve your filter operation to the point where zero ammonia and nitrite readings are obtained.

### Ideal diet

What do you consider to be the ideal diet for Koi? Are trout pellets OK?

It's impossible to go far wrong by sticking to one of the commercially produced foods sold either in pellet, flake or stick form. These foods provide a carefully balanced diet containing all the required vitamins, trace elements etc. which ensure good year-round growth in Koi.

Trout pellets are a very high-protein food and, as such, are intended to put on as much weight as possible in a short time for fish bred as food. There should be no harm in using some trout pellets in conjunction with other foods, but the savings in cost are hardly worthwhile.

**Proprietary foods (in this case, pellets) will provide Koi with all their dietary needs.**



## HERPETOLOGY

### In-betweens

Is there a difference in the correct use of the descriptions 'hybrid' and 'intergrade' as applied to reptiles and amphibians?

Hybrids are the offspring from parents of two different species or subspecies. Hybridisation occurs in the plant kingdom, as well as in the animal kingdom. Hybrids are not 'pure-bred' and are sometimes infertile. The deliberate production of hybrids among captive reptiles and amphibians is not good practice and should not be encouraged.

'Intergrades' are animals (or plants) which are intermediate in appearance between members of two different species or subspecies. They are an example of hybridisation which can occur naturally in the wild, especially where the geographical distribution of two different species overlap.

For example, in France where the Marbled Newt (*Triturus marmoratus*) and the Great Crested Newt (*T. cristatus*) co-exist, intergrades can result due to natural hybridisation between the two species. The intergrades have similarities with both parental species and, in the past, have been incorrectly described as a new and separate species, *T. blasii*.

### Absent colour

What are amelanistic reptiles?

Any animal which is described as amelanistic lacks the pigment melanin. When this pigment is present, it creates the colours black, brown or yellow, according to how much is present.

When melanin is absent, animals are pale, but may have other coloration. For example, amelanistic snakes may be red,

due to the presence of other pigments.

Such red snakes are described as 'erythrid' and include the red colour morph of the Corn Snake (*Elaphe guttata*).

### Food for agamids

Can you supply any information about the correct diet for Agamid lizards?

The Rainbow Lizard (*Agama agama*) is a typical Agamid species originating from North Africa. These lizards grow to a length of about 11½ inches (30cm). They are very active reptiles and so require a large vivarium. This species, in common with the majority of the other 300 species of Agamid, eats live invertebrates, including crickets and Waxworms — the larvae of the Greater Wax Moth, *Galleria mellonella*. (For culturing details, refer to **Your Questions Answered**, page 104 in the June '91 edition of *Aquarist & Pondkeeper*).

However, members of one Agamid genus, *Uromastyx*, are atypical because they are herbivorous. These heavy-bodied lizards are known as Mastigures or Dabb Lizards. They eat plant material in the form of leaves and flowers, such as dandelions and *Aubrieta*. They will also eat the seed pods of peas and beans.

Food for Agamids should be dusted with a multi-mineral and vitamin supplement such as Vionate powder which can be purchased from most pet shops.

In particular, calcium and vitamin D<sub>3</sub> are especially important in the diet of lizards to promote the healthy growth of the skeleton.

## TROPICAL



AS RESOLUTION NOT

### Secretive Angelicus

I have a 3in *Synodontis angelicus* in a tank with a 4 1/2in Salvini Cichlid. I am concerned that the Angelicus may not be getting enough food.

It never comes out into the open at feeding time, and there are always meat chunks left over every morning. Is there any need for me to worry?

Also, will my Angelicus lose its spots as it grows?

Finally, I'd like to introduce a few other Angelicus but am getting conflicting advice on this. Can you help?

*Synodontis angelicus* is, indeed, a beautiful cat fish when young, but the colour fades with age; it is genetic, so nothing can be done.

Like all Mochokidae, African Naked Catfish, this fish lives in shoals that hide by day and feed at night on insects, plants and algae. That may well be why you are finding meat chunks left alone. Try a vegetable flake and freeze-dried insects.

Obviously, shoaling fish are better kept in groups but experience has shown that the fish do accept aquarium life, even if alone. They are inquisitive fish and so, eventually, swim in the daytime, if only to see what its owner is up to. But you must be patient ...

*Synodontis angelicus* is a beautiful catfish, particularly when young, that is worth a bit of effort to get the best out of.

### Softening thoughts

I would like to boil my tapwater (pH 8.4) to remove its temporary hardness. What sort of vessel should I use?

Would it be safe to keep the water for a while in this container (until it cooled down) and, if so, would such water be OK for freshwater tropicals?

Yes, boiling the tapwater will help bring down the temporary hardness and the pH (8.4 is very high, the Waterboard must be adding lime). Any stainless steel, enamel or Teflon coated pan will do.

I would avoid aluminium pans however, although nothing is yet proved, scientists are suggesting that the metal is involved in ageing problems and this could be sourced from kitchen pots and pans. What isn't good for humans, can't be good for our fish.

You can also store water in the same pan, and it will be safe for tropicals, but do cover it to prevent it from adsorbing fumes (kitchen fat, smoke, etc.) and give it a whisk before use to replace oxygen lost by boiling.

## COLDWATER

### New-fish problems



My pond contained three small fish and all went well until I added a few more fish which I purchased from a garden centre. They all then appeared to stop feeding, closed their finnage and many of them have now died, some of them suffering from Fungus and Fin Rot. Please help.

You do not say whether or not you quarantined your new fish before they were added to the pond, but it is possible that they may have brought infections with them. I am, through my own, and the experience of others, quite convinced that proper quarantine is essential.

Fungus and Fin Rot are sure indications that water quality is poor. Changing about 50% of the water and reducing stocking levels to recommended numbers (1 in of fish per 30 sq in of surface), followed by two-weekly 1/2 volume changes throughout the coming summer months will improve the pond environment and then the fish should be very much healthier and happier.

### 'Impure' Redcaps

Last year, I attempted to breed some Redcaps but none of the young actually turned out like their parents. They were simply silver fish with red blotches all over their bodies; in fact, anywhere other than on top of their heads. Where did I go wrong?

I can sympathise because, in the past, I too have had several attempts with different adults and fared the same as you.

I have come to the conclusion that commercial breeders allow flock spawnings and then, out of thousands of the resulting young, simply collect the fish with the characteristic silver

body and red patch on the head, while the rest will be sold as Red and Silver Orandas.

Therefore, breeding on a small scale as the hobbyist does gives very little chance of success.

### Burst Bubbles

I have recently purchased a pair of Bubble Eyes and am now wondering what will happen if a bubble should burst. Would it regrow?

The bubbles are filled with a fluid and can quite easily be damaged by sharp objects or rough handling during the course of a fish's life.

Should this happen, the skin of the bubble will gradually disintegrate as the injury heals. A new bubble will then form, but it will not attain the size of the original one.



MOSKOWSKI BRYTVA

If a bubble bursts, it will quickly collapse, as in this specimen.



MOSKOWSKI BRYTVA

After a while, fluid will begin to accumulate and a new bubble will form.

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In the first article (December '93) I dealt with some of the factors which influence the growth of aquatic plants. I rounded that feature off by dealing with fertilisation. However, probably the most important substance for building plant or animal tissue is the element carbon. So, all the fertiliser in the world will be of little use if there's no carbon around. I will therefore be dealing with this vital substance in the paragraphs that follow.

In addition, the importance of choosing suitable gravel and other substrate material, plus the significance of undergravel heating cables will be considered.

## 1 CO<sub>2</sub> SUPPLY

Almost half the dry matter of any plant is composed of carbon, which means that this substance is the main building material for cell structure. Carbon can only be taken up by the plants in the water-soluble form of the gas carbon dioxide (CO<sub>2</sub>).

While abundant supplies of this gas are available in nature, there is always a deficiency in aquaria for various reasons, not least because the pressure of CO<sub>2</sub> in the atmosphere is considerably lower than in water, and consequently, the gas escapes via the surface.

It is therefore necessary to introduce extra supplies by artificial means. To this end, both the leading companies Dupla and Dennerle have developed very efficient systems for introducing CO<sub>2</sub> into aquaria.

Although Dupla, Dennerle and a number of other manufacturers offer starter systems for CO<sub>2</sub>, I shall concentrate on the more sophisticated ones. These all

derive their gas from compression cylinders and come in various sizes, depending on the size of tank to be supplied. The accompanying table indicates the size of cylinder required for a variety of aquaria and how long a full cylinder is likely to last.

Cylinders are sent by air from Germany and, due to air transport regulations, are shipped empty. Upon receipt, customers should approach their local fire extinguisher company, who will normally fill a CO<sub>2</sub> cylinder for approximately £4.00.



DUPLA AQUARIUM

## CO<sub>2</sub> in action

It is normal, because most cylinders have rounded bases, to fasten them securely to a backboard or the wall by means of a special mounting bracket. The regulating valve system is screwed to the thread on the outlet of the cylinder. All the pieces of equipment are joined by means of special CO<sub>2</sub>-resistant silica hose. The non-return valve prevents the siphoning of water back into the needle valve.

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'Night Shut-off Valve' connected to a time switch, which, of course, can also be used to switch off the lights at the same time.

It is possible to automate the system fully using a specially designed electronic pH meter. This, working in conjunction with an electronic probe inserted in the water, will constantly monitor the pH, and, according to the desired setting on the meter, will electronically open and shut the magnetic valve, thus maintaining the pH at any predetermined level.

## 2 GRAVEL CHOICE

The use of gravel is a very contentious issue in many areas. Because of the high cost of transport, trade supplies tend to use local sources wherever possible.

Although many of these local products are entirely satisfactory for general use in aquaria, some, because of their lime content, are not suitable for aquaria where a low pH and hardness level is desirable. It is therefore essential to find a source of lime-free gravel if you wish to grow perfect plants.

Particle size is also important. I prefer to use gravels of 3/16 in. (0.5 cm) or thereabouts, although some authorities advocate smaller sieve sizes.

Throughout the tropical world, the commonest soil type is a substance called laterite. Containing a large percentage of iron (some 8-9% by volume) the pH is slightly acid.

Installed as a layer beneath the gravel, this substance is of great benefit to plant growth, as it stimulates root growth and makes available large quantities of essential iron. The gravel should form a layer at least 3 in. (c. 7.5 cm) deep over the top of the laterite. Available commercially in powder form, as Everite No. 1, laterite can also be bought in pellet form for use in already-established aquaria.

There are, of course, many types of aquatic biotopes. Under the dense jungle canopy, for example, things are very different to those that exist in more open country.

Here, the laterite bed of the stream is overlaid by (often) thick accumulations of waterlogged leaves and twigs which rot down to form a rich humus. This is where the Cryptocorynes of South-East Asia and the *Anubias* of West Africa grow.

To facilitate the growth of these plants, a humus supplement which is mixed with the powdered laterite has been developed. This product must, however, not be used without an undergravel heater.

## 3 HEATING

While every aquarist realises the importance of submersible heaters and thermostats to maintain tropical temperatures in the aquarium, few realise that it is equally important to keep the growing medium warm as well.

It is an old adage among horticultural-

CYLINDER CHART			
Tank Size in Litres and (Gallons)			
	80 (17.4)	150 (33)	250 (55)
Cylinder size (gm)			500 (110)
250	292	158	92
500	417	222	132
1500	1250	666	400
2000	1568	888	532
			268

No. of days one single filling lasts

Note: Aquarists need 1.5 gm CO<sub>2</sub> per 100 litres (22 gal) per day

DENNERLE AQUARIUM



There's no mystery or luck surrounding well planted, healthy aquaria. Just follow the rules.

# BLOOMING SUCCESS

BILLY WHITESIDE

## PART 2

### Heat, Medium and CO<sub>2</sub>

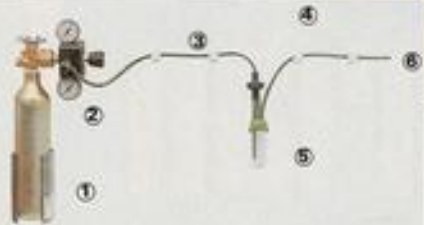
**Barry James** of Everglades Aquatic Nurseries, rounds off his two-part guide to everything you wanted to know about growing plants ... but never dared to ask.

A carbon dioxide cylinder and accessories — one of the key factors leading to success.

CO<sub>2</sub> system components.

CO<sub>2</sub> supply — sequence of assembly:

1. CO<sub>2</sub>-cylinder with wall mounting bracket
2. Regulator with needle valve
3. CO<sub>2</sub>-proof hose
4. Check valve
5. Bubble counter
6. CO<sub>2</sub>-dispersal appliance inside the aquarium.



DUPA-AQUARISTIK



The principle of subgravel heating resulting in healthy plant growth.

GENNERLE NATUR-AQUARISTIK

In the first article (December '93) I dealt with some of the factors which influence the growth of aquatic plants. I rounded that feature off by dealing with fertilisation. However, probably the most important substance for building plant or animal tissue is the element carbon. So, all the fertiliser in the world will be of little use if there's no carbon around. I will therefore be dealing with this vital substance in the paragraphs that follow.

In addition, the importance of choosing suitable gravel and other substrate material, plus the significance of undergravel heating cables will be considered.

## 1 CO<sub>2</sub> SUPPLY

Almost half the dry matter of any plant is composed of carbon, which means that this substance is the main building material for cell structure. Carbon can only be taken up by the plants in the water-soluble form of the gas carbon dioxide (CO<sub>2</sub>).

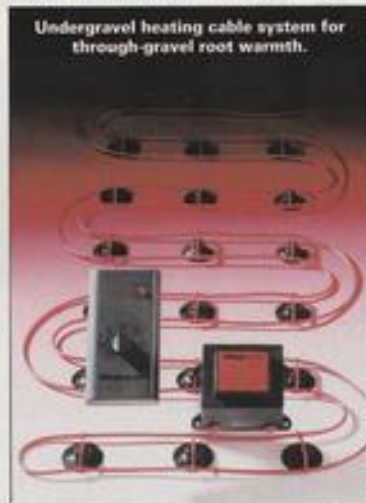
While abundant supplies of this gas are available in nature, there is always a deficiency in aquaria for various reasons, not least because the pressure of CO<sub>2</sub> in the atmosphere is considerably lower than in water, and consequently, the gas escapes via the surface.

It is therefore necessary to introduce extra supplies by artificial means. To this end, both the leading companies Dupla and Dennerle have developed very efficient systems for introducing CO<sub>2</sub> into aquaria.

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Tank Size in Litres and (Gallons)				
	80 (17.6)	150 (33)	250 (55)	500 (110)
Cylinder size (gm)	300	292	158	93
500	417	222	132	47
1500	1250	666	400	200
2000	1666	888	532	268
No. of days one single filling lasts				
Note: Aquariums need 1.5 gm CO <sub>2</sub> per 100 litres (22 gall per day)				



ists that, if you keep the roots warm, the tops will take care of themselves. The same principle applies to aquatic plants.

Sub-gravel cable heaters are well established on the continent where there are two principal systems. One type works on low voltages, the other on mains current.

The objective of both systems is to initiate convection currents in the gravel and substrate. These convection currents ensure that fertilising elements are circulated around the roots, and this not only facilitates the uptake of nutrients, but also ensures aerobic (oxygen-rich) conditions in the gravel.

The heating cables are very soft and flexible. Special suckers with clips attached are stuck to the bottom glass, and the cables attached in loops so as to cover as much of the bottom as possible (1-3 watts per 10 litres — 2.2 gal — is recommended).

## Alternative approaches

Dupla uses an operating system of 42 volts, Dennerle one of 24 volts. Both systems have their own highly sophisticated thermostats. The Duplatherm Digital Thermostat is equipped with two probes, one to monitor gravel temperature, the other to do likewise for the water temperature. A liquid crystal display indicates the temperature with an accuracy of + or -0.1°C.

The Dennerle Duomat 1200 is a multi-

function appliance, and its performance cannot be matched by ordinary thermostats. It controls both the mains heater/thermostat and the 24-volt heater cable automatically in a logical sequence.

Once the cable is in position, the substrate medium is placed on top, followed by a further layer of clean gravel.

Mains operated cables, although much cheaper, give a greater heat output per centimetre of length than low voltage systems. This can result in rather higher localised 'hot spots' around the roots unless controlled by thermostats equipped with a gravel probe.



BILLY TOMMY

## SIGNS OF CO<sub>2</sub> DEFICIENCY

(i) Stunted growth in plants; (ii) Biogenic decalcification; (iii) Unnaturally high pH values (i.e. highly alkaline conditions). This high pH value in turn causes: (iv) Deficiencies in available iron for plants and fish; (v) A sudden upsurge of ammonia, resulting in toxic levels; (vi) Iron chlorosis, with resulting diseases, such as 'Cryptocoryne Rot' and disintegrating plants; (vii) Serious skin diseases and fungal infections in fish.

## VOTE OF THANKS

The systems I have considered in my two articles have all been based on scientific monitoring of the conditions pertaining in the natural environment.

In this respect we owe a great debt to pioneers such as Ludwig Dennerle of Dennerle Natur-Aquaristik, and Kaspar Horst and Horst E. Kipper of Dupla Aquaristik for their untiring devotion, financial courage and business acumen in developing the equipment and systems to make the realisation of the optimal and problem-free planted aquarium a practical proposition for any aquarist who wants one. **ADP**

**Delicate plants like the Madagascar Lace, need top conditions for long-term health.**

## FASCINATING FISH FACTS

### Heavy-drinking, belching killer

In order to avoid being eaten, Pufferfish can puff in water at a phenomenal rate when they are threatened. In so doing, they blow themselves up like water-filled balloons. Once they do this, they are virtually incapable of swimming and simply float upside-down towards the water surface. Some closely related species (the Porcupine Fishes) have an added, super-effective weapon in the form of formidable spines.

Either way, a 12-inch blows-up Puffer is not the sort of mouthful anyone is likely to fancy — hungry or not!

When the danger's passed, the Puffers return to normal by expelling all the extra water in one mighty belch.

What's not clear is why Puffers puff themselves up at all, seeing as they also contain a powerful toxin in their muscles. This poison is so potent that, over the years, it has resulted in numerous human deaths, through what's known as Ciguatera Poisoning, in those countries where Puffer meat is considered a great delicacy.



**A real mouthful ... and a little more besides ... for any unsuspecting predator ... humans included.**

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PAULINE HODGKINSON

Whatever you do, never overcrowd Goldfish.

# A Fish for all Seasons PART 2 Successful Keeping

Alex Stephenson moves on to the second stage of his Goldfish keeping review for beginners

There must be many hundreds of successful fishkeepers whose first taste of the hobby came in the shape of a Goldfish. Equally, there must be hundreds more whose first experience with Goldfish has encouraged them to take up taxidermy!

It is a common practice for well-meaning people to suggest 'trying Goldfish' before attempting tropicals. More than once, I have heard people, who should know better, say things like: "Start with a small tank and a few Goldfish". This is much the same as saying, "Buy a few sheep and keep them in the conservatory."

Although the Common or 'Primary' Goldfish is a very hardy creature, capable of surviving in spite of human ignorance, the more exotic forms are much less forgiving. Having said this, experienced fishkeepers should find Goldfish fairly straightforward, that is, providing a few basic principles are observed.

## Temperature factors

Firstly, realise that these fish are not, in the true sense, coldwater fish. Yes, I know that famous 'pond filler', the Common Goldfish, survives outside in our climate. So do some of the hardier strains of fancy varieties.

This is only possible owing to the adaptability of the species. These fish can somehow hang on to life at temperatures just above freezing, but not for long. At the other end of the scale, temperatures over 90°F (32°C) can be endured, again for a limited period. Slow temperature changes are not normally a problem, but rapid ones almost always are.

If the intention is to keep the fish outdoors all year round, then it might be prudent to stick to the more basic varieties i.e. those with long bodies and short or medium length finnage. Some round-bodied types can be sensitive to chilling,



The Comet can be kept both in aquaria and most ponds.

BRONKHORST JARVIS

and extensive finnage is often damaged by prolonged cold.

Another thing to bear in mind is the fact that fish imported from the Far East have been reared in a climate much warmer than ours. It would therefore be a mistake to subject these fish to a pond full of icebergs without suitable acclimatisation.

For the more exotic types, indoor tanks offer a more protected environment. Opinions vary on the ideal temperatures for Goldfish, but most agree that between 60° and 70°F (15.5-21°C) is best. Many breeders believe a cooler resting period, representing a short winter, is beneficial.

I think you will agree that temperatures in the mid sixties are not very different to those preferred by some species we think of as 'tropical'. In fact, it is true to say that many so-called 'tropicals' are kept too warm. This serves to make them 'super active' and is likely to shorten their lives. The same applies to Goldfish. If kept at constantly high temperatures they can 'burn themselves out'.

Other factors like pH values (acidity/alkalinity) and hardness levels are not critical, as long as any changes are gradual and extremes are avoided.

## Currents

One important point, often overlooked, is water movement. These fish did not evolve in mountain streams and cannot therefore be expected to fight constantly against strong currents.

I find it inexcusable to see round-bodied fish, totally exhausted, drifting in the wash created by an unsuitable filter system. Tanks with turbulence like a dishwasher are ideal for some fish species, but are no use at all for Goldfish.

## Space and stocking

Probably the most important consideration for success is adequate space: large tanks rather than small; or, to put it another way: much water and few fish.

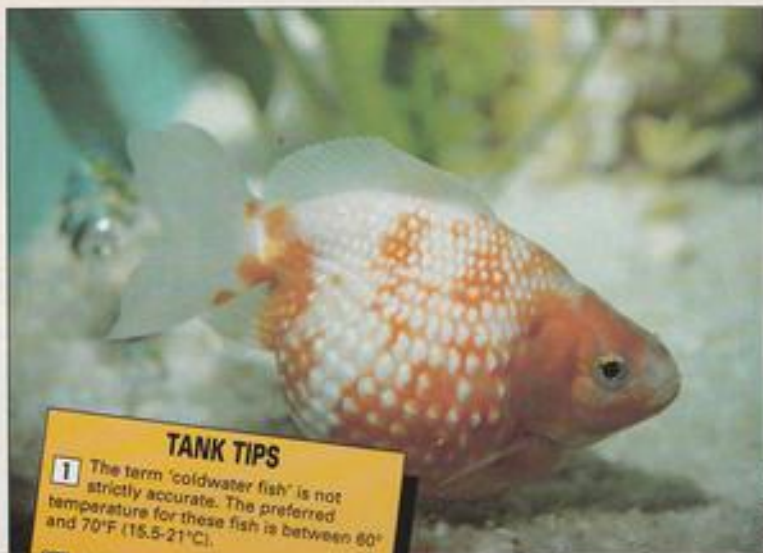
As all set-ups are different, it is difficult to recommend stocking levels. As a guide, one adult fish per square foot of tank surface area should prove satisfactory. For tanks which measure twelve inches from back to front, this means one fish per foot of tank. Eg. a four-foot tank = four fish.

This may not sound like many fish, but these few will thrive and reach their full potential, instead of remaining undersized and constantly ailing.

## Quality control

Goldfish are very messy things. They eat almost constantly, utilise large amounts of oxygen and produce huge quantities of waste products.

If water quality is allowed to deteriorate, the fish will be seriously affected, but



SHAWN MUIR

Fancy varieties like the Pearlscale should be kept in aquaria at all times.

**TANK TIPS**

- 1 The term 'coldwater fish' is not strictly accurate. The preferred temperature for these fish is between 60° and 70°F (15.5-21°C).
- 2 A wide range of temperature, pH, and hardness is tolerated, providing the change is gradual and extremes are avoided.
- 3 Good water quality is essential. Never overcrowd!
- 4 Strong currents, such as those produced by power filters, should be avoided. Diffuse the discharge with a spray bar or some other mechanism.
- 5 Furnished tanks similar to tropical community set-ups make attractive accommodation.
- 6 Keeping other species with Goldfish can be done, but the problems are many and the failure rate high. I would not recommend it!



BILLY WHITEHEAD

The best varieties for a pond are the plain-bodied, short-finned ones such as the Common Goldfish.

the results of this kind of problem may not be immediately apparent. My own opinion is that every upset takes its toll, and that the effects are cumulative, a fish eventually 'popping its' clogs' for no obvious reason.

To maintain good water, most hobbyists employ effective filtration systems and back this up with regular part water changes. Some enthusiasts keep their fish in bare tanks, without gravel or plants. This makes cleaning and maintenance easier, very important if you have a lot of tanks.

## Furnished accommodation

A functional set-up like this is fine for a fish-house, but it doesn't look too good in the living room. It certainly won't impress a non-fishkeeping-spouse. So, to keep up appearances... and avoid divorce ... we need to consider 'furnished tanks'.

The Goldfish tank can be very much the same as the 'tropical' community set-up, with the usual lights, filters, gravel, plants, etc. Bear in mind, though, that your plants will have to survive not only

the attentions of the fish, but the different temperature range as well. This is not as difficult as it sounds, since many plant species used for tropical aquaria adapt very well to these slightly cooler conditions; some even prefer it.

If undergravel filtration is chosen, do provide a more-than-adequate depth of gravel; healthy Goldfish dig constantly and can move enormous amounts of the stuff.

Sharp rocks and ornaments should, of course, be avoided. Goldfish, especially the deep-bodied types, are notoriously clumsy. The fish themselves make ideal domestic pets, though. Having adapted to an artificial lifestyle for countless generations, they are better suited than most to life in captivity. **ASP**

In Part Three, I will be dealing with choosing fish, Standards and showing.



# FROGS AND FRIENDS



## Softshell problems

Softshell turtles belong to the family Trionychidae. They are fascinating freshwater reptiles which show a remarkable degree of adaptation to their natural habitat. However, these special features can lead to problems if softshells are maintained in captivity.

As their name suggests, softshell turtles have a soft 'leathery' shell (upper carapace and lower plastron). Due to this biological feature, it is not a good idea to keep 'hard-shelled' freshwater turtles, for example, Red-eared Sliders (*Trachemys scripta elegans*) with softshell turtles. The soft-shelled reptiles are very vulnerable, and the edges of their shells and their webbed flippers get nibbled by other turtles.

To protect themselves from this type of damage, softshell turtles tend to be quite aggressive. They snap at other turtles and can also give human fingers a very painful bite! For this reason, softshells are best kept on a solitary basis in an aquarium — not even with others of their own species.

Softshells also like to dig into fine, rounded gravel. In the wild, they bury themselves in the mud or gravel at the bottom of a pond or stream. In this way, they conceal themselves from predators, while they lie in wait for their prey (live fish and invertebrates).

It is normally not a good idea to use gravel in turtle tanks — aquatic reptiles can accidentally swallow this with their food. Gravel also makes thorough cleaning of the tank difficult. Due to their lifestyle, softshell turtles are an exception to this general guidance — another reason why they are best kept by themselves and not with other freshwater turtles.

A further problem which can be encountered with softshell turtles is fungal infection of the skin covering their limbs, carapace and plastron. This type of disease often occurs with newly imported

By JULIAN SIMS



JULIAN SIMS

animals — perhaps as a result of low temperatures encountered during transit. Fortunately, if treated in the early stages, fungal infections are relatively easy to cure.

In the past, I have successfully used **Liquitox** to cure a fungal infection on a Malayan Softshell Turtle (*Dogania subplana*). This product has now been superseded by **Advanced Formula**

**Super Liquitox** which is marketed by **Interpet** as **Anti-Fungus & Finrot in their Aquarium Treatment Range**.

**Super Liquitox** should be used in aquarium water at a concentration of 1:10,000. A table on how to calculate the volume of water in an aquarium is included in a very informative booklet, **Guide to Fish Health**, which is supplied with the product. Also

supplied are a pipette and measuring cap.

One final point: to ensure that the chemicals present in **Super Liquitox** are thoroughly mixed, it is important to shake the product container 'actively' before use.

**Malayan Softshell Turtle (*Dogania subplana*)**. Like all softshells, it is prone to a number of problems unless its requirements are adequately catered for.

## Glossy Boas & Pythons book

A very glossy book entitled **Boas & Pythons: Breeding and Care** has recently been published by **TFH**. Written by Erik D. Stoops and Annette T. Wright, the book contains 192 pages and 175 full-colour photographs.

Indeed, it is these photographs which are a particular feature of this publication. Each photograph is laminated for special effect and greatly enhanced clarity.

When the book is first used, the special finish to the pictures causes the pages to stick together; they separate with a loud 'crack'. As you repeatedly delve into the book, though, the pages open with increasing ease.

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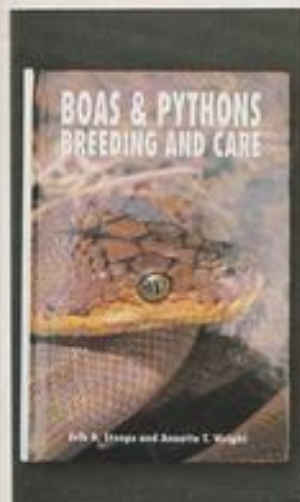
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## BOAS & PYTHONS BREEDING AND CARE

John B. Long and Annette S. Long

The text is divided into sections which provide practical information about basic care, feeding and nutrition, health problems, captive breeding and an account of the 48 species and subspecies of boas and pythons most commonly maintained in captivity. There is also a chart which outlines the environmental conditions needed by different species (vivarium design, temperature range and humidity requirements) and an appendix describing chemicals and medications which prevent and / or cure a variety of ailments encountered by these (and other) reptiles.

I have three criticisms about this book, one of which might disappear with the passage of time. When newly acquired, it has a strong smell originating from the lamination of the pictures. I hope

## Name Spotting

The term punctatus, sometimes used as punctata or punctulata, means "spotted". Its nearest modern-day use in the English language is "punctuated" — the use of "spots" in the form of a colon (:), semi-colon (;) or a full stop (.) to interrupt and separate a sequence of words into sentences.

Examples of spotted amphibians and reptiles which have a specific name relating to their body coloration and markings include the Parsley Frog (*Pelodytes punctatus*) from western and southern Europe and the Ringneck Snake (*Diadophis punctatus*) from North and Central America. The presence or absence of black spots and their arrangement on the ventral surface of the snakes are two of the distinguishing features used in the identification of the twelve different subspecies.

The Indian Flapshell Turtle (*Lissemys punctata*) is another spotted reptile. This chelonian inhabits the tributaries and marshlands associ-



The green, black and white spots of the Parsley Frog, have earned it the name *Pelodytes punctatus*.

MARC STANGSDWIK

ated with rivers such as the Indus, Ganges and Irrawaddy. It is a softshell species of variable coloration which can have small dark brown or large yellow spots on its carapace.

As its name suggests, the Spotted-legged Turtle (*Rhinoclemmys punctulata*) has distinctively spotted limbs. This freshwater reptile has large black spots on the red or yellow scales of its front legs. Its hind limbs are grey and yellow with black spots. This species is found in north-eastern Brazil, Guyana, Venezuela, Colombia and on the island of Trinidad.

that this odour will lose its strength within the near future! The other two points relate to the layout of the pages — the print is larger than usual for a book of this style and the majority of pages are bordered with a coloured stripe which ranges from bright pink to yellow. I found that these bright stripes in no way supported the detailed pic-

tures and often distracted my attention.

These points aside, *Boas & Python: Breeding and Care* will prove a useful book for anyone keeping, and much more importantly, intending to breed these snakes. The publisher's price of £20.95 reflects the cost of producing illustrated material of this quality.

## HERP FACT / White For Danger

The popular name "Cottonmouth" rather implies that its owner belongs to a group of gentle, easily handled animals. In fact... this is the correct common name for the semi-aquatic, venomous snakes belonging to the genus *Agkistrodon* which inhabit the southeastern United States of America.

These snakes have facial pits and all the other characteristics of the pit vipers. They are VERY dangerous and should not be handled.

The main items in the diet of Cottonmouths are fish and frogs, although they also eat small mammals, birds and reptiles (including small freshwater turtles and alligators). The name "Cottonmouth" originates from the obvious "white-lined" mouth which is opened widely when these snakes are threatened.

Predators include large wading birds, owls and Snapping Turtles (*Chelydra serpentina*), but their greatest enemy is man.

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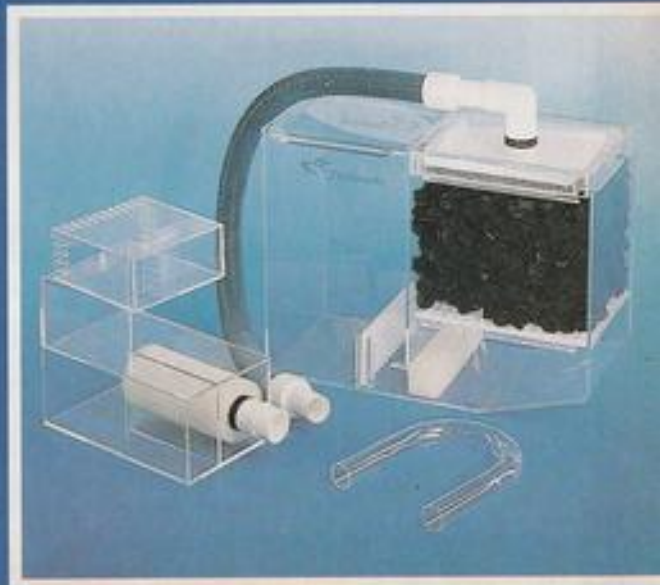
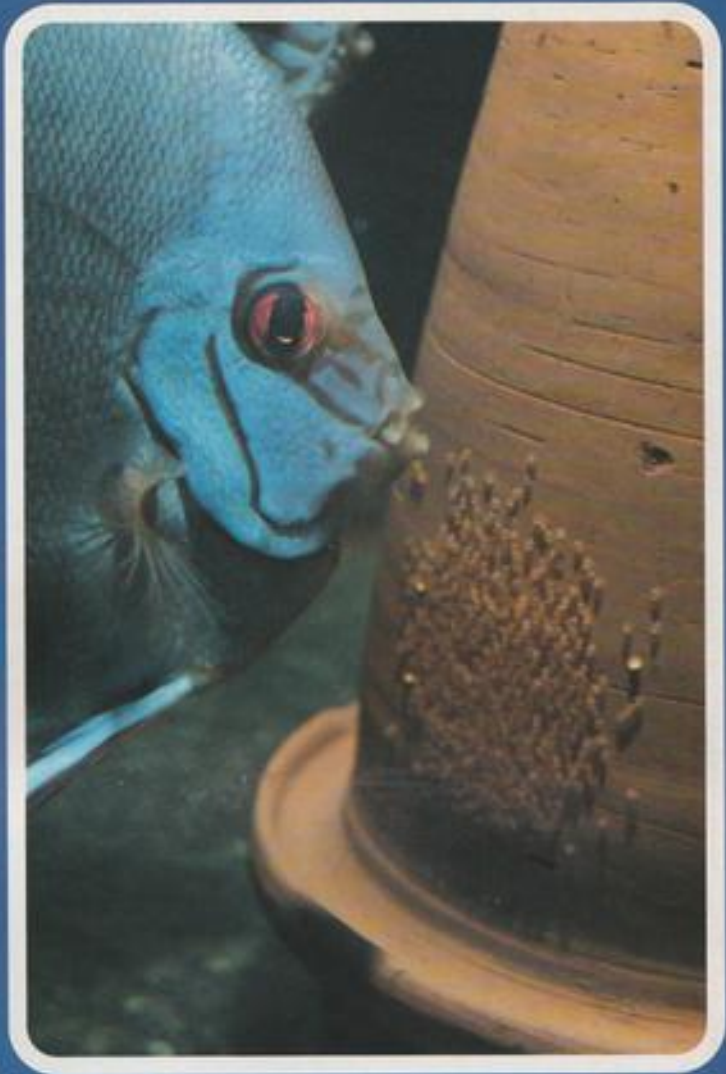
# A&P

**AQUARIST &  
PONDKEEPER**

*Supplement*

## AQUARIUM FILTRATION

- POWER HEADS
- TRICKLE WET/DRY SYSTEMS
- UNDERGRAVELS
- USE OF ULTRA VIOLET AND OZONE
- CONTROL OF AMMONIA
- POWER FILTERS
- NITRITES AND NITRATES







# The Undergravel Phenomenon

A&P editor **John Dawes** explores the often misunderstood workings of the long-lived, simple, but highly effective, undergravel filter.

In order to provide adequate conditions for aquatic plants and animals, an aquarium must be illuminated, aerated and — in the case of tropical organisms — heated. In addition, the water must be kept in clean, tip-top condition, and be of the appropriate chemical composition.

There are numerous ways of maintaining water clean and pure, and most of these are dealt with in the various articles that appear in this **Supplement**.

## Filtration types

Filtration — as the 'cleaning' up of water is referred to — is generally categorised as being mechanical, chemical or biological. While it is easy to see the mechanical removal of solid particles as being filtration in the true sense of the word, chemical and biological actions are more of the purification or detoxification type.

Different types of filter carry out one or more of these functions, sometimes all three (see details of these in the articles that follow this one). In the case of undergravel filters, chemical purification is non-existent. However, mechanical filtration

occurs in all undergravels operated in the normal (downflow) mode, but it is their biological detoxification that undergravel filters are particularly recognised for (see **Dr. David Pool's** article for fuller details of the nitrifying properties of filters).

## General principles

Basically, undergravel filters consist of one or more plates that possess holes or slits over their surface, with one or more larger holes situated at the corners. These carry an upright tube, called an airlift, down which an airline — with or without an air-stone — is inserted until it reaches the bottom of the tube.

The airline itself is attached to an aerator, usually of the diaphragm or piston type. The air that is delivered by the aerator is pumped down the airline to the bottom of the airlift.

As the bubbles rise through the airlift tube, they lift some water up through the column and release it into the tank. In so doing, they create a sort of notional space

**Top, Corydoras catfish and related species will forage along the tank bottom and will help keep the gravel unclogged.**

where the water used to be.

Clearly, this space needs to be filled by new water molecules. However, since none (or very few) are likely to travel down the airlift, i.e. against the rising bubbles, water is dragged from the aquarium instead, through the slits or holes in the filter plates and into the bottom of the airlift.

This is how a simple undergravel filter works in theory. In practice, of course, no 'space' is actually created, subsequently to be filled by water molecules from the aquarium. It all happens in one continuous flow that results in water — with all its contents — being transferred from the aquarium down through the filter plates and upwards through the airlifts, to end up eventually whence it originally came, i.e. the aquarium.

The type of arrangement just described — because it relies on an air-driven pump — can only force water through the system at a relatively slow rate. Obviously, if this rate could be speeded up, then the larger volumes put through the filter would result in greater cleaning capacity (though not necessarily higher biological efficiency). This is precisely what powerheads do. A powerhead is a motorised pump that fits on top of an undergravel filter airlift and turns over water at a fantastic rate compared to even the strongest of aerators.

Powerheads also offer other excellent

possibilities. For example, by forcing water down the airlifts, instead of upwards, we can reverse the whole sequence, so that water is dragged from the aquarium into the top of the airlifts, then downwards towards the base of the airlifts, then into the space under the filter plates and, finally, upwards through the gravel.

When an undergravel filter is set up to work in this way, it is said to be operating in *reverse mode*, as opposed to the more usual *downflow mode* described earlier.

## Reverse v downflow

Both types of operation have their advocates, and both have their advantages and disadvantages. Taking the **Downflow Mode** first, here are some of its **advantages**:

- 1 It allows for the use of both powerheads and aerators.
- 2 It can incorporate aeration of the water via the bubbles generated by the airstones and dispersed at the top of the airlifts (when aerators are used), or by the surface turbulence created by the outflow from a powerhead. Bubbles — and, therefore, aeration — can also be generated by powerheads through the use of a Venturi (an aerating device which is incorporated into many of today's models).

3 When aerators are used, the downflow mode can help with the cultivation of plants (see below for further details).

Among the **disadvantages** of the downflow method, perhaps the most significant is that, by dragging solid wastes into the gravel, clogging of the inter-grain spaces is likely to result in time. This will, in turn, affect efficiency and can lead to 'canalisation', in which narrow channels or canals are created along the lines of least resistance, which are precisely those to which water will be attracted. The effect of this is that very little of the potential active surface of the filter will be used.

With **Reverse Flow** there are some



Lime-rich gravel placed on top of undergravel plates will help establish and maintain the hard alkaline water conditions that African Rift Lake Cichlids need and love.

very important **advantages**. For example:

1 Since powerheads are necessary, it is possible to couple a reverse flow set-up with an external canister-type powerfilter (or any other filter) so that the water is cleaned outside the tank before being pumped down the airlifts.

2 If clean water is pumped down the airlifts, this will result in minimal clogging of the gravel, a feature that will extend its effective biological activity almost indefinitely, if properly managed.

One undoubted **disadvantage** of reverse flow filtration is that it doesn't offer the same opportunities as downflow filtration for aerating the water. Therefore, if an undergravel filter is being operated in reverse mode, it is always advisable to make arrangements for additional aeration.

## Installing undergravels

The more-or-less circular movement of water created by undergravels offers us several opportunities for purifying aquarium water.

For instance, if we place some form of medium in the way of the water flow, then, by definition, we can trap solid wastes, thus cleaning the water mechanically.

Further, if this medium is such that bacteria can become established on it, then dissolved toxins such as ammonia and nitrites can be neutralised (as explained in **Dr David Pool's** article).

On top of this, if we choose our medium (or media, if more than one is used) carefully, we can actually control the chemical nature of the water. If, for example, we plan to keep marines, using coral sand/gravel and/or Calcium Plus, will help us keep the water as alkaline as it needs to be for these organisms. Using lime-rich gravel could serve a similar purpose for African Rift Lake Cichlid tanks, while a properly 'restrained' peat layer could help establish and maintain the acid conditions which some freshwater tropical species, such as Discus, or many of the tetras, thrive in.

Installing an undergravel filter is simplicity itself.

- 1 Assemble the plates and lay them flat on the bottom of the tank.
- 2 Insert the airlifts.
- 3 If using coarse substrate, spread this directly onto the plates to a depth of at least 3 inches (c. 7.5 cm) — see below for an explanation.
- 4 If using fine medium, lay a sheet of Gravel Tidy (a fine-pored inert material that will prevent fine grains from clogging up the filter pores or slits).
- 5 If you plan to use more than one medium, then use the coarser one on the plates and separate it from the top layer with a sheet of Gravel Tidy.
- 6 You are now ready to proceed with the rest of the setting up of the aquarium.

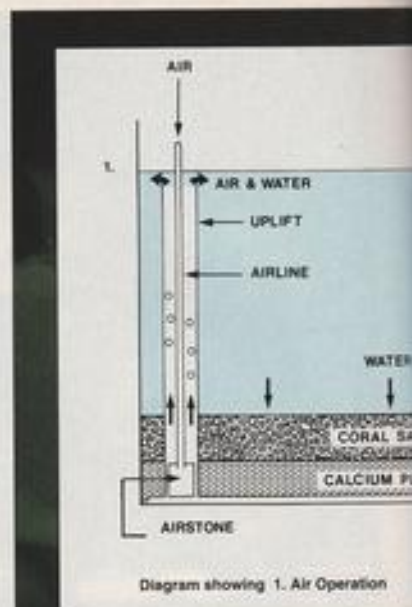
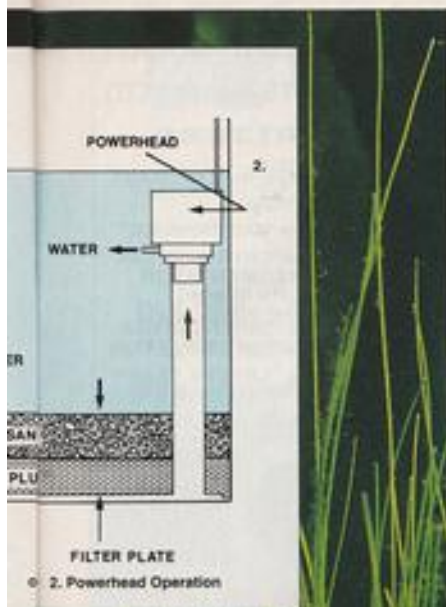


Diagram showing 1. Air Operation





Top, undergravel filters are still defiantly — and justifiably — holding their own in today's world of ever-more-sophisticated filtration systems.

Above, powerheads have revolutionised undergravel filtration in recent years.

Top left, the principle of u/g filtration using both aerator and powerhead airlifts (both would not be found together) as applied to a marine set up.

Left, choosing a substratum of the right type, and using it in a thick layer, will help plant growth. Fish will take kindly to it as well.

## U/G Maintenance

- 1 Every once in a while — the period depends on stocking levels, types of fish kept, and so on — switch off the pump or powerhead and gently rake the surface of the gravel to release some of the trapped mulm.\*
- 2 Wait several minutes until the mulm settles on the gravel, and then siphon this off.
- 3 Replace the water thus removed with fresh water of the same temperature and chemical nature.
- 4 Switch on the pump or powerhead.

- 5 Occasionally — say, every few months — switch off your pump and powerhead and remove it from the airlift.
- 6 Insert a siphon tube down each airlift in turn until it touches the bottom of the tank.
- 7 Siphon out a few litres of 'under-plate' water via each airlift.
- 8 Repeat steps 3 and 4.

\*The surface of the substratum can also be maintained, at least partially free of trapped mulm, by keeping suitable bottom grubbing or burrowing species, e.g. *Corydoras* catfish in tropical freshwater aquaria, Goldfish in coldwater set-ups (though other types of filter are probably better for Goldfish aquaria), and Wrasses, crabs, shrimps, etc., in marine systems.

## U/G's and plants

It is often said that you can't grow plants if you use undergravel filters. This is not quite true.

It is certainly the case if you use powerheads that pump the water through the gravel at a fast rate of knots. Most plants appear to dislike these conditions and will gradually waste away. However, exactly to what extent this deterioration is directly the result of subgravel currents or other limiting factors such as lighting, unsuitability of medium ... or whatever, is impossible to say.

It is also difficult to grow good aquarium plants if your undergravel filter plates are covered by a thin veneer of substrate. Few plant species, particularly those with substantial root systems, will take kindly to such conditions.

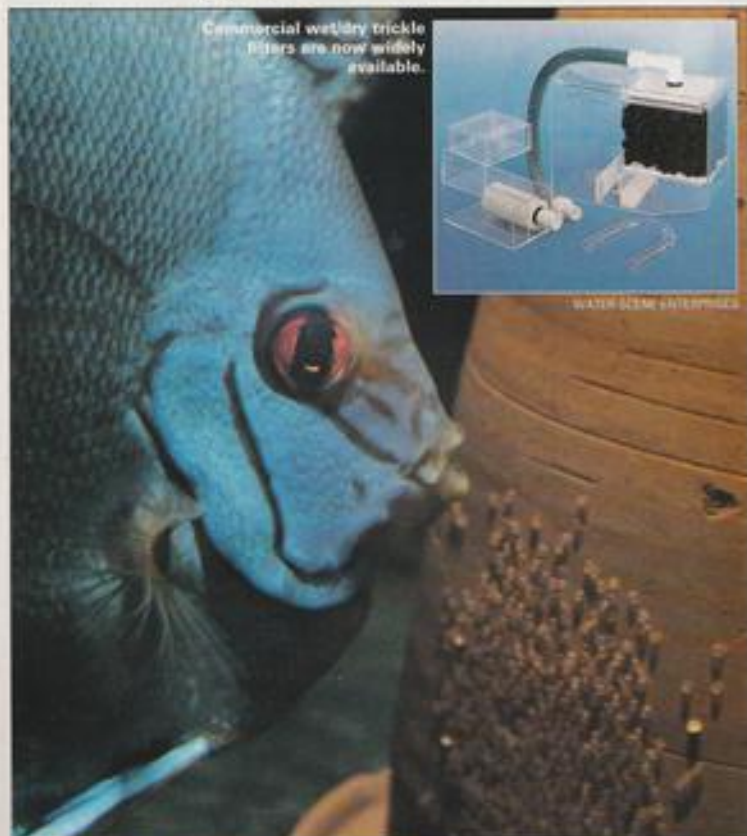
Now ... place a good, thick layer of medium (at least 3in-7.5cm thick) on your undergravel plates, match the grain size and composition to the plants' requirements ... AND — very importantly — allow the water to flow gently through the filter, and your chances of growing healthy plants are immeasurably improved. As a guide, plants with vigorous root systems tend to do better in a coarse medium. Those that have a tendency to float, or are shallow-rooted, are best anchored in finer-grained media.

After having done this successfully for over 30 years, I can assure you that it is very possible to grow plants using undergravel filtration. It's like everything else: obey the rules of nature, and you will succeed; go against them and you're bound to fail ... no matter how fervently you wish to succeed. Just don't ask from a system, or an organism, that which it can't deliver, and you won't be disappointed.

As a lifelong fan of the undergravel filter, I am delighted to see that, despite all the many sophisticated and highly effective types of filters and arrangements of filtration systems that we can (happily) choose from today, the good, old, faithful, uncomplicated, and phenomenally successful undergravel is still there, more than holding its own. Long may this continue. **AGP**

# Wet and dry 'Cleaners'

Dick Mills takes a close look at the oxygen-rich and oxygen-poor world of trickle filters



BILLY WHITENER

It could be said that trickle filtration is the ultimate process in the whole water purification operation, ultimate meaning final, rather than the most superior.

Most aquarists will be quite familiar with the main filtration processes — mechanical, chemical and even biological methods of removing unwanted, suspended or dissolved materials from the aquarium water.

Until relatively recently, the end of most aquarium water purification processes stopped at nitrates, whence it was supposed (and expected) that plants would take up these and so keep nitrate levels down to a minimum. However, to really complete the process, nitrates should ideally be converted back to natural nitrogen, a gas, which can then be expelled from the water entirely.

This apparently now-mandatory need to rid the aquarium of nitrates has come about, not necessarily because the traditional biological filters are failing in their job (these days they're more than likely doing their job only too well and producing lots of nitrate!) but because of our growing understanding of the adverse effect on fishes of high nitrate levels on one hand, and because of the increasing amounts of nitrates already existing in tap-water before the fishes' waste products start adding further to the total, on the other.

Incidentally, no fishkeeper is entirely without blame in adding to the nitrate level — overstocking and overfeeding are two typical 'crimes' in this respect.

## Varying tolerance

Fishes' tolerance to nitrate levels vary from species to species and from system to system, freshwater species generally having more tolerance than their saltwater counterparts.

A general guide is to regard anything over 50mg/litre as harmful for freshwater species, with the 20mg/litre being the similar threshold for marine fishes. Where marine invertebrates are kept, the thresh-

**Left, above freshwater species, such as Discus, which require very good and precise water conditions — particularly for spawning — benefit from the use of trickle filters.**

**Left, trickle filtration is especially useful if you plan to keep delicate tropical marine invertebrates.**

old should be regarded as being around 5mg/litre and this lowest figure used where a mixed collection of fishes and invertebrates is involved.

Although nitrate is sometimes regarded as harmless to most fish, the danger of high nitrate levels occurs when oxygen levels become depleted and the nitrate is reduced back to the far more toxic nitrite.

Before describing the 'hardware', two other methods of controlling nitrate levels should not be omitted: dilution by regular partial water changes (see note above on dangers of nitrate-rich tapwater, so use correct water pre-treatments) and algae filters. Of these, the former is well-practised, the second pretty high self-explanatory. (The garden pond equivalent of the latter might be construed to be a Watercress-filled cascade, beneficial for both fish and fishkeeper alike.)

## Trickle evolution

Modern trickle filters have gained ground rapidly with the advent of marine system tanks. Say 'trickle filters' to most aquarists and they will imagine a smart acrylic box with all sorts of pipework and media, looking very much like a distillery or a medical life-support system at best, and certainly (presumably) very expensive at worst!

Such filtration equipment is normally found in a cabinet beneath the main aquarium, where there is plenty of room for spray bars, reservoirs and water pumps. But it wasn't always so.

An early denitrification system was Interpet's Nitrex Box, a shallow container filled with a special medium and buried beneath the substrate, in which anaerobic conditions were created, the occasional rising bubble of nitrogen gas showing that it was working.

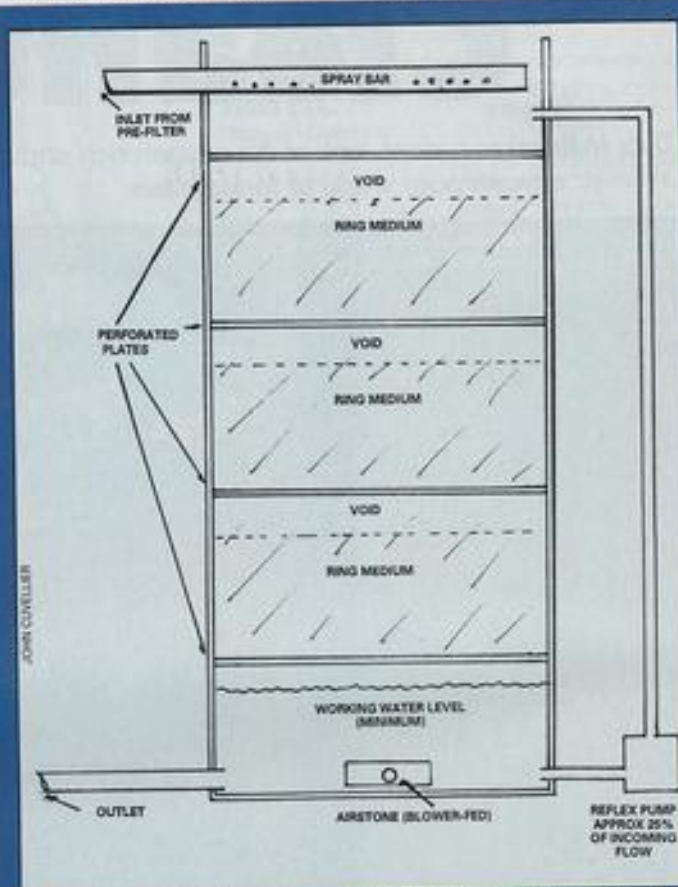
One of the first deliberate aquarium trickle filters was the OTT Filter from King British; yes, OTT did mean 'over the top', because that was where the filter

tray was situated — over the top of the tank. Here, it was at the mercy of very warm humid air, an ideal breeding ground for external algae.

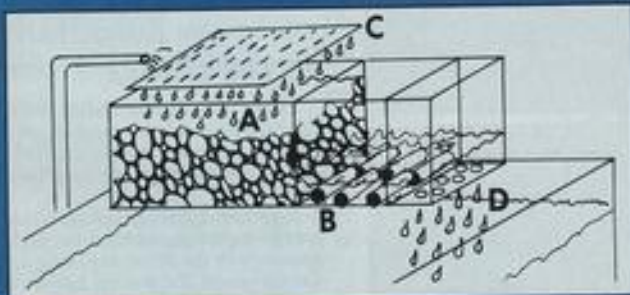
This was the forerunner of the practice of getting nitrifying bacterial colonies out of the aquarium, where the bacteria com-

peted with the fish and plants for dissolved oxygen, into a separate area where atmospheric oxygen could be used.

Another, and current, typical example of this operation can be found in Hagen's excellent comprehensively-complete Bio-Life filter; the central wet/dry chamber

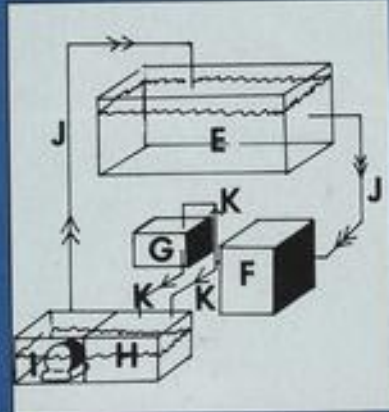


Where a large number of aquaria need to be filtered, the trickle principle can be adapted as a 'tower'.



The principles of trickle filtration.

Above, an overtank trickle filter. A: 'dry' section — plastic balls, etc; as medium in atmospheric air. B: 'wet' section — ceramic pipes, etc, submerged in shallow water. C: inlet dispersing tray. D: water returns to aquarium. Right, aquarium fitted with conventional and trickle filtration. E: Main Aquarium. F: External power filter. G: Trickle filter. H: Final collecting reservoir (can contain carbon filter medium). I: Circulating pump. J: Total water flow. K: Individual flow to each unit (NB, flow through G very slow). Note: F, G and H are often assembled as one unit.



features a ceramic block section in which aerobic nitrifying bacteria do their processing. It is only once the trickling flow of water reaches the submerged hex-nodes material that anaerobic denitrification occurs.

Do look carefully at the specifications for any so-called trickle filter and make sure it really does do that extra process, and isn't just an external conventional biological nitrifying filter, although such top-of-the-tank custom-designed filters do their job perfectly adequately.

## Wet/dry in action

How do trickle filters work? Basically, pre-filtered water is fed through a large-area drip-tray on to an exposed bed of granules (again, to provide the largest surface area for bacterial colonisation); this is the 'dry' part of the filter.

After passing through this bed, where nitrification occurs under maximum aerobic conditions, the water then trickles along a submerged bed, the 'wet' section of the filter, where oxygen content is virtually non-existent. Here, the bacteria still require oxygen but, because they are deliberately kept in oxygen-deficient conditions, they are forced to acquire oxygen from other sources, in this case the nitrates.

Nitrate has the chemical formula  $\text{NO}_3$ , and the bacteria progressively whittle away at it to produce  $\text{NO}_2$  (Nitrite),  $\text{NO}$

(Nitrous Oxide),  $\text{N}_2\text{O}$  (Laughing Gas) and finally  $\text{N}_2$  (Nitrogen). Readers will be quick to see that this is the opposite process to that found in aerobic (oxygen-rich) biological filtration systems, where *Nitrosomonas* and *Nitrobacter* bacteria break down ammonia-based compounds into less harmful nitrates.

The final part of the trickle filter often contains a carbon-filled bag for final adsorption of unwanted dissolved substances.

It may be true to say that a hardly-flowing, muck-laden filter connected to your tank will also act as a denitrifying system to a certain extent, but such an 'accessory' is just as likely to re-dissolve toxins and pass them straight back into the tank, so this lazy way out is not to be recommended.

## Add-ons/maintenance

For those aquaria with already functioning biological systems, there are units available as 'add-ons' which will provide the final denitrification process as a separate entity.

The waterflow has to be adjusted to a very specific rate (one litre per hour is typical during the early stages, with an increase to 1.5 litres per hour as a general running rate once established) and the bacteria fed with a suitable food. This food (usually carbon based) may be provided to some extent by the substance on

which the bacteria grow, or else in a liquid form by the filter's manufacturer.


Trickle filters need maintenance, just as all other types of filter do. With separate de-nitrators, for example, 'overfeeding' can cause obstructions — and nasty smells — so regular nitrate readings should be taken to check performance.

It is best to de-activate such filters if they are likely to be left unattended for periods in excess of the normal annual holiday. Safeguards for the bacteria should not be overlooked either, particularly in marine aquaria: ozone and ultra-violet treatment of the water can damage anaerobic bacterial colonies and protein skimming may result in a slow initial establishment.


## Best use

In closing, it appears that trickle filters contradict the common belief that a fast waterflow rate is necessary for optimum filtration, but it should be remembered that trickle filters are best used in conjunction with other, more conventional, types, leaving their 'faster' relatives to deal with the real dirty work of removing visible, and paradoxically, less harmful substances.


Incidentally, as their operational method uses pre-cleaned water, less maintenance of trickle filters is needed than for in-tank, sub-gravel systems, even when reverse-flow is employed.




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# Power Filters

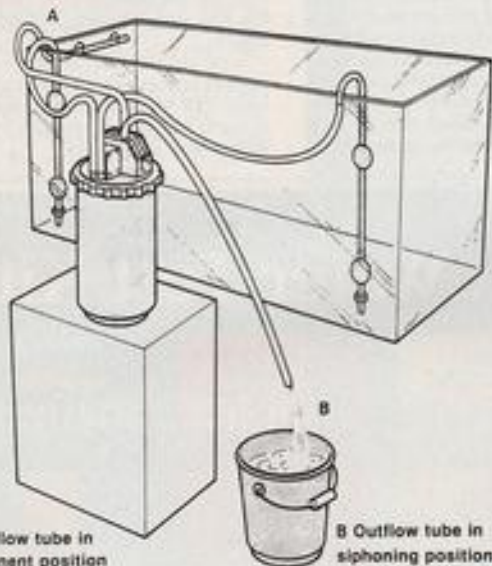
Whether internal or external, power filters are both convenient and effective, as Aquarian's Dr David Ford explains

## HOW TO START AN EXTERNAL POWER FILTER

Practically all power filters work by a magnetic drive spinning a plastic impeller that causes water to flow through a chamber. This is not a pumping action, so the flow can be irritatingly difficult to start. It is a siphon action that gives the main flow, while it is the spinning impeller that maintains the flow. Hence, site the power filter so that siphoning can occur. The impeller housing must be below the aquarium's water level and pipework must be kink-free and water-filled (no air bubbles to give an airlock).

When first fitted, run the exit pipe (low down) to waste, rather than install in the aquarium, so that a good siphon flow will occur. Once all the air is flushed out (shake the power filter body a little), quickly (to avoid splashing everywhere) lift the exit pipe into the tank and fit to the rigid outlet or spraybar.

The diagram shows a typical double inlet, one spraybar outlet, external power filter. Once the filter is flowing well, it can be lowered from the box to a position under the aquarium (check the pipes reach first!) or better still, left adjacent to the tank, as long as the impeller housing is below the water level.



A Outflow tube in permanent position

B Outflow tube in siphoning position

In terms of efficiency, the most thorough form of filtration is that provided by the trickle, or wet and dry, filter. In terms of cost, the cheapest is the air operated undergravel filter. But the most convenient is the power filter. In many cases, you just plug in and switch on, for clean, clear water.

There are two basic types of self-contained, powered filters, the internal and the external. This refers to whether the filter is immersed in the aquarium or is free-standing outside. Obviously, the internal models have to have a waterproof motor but cannot be too large, so they are the cheaper option. An external model can be

### CLEANING TIP

The bucket method can be used to 'quick-clean' the filter. Just give the filter body a shake with the outlet tube in a bucket, so muck is shaken loose and siphoned out. Restart when the water runs clean.

BILLY WHITEHEAD

much larger and requires tubes and fittings, so is more expensive.

Which type to choose depends on your situation: the aquarium may be a living decoration where an external filter is not appropriate, or you may have a fish-house with lots of tanks, so small internals are cheaper to fit and run. Where space allows it, however, the external power filter is to be recommended, simply because it is larger. The greater the volume of water and the larger the area of filtration, the better it is for the fish.

The point to remember is that fish have to swim in their own loo! Flushing that loo is the best way of maintaining water quality, but that becomes a chore if carried out daily. Bacteria can convert the excreta from the fish into harmless material (see, for example, Dr David Pool's article on nitrification and denitrification) and they will grow in the filter's medium, whether just a foam block in a small internal filter,





DANIEL GARDNER

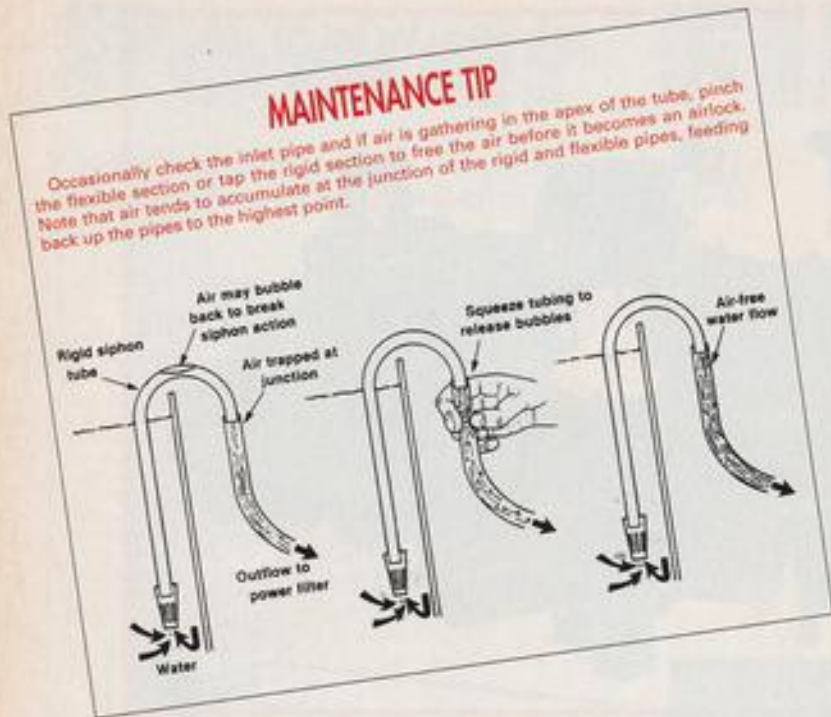
A collection of power filters. There are at least a dozen makes here, but all are effective because it is the bacteria that do the real work; the power filters merely pump water.



DANIEL GARDNER

The plastic basket from a typical external power filter with media that can be used. From left to right, from the top: nylon floss, polyester wool, polyfoam square and cylinder, carbon (in a nylon bag), ceramic daisies, ceramic cylinders, nylon bag, polyball tubes, two colours of polyball interlocking pieces, sintered glass and plastic hair rollers. Use any, some, or all!





**Air bubbles may form in the tube carrying water from tank to power filter. By pinching as shown, you'll correct this problem.**

or a multi-media filter system in the external unit. Then, only occasional flushing is needed via the routine partial water changes every few weeks or so.

Another point to remember is that you cannot overfilter, so the bigger your filter, the better. Some books will state the opposite, but what they are really referring to is the effects of strong water flows on fish and plants that prefer still or gently flowing water. If the fish are being thrown around by a powerful return jet, even species that like strong flows will be stressed.

Some large power filters have a control valve so such jets can be turned down, while many have spray bars that can be turned into the back glass to dissipate flow jets. Internal power filters can be fitted with spray bars, too, even if they are not standard.

## Flow rates

The popular formula is that a freshwater tank should have a complete change hourly and a marine tank twice an hour. In other words, choose a flow rate of the tank's volume per hour (or double for marines).

Note that the manufacturer's claims for flow rates are based on the motor's maximum pumping capabilities. In real life, the

water flow is slowed by the restrictions of filter media and pipework, then by silting up with mulm (the solids formed from bacterial activity). This can be 50% initially, reducing to a mere trickle as time allows silting of the media.

So choose a power filter that the makers claim will turn over the aquarium's water volume at least two or three times per hour. If a small internal model is preferred, use two filters, or combine with other filter methods, or rely on lots of partial water changes.

## Media choices

There have been volumes written about filter material, and the choices are bewildering. Some claims are unbelievable too! In fact, the choice is not as important as often claimed, because it is not the medium that does the work, but the nitrifying bacteria that reside thereon.

These bacteria need a surface, so the best medium is one with a large surface area. Hence pebbles are good, but not as effective as fine gravel. Carbon granules are even better, not because of the chemical reactions (the adsorbing power of fresh — i.e. 'activated' carbon — is spent in just a few hours) but simply because the carbon has a sponge structure, and so possesses a massive surface area.

Ceramic pieces are excellent because they are baked with lots of pores and do not suffer from dust and staining like carbon. Plastic pieces are also useful, being totally inert; they can also be fashioned into shapes that help the bacteria grow and the water to flow, even when clogged

with mulm. There are beads and balls, tubes and stars, pipes and streamers, some in black, others in bright colours just to attract the customer.

Glass has been used because it is inert and light, and can be made with very tiny pores (called sintered glass), the sintered form being made into balls or tubes or cylinders etc. This is an expensive process, however, so such media are not cheap if required totally to fill a large power filter unit; small quantities are often added in addition to cheaper media.

Plastic foam is simple to make and fit, so many internal filters have a sponge filter included. Being porous, these sponges will act as mechanical filters, but the pores soon develop bacteria and become 'biological' too. Another advantage is that the sponge is easy to clean, but remember that chlorinated tapwater will kill the useful bacteria, so just rinse off the excess dirt and mulm in a little aquarium water (or even water from the hot tap because it is dechlorinated by the heat — only run a little, and use before it becomes scalding).

The simplest filter medium is polyester wool or nylon floss. This can rarely be rinsed because it mats on rinsing, but is cheap enough to renew each time. It has no pores, so few bacterial colonies form; therefore, use the wool as a mechanical filter only. It can be a prefilter to remove solids before the solubles pass to the main filter medium, and/or a final filter to polish the purified water returning to the tank.

In some filters, the floss has been woven into fabric which can be washed and reused, but these are usually part of the polishing section of a multifilter system. In the 'Diatomaceous Earth' filters, a nylon fabric bag is coated with the diatom powder to give a barrier that polishes water until gin-clear. These filters are only for short-term use because the filter bags will clog and stop flowing within a few hours. They are useful gadgets for show tanks at fishkeeping exhibitions, though!

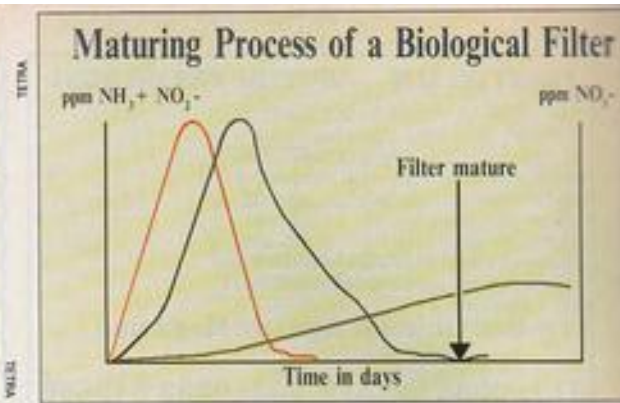
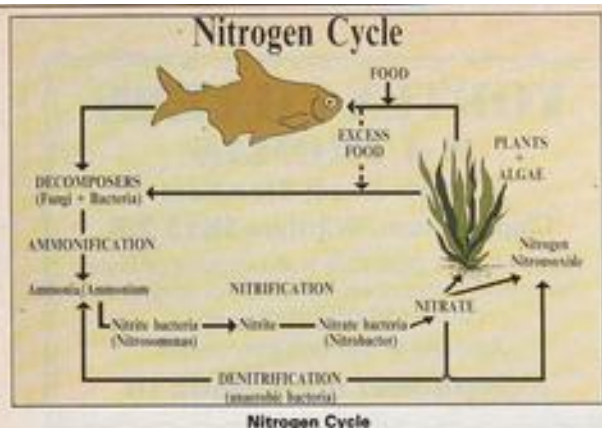
Never use cotton wool. Being organic, the wool will degrade and add to the pollution of the aquarium, rather than cleaning it.

## No best buy

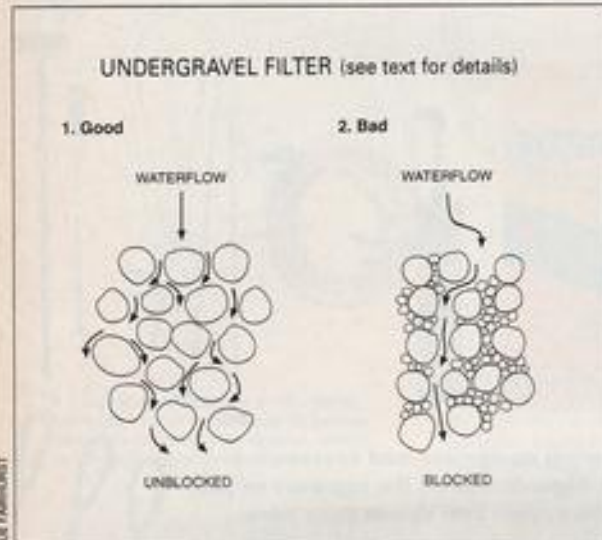
It is part of the fun of fishkeeping that so many choices are available to the hobbyist. There isn't one 'best buy' or one 'ideal filter medium'; if that were so, that one unit would be made by every manufacturer.

It doesn't matter how you filter, so long as you do filter, copiously and continuously, because that is how water quality is maintained. All filters work, whether a simple bubble-up, polyfloss-filled box or a powered external box filled with bio-balls and sintered glass.

Choose the system that suits your aquarium set-up the best, then choose the model that suits your pocket ...



In a new tank there is a characteristic rise and fall in the concentration of ammonia (red line), nitrite (blue line) and nitrate (brown line) as the biological filter matures.



almost every body of water, but are encouraged to live in an aquarium or pond through the use of a filter, which provides them with ideal living conditions. Having the wrong amounts of these bacteria, or too few of one species, can lead to considerable problems with pollutants. However, a little knowledge of the subject allows most of these problems to be prevented, and enables us to get the most from our filter system.

When a filter becomes blocked with debris, the water will all flow through a small number of passages, with the remainder being starved of oxygen.

### The N<sub>2</sub> Cycle

The Nitrogen Cycle, which is illustrated in one of the accompanying figures, involves the breakdown of organic material such as fish waste, uneaten food and dead plants or fish into ammonia or ammonium, ammonia or ammonium into nitrite, and nitrite into nitrates. This process occurs by means of aerobic (oxygen-loving) bacteria and is known as nitrification.

To complete the Nitrogen Cycle, nitrate is broken down into nitrous oxide and nitrogen by anaerobic (oxygen-hating) bacteria in a process known as denitrification.

# Managing Aquarium Nitrogen

Nitrogenous wastes are highly dangerous in aquaria. Learn how to keep them under control following the valuable advice provided by **Dr. David Pool** of the Tetra Information Centre.

**W**ithin any aquarium or pond, there is a whole range of reactions and interactions occurring which influence the fish and plants we are trying to keep. None is more important to the fishkeeper than the breakdown of waste material, which is achieved by a series of bacteria in a process known as the **Nitrogen Cycle**. These bacteria are found naturally in

### Nitrification

For nitrification to be completed efficiently, we need to ensure that there are sufficient bacteria in our aquarium or pond to cope with all of the waste produced. To achieve this, we have to provide the bacteria with the conditions that they require, which are the following:

- 1 Surface area**  
The bacteria responsible for the Nitrogen Cycle are not fussy about the surface they grow on, providing there is enough of it. They will, for example, grow on the rocks, plants and the glass of the aquarium.  
If a tank is only stocked with a small number of fish, there will be sufficient bacteria present to break down all of the waste produced.

If, however, the tank is moderately or heavily stocked, there will simply not be sufficient space for enough bacteria to grow.

Filters overcome this by having media with massive surface areas.

## 2 Oxygen

For the bacteria involved in the breakdown of ammonia to nitrite to nitrate, oxygen is essential. Without it they do not function, and so waste material is not broken down.

Providing a suitable supply of oxygen can limit the efficiency of a filter in a number of ways.

If there is a low water flow rate through the filter, or a large depth of filter medium, only the area close to the water inflow will receive sufficient oxygen for effective bacterial action. These bacteria will remove most of the oxygen, resulting in the rest of the medium not having sufficient to function.

Similar problems can occur if the filter medium becomes blocked. Whatever the medium is, once blocked, the water will all flow through a small number of channels, starving the remainder of oxygen. Regular cleaning is therefore advisable.

Filter design could also cause areas of medium to have low oxygen levels, and so not function efficiently. Consider the accompanying diagrams of gravel grains in an undergravel filter. There are a number of dead spots which receive little or no flowing water and so would not decompose waste effectively.

## 3 Food

The bacteria responsible for all stages of the Nitrogen Cycle are living organisms and, like us, require food if they are to survive. The number of bacteria in an aquarium and filter quickly adjusts to cope with the amount of fish waste being produced.

If there are four fish in the tank, the number of bacteria will, given suitable conditions, increase in number until they consume and decompose four lots of fish waste.

If three of these fish are removed, there will be only one quarter of the amount of fish waste produced, and so three quarters of the bacteria will starve and die, leaving the numbers of fish and bacteria in balance.

## Denitrification

The bacteria responsible for denitrification, or the breakdown of nitrate, are all anaerobes, that is, they live in the absence of oxygen. Other than this, the bacteria require the same conditions as nitrification bacteria, namely, a food supply and space to live.

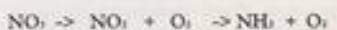
Space can be a problem because the anaerobic bacteria are inefficient. Consequently, a large number are required to break down a small amount of nitrate,

resulting in nitrate filters often being quite large. These filters require a slow flow of water to ensure there is little oxygen present in most of the filter.

A source of carbon is also essential to the anaerobic bacteria. This can be artificially provided (via the addition of an alcohol, such as ethanol, in some cases), from the debris within the filter, or even from the filter medium itself.

The bacteria responsible for the breakdown of nitrate remove oxygen from the nitrate molecule. This can work in two ways.

In simplified form:



(Nitrate) (Nitrite) (Oxygen) (Ammonia) (Oxygen)

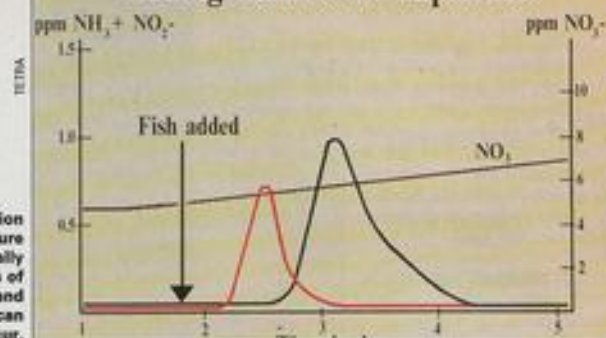
or:



(Nitrate) (Nitrous oxide) (Oxygen) (Nitrogen gas) (Oxygen)

Any nitrate broken down into nitrite or ammonia will cycle through the aquarium and be broken down by the nitrification bacteria.

## Adding Fish to the Aquarium



Following the addition of fish to a mature tank, potentially dangerous increases of ammonia (red line) and nitrite (blue line) can occur.

## Problems

The Nitrogen Cycle, and its effective functioning, is a concern to aquarium and pond keepers because of the toxicity of the chemicals within it.

### 1 Ammonia and Ammonium

The first stage in the cycle is the formation of ammonia (toxic) or ammonium (non-toxic). Each is easily converted into the other, with the ratio of ammonia to ammonium being largely dependent upon pH (acidity/alkalinity).

At pH values below 8.0, the water contains mainly ammonium, whereas, above 8.0, i.e. more alkaline conditions, there is a rapidly increasing proportion of ammonia.

Consequently, ammonia is only a major problem in brackish and marine aquaria, (which have a pH of around 8.3) or in alkaline areas of the country (eg London and the South Coast).

A high level of ammonia in the water will severely irritate and damage the gills

GORDON WIGGINS



**Breckish fish** (this is an Archer fish — *Toxotes*) can find themselves subjected to high ammonia levels far more quickly than their freshwater counterparts.

of the fish, resulting in them having difficulty obtaining sufficient oxygen. As a result, fish suffering from ammonia poisoning often show rapid gill movements, gasp at the surface, or rub against underwater objects. The skin will also be irritated and may appear pale, due to excess mucus production. Such effects are particularly obvious on dark regions of the skin and on the eyes.

### 2 Nitrite

Ammonia is converted into nitrite by *Nitrosomonas* bacteria. Nitrites are less toxic than ammonia, but wherever possible the concentration should be kept below 0.2mg per litre of water.

At raised levels, nitrite binds with the haemoglobin in the blood of the fish or invertebrate, forming methaemoglobin. This affects the blood's ability to carry oxygen, causing the fish to become lethargic, gasp at the water surface, and accumulate in areas of moving water.

### 3 Nitrate

Nitrite is finally converted into nitrate by *Nitrobacter* bacteria. In comparison to nitrite and ammonia, nitrate is considerably less harmful to fish and invertebrates, and is used by plants and algae as a source of nutrition.

Consequently, it promotes plant growth, but in excess quantities can also lead to undesirable algal growth. In almost all situations, the nitrate is not absorbed completely by the plants and, in time, will accumulate in the water.

Nitrate levels of only 25mg per litre of water can have adverse effects on marine invertebrates. In freshwater, values of 50mg per litre can affect fish fry, as well as reducing fin development and growth. Such levels may also encourage blue-green algal growth. Values of more than 400mg nitrate per litre are necessary before lethal effects are seen on fish such as Goldfish.

## Imbalances

In a stable aquarium or pond, the nitrogen cycle should be working efficiently, with enough bacteria present in the filter to cope with all of the waste, uneaten food etc that is being produced.

This is by no means always the case, though. The following examples show some instances when the Nitrogen Cycle is not in balance with the amount of organic material being produced, and can result in problems.

### 1 New Tank Syndrome

In the first 3-4 weeks after setting up a new aquarium (or pond) a process widely known as 'New Tank Syndrome' occurs as the nitrifying bacteria become established.

When first set up, there are very few, if any, nitrifying bacteria present. Therefore, any waste or uneaten food will not decompose and will gradually accumulate in the aquarium.



Goldfish are among the toughest fish when it comes to resistance to nitrogen-based pollutants.

The first organisms to develop are those which can take advantage of the food supply, and convert the waste into ammonia, resulting in a build-up of ammonia or ammonium. Once ammonia is present, any *Nitrosomonas* bacteria present have an abundant food supply and will rapidly increase in numbers, converting ammonia to nitrite. The result is a reduction in the ammonia or ammonium concentration and a build-up of nitrite.

Finally, the *Nitrobacter* increase in numbers, converting the nitrite into nitrate. The tank is described as mature when there are sufficient bacteria present to complete all of the stages of nitrification, and ammonia and nitrite concentrations are at zero.

This process can be speeded up by seeding the aquarium with bacteria from an established filter, or by using commercially available 'filter start' preparations. Taking time and care when stocking initially will also ensure that toxin levels are kept to a minimum.

### 2 Adding New Fish

Once established, a tank and filter will have sufficient bacteria to cope with all of the organic debris produced. In a tank holding 20 fish, there would therefore be enough bacteria present to break down 20 lots of fish waste.

If we added a further 10 fish following a visit to an aquatic shop, we would have 30 fish, producing 30 lots of fish waste, but only enough bacteria to break down 20 lots of waste. The result would be a build-up of waste, followed by a build-up of ammonia.

This whole process may only take a few hours, but can result in all the fish being adversely affected shortly after new fish are added. A similar effect could occur if excess food is added, or a dead fish is left in the tank.

Overstocking places heavy demands on filter bacteria.



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### 3 Cleaning the Filter

The Nitrogen Cycle relies on the bacteria which live in the filter. We therefore need to ensure that these receive a good oxygen supply, and so we need to clean the filter occasionally.

It is important that this is only done using old pond or aquarium water. Never use tapwater, as the chlorine present will kill many of the bacteria. Over-washing should also be avoided, as the bacteria may be dislodged.

### 4 Overstocking

Filter bacteria require space in order to live. Therefore, there is a limit to the numbers that can survive on the space available in a filter.

If the fish that are present produce more waste than can be decomposed by the filter, the result will be a build-up of nitrite, followed by increased ammonia or ammonium levels. If these conditions occur, the aquarium would be described as overstocked, and fish should be removed to allow safe and stable conditions to be re-established.

## Sensible management

Managing the Nitrogen Cycle is essential if an aquarium is to remain healthy. A filter is the usual means by which this is achieved.

Elsewhere in this Supplement, a number of different filtration methods are



Marine organisms — especially invertebrates such as cuttlefish — are particularly sensitive to the toxic effects of ammonia and nitrites.

examined, each of which provides food, space and oxygen in slightly different ways in order to encourage a good growth of bacteria. Looking after these bacteria is as

important as looking after the fish themselves. **49**

## OZONE AT A GLANCE

- Ozone is a powerful oxidising agent
- Ozone must be used with great care, as it can be harmful to fish and aquarists
- Ozone can kill bacteria and protozoans, and oxidise organic pollutants
- Ozone can increase the efficiency of protein skimmers
- Ozone can increase the redox potential of aquarium water
- Ozone is no substitute for an effective biological filter
- Ozone must never be pumped directly into the aquarium water
- If ozone can be detected around the aquarium, too much is being used
- To make the best use of ozone, it should be used with a redox controller and an efficient protein skimmer
- Keep ozone well away from biological filters, and never use it when a new system is being matured
- Ozone can corrode rubber and plastics: check tubes and reactors regularly for signs of wear

## ULTRAVIOLET STERILISERS AT A GLANCE

- UV sterilisers can kill bacterial and protozoan parasites without affecting biological filters
- UV treatment can help to prevent disease, but cannot cure sick fish
- Replace UV bulbs at regular intervals: every six months is recommended
- Carefully clean the quartz sleeve of the steriliser regularly to maintain efficiency
- Never run a UV steriliser when maturing a new tank
- Never look at a lit UV lamp. Always disconnect the unit before dismantling it

Delicate marine organisms — both plants and animals — benefit from the conditions produced by UV units and ozonisers.

JOHN ANDERTON

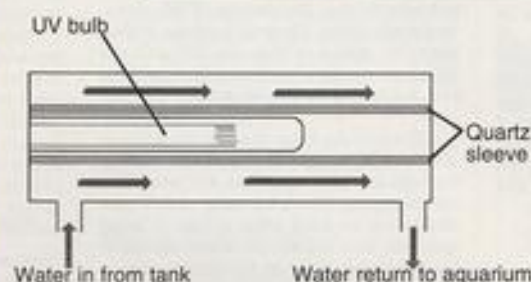


Diagram of a typical ultraviolet steriliser.



A bank of UV sterilisers at a top marine importer's premises.

# Sterile Solutions

Philip Hunt takes a close look at the use of ozone and ultraviolet radiation as aids to maintaining good water quality

Diagrams by the author

By the time you've gone through some of the articles in this Supplement, you will be familiar with the basics of mechanical, chemical and biological filtration, if you aren't already 'au fait' with them. Some less common 'filtration' devices are not so well understood, however, and among these are the ozoniser and ultraviolet steriliser. Both, used properly, are capable of actually sterilising aquarium water, and in the case of ozone, can do a lot more besides. In this article, I'll take a look at how ozonisers and ultraviolet sterilisers work, their uses, and their limitations.

## 1 ULTRAVIOLET STERILISERS

Ultraviolet sterilisers are more frequently found in pond filtration systems than fitted to aquaria. In the context of ponds, they are used to kill microscopic algae, thus preventing the algal blooms

which turn pondwater an opaque green, rendering the fish invisible. In the aquarium, however, this sort of algal bloom only occurs very rarely.

So why fit an ultraviolet steriliser? Well, algae are not the only things which can be killed by ultraviolet light; bacteria and protozoa are also vulnerable, and so the UV unit can be used to control disease-causing organisms.

## UV energy

Ultraviolet light is invisible to humans (though many fish and insects can see it), as it has a wavelength which is shorter than the detection limit of our eyes. As a consequence of its short wavelength, and therefore its high frequency, ultraviolet light is highly energetic; this is why UV can kill microscopic organisms when visible light does not.

The primary killing mechanism of UV is damage to the DNA of the organism, which, incidentally, is the reason that

exposure to an excess of UV is dangerous to humans, damaging the eyes (conjunctivitis and cataracts) and skin (sunburn, and, in some cases, cancers). In an aquatic environment, UV light can also produce small amounts of ozone.

Ultraviolet can be divided into three categories by wavelength: UV-A and UV-B, which are relatively long wavelengths, involved in sunburn and tanning, and UV-C, which is the shortwave, high-energy light which can kill bacteria and protozoans. The UV-C component of sunlight is usually filtered out by the ozone layer of the upper atmosphere.

UV-C has wavelengths in the range of 200-280 nanometres (nm\*), and is blocked by glass and can only penetrate a short distance in water. UV-C with a wavelength of 250-260 nm is most effective in killing bacteria, and so lamps designed for this purpose emit light at 254 nm.

\*1nm = 0,000,000,001 of 1 metre.

## Components

A UV steriliser, whether intended for pond or aquarium, generally consists of a UV lamp which is enclosed by a transparent quartz sleeve (UV-C does not pass through glass, remember) surrounded by a jacket through which the tank water is pumped.

Because of the poor penetration of water by UV-C, the water jacket is quite tight around the bulb, thus providing only a small depth of water which can be effectively irradiated by the light from the bulb.

## Use

To get the best out of a UV unit, it should be plumbed into the system, either on a separate water feed and return of its own, fed by a powerhead, or on the return line from an external filter. Any turbidity in the water passing through the unit will reduce its effectiveness. A slow flow through the unit will provide better killing of parasites etc because of the longer exposure time.

Ultraviolet lamps lose efficiency with age, and thus need to be renewed at regular intervals, every six months or so. Also, mineral deposits and biological slime build up on the quartz sleeve and need to be carefully removed from time to time.

## Applications

UV units work equally well in marine and freshwater tanks, but are perhaps of most value in some rather specific situations where keeping disease under control is of most importance; quarantine tanks are one prime example, and fry rearing systems are another. Fish-only marine tanks can also benefit to some degree, but most marines, being wild-caught, are pretty disease-resistant anyway.

Given the difficulties of treating dis-



Two modern ozonisers.

ease fish in mixed fish and invertebrate aquaria, a UV steriliser can be helpful in reducing further the chances of fish developing infections. There is a caveat to this, however, which is that the UV will not discriminate between harmful organisms and the rest of the planktonic life in a reef tank.

UV units do have the advantage that they only kill organisms which are passing through the unit, and thus will not affect the biological filter's bacteria. A UV unit should not be used when a filter is being mated, as it will kill the nitrifying bacteria before they settle on the filter media.

## Warning

One final safety note: **NEVER, EVER LOOK AT A LIT UV LAMP.** At best, it will give you conjunctivitis; at worst, you could develop cataracts. Always turn the unit off and unplug it before changing the bulb, cleaning the quartz sleeve or otherwise dismantling it.

## 2 OZONE AND OZONISERS

Ozone is a bluish gas with a sharp, distinctive smell. Each ozone molecule is composed of three oxygen atoms (O<sub>3</sub>), rather than the two (O<sub>2</sub>) which make up a molecule of the everyday oxygen that we all breathe.

This extra atom of oxygen makes ozone unstable, and gives it its key property as far as aquarists are concerned, which is that it is a powerful oxidising agent. This allows it to kill microorganisms and to oxidise many organic chemicals dissolved in the aquarium water, which allows them to be more easily removed by a protein skimmer (in a marine or brackish tank).



Ozone penetration can be combined with a redox control unit, as in this model, for optimal efficiency.

The same oxidative power, however, makes ozone dangerous to aquatic animals, and, in sufficient quantity, to humans. Ozone is a more powerful oxidising agent than chlorine, for example, and no-one would dream of treating their tanks with bleach!

The instability of ozone, however, makes it possible to use it in an aquarium; it decays so rapidly in water, that if the correct dose is used in a reactor which is isolated from the main tank, the ozone will have disappeared when water returns to the aquarium.

Ozonisers are rarely used in freshwater aquaria, for various reasons. For example, marine fishkeeping has always been more 'high tech' than the freshwater side of the hobby, skimmers (in which ozone is traditionally used) do not work in freshwater, and the high price of marine livestock, plus the need for high water quality, has meant that the expense of devices like ozonisers has seemed more justified.

## O<sub>3</sub> production

There are a number of ways to generate ozone, but the most common is passing an electrical discharge through air; some of the oxygen in the air is converted into ozone.

The efficiency of ozone generation depends on a number of factors, most notably the humidity of the air. Usually, an air dryer is fitted between the air pump and the ozoniser to ensure maximum efficiency.

## Use

Ozone must always be pumped into the water in a separate chamber to the aquarium; traditionally, a protein skimmer is used. This is not only to keep the ozone out of the main tank, but also because the use of ozone can improve the efficiency of skimming. As an alternative, some trickle filter systems incorporate special chambers to mix ozone and water.

Whatever system is used, the water returning to the tank should be passed over activated carbon to adsorb any residual ozone (note that ozone should never be passed over dry carbon, as an explosive mixture results).

## Precautions

Traces of residual ozone in the system can cause problems; even if there is not enough to harm fish or invertebrates, the bacteria of the biological filter can be affected. For this reason, ozone should not be used in protein skimmers which stand in the sumps of trickle filters.

Some further cautions are that ozone badly damages rubber and many plastics, so pipes carrying ozone need to be ozone-proof and checked regularly for signs of wear and replaced at regular intervals.

If excessive amounts of ozone escape

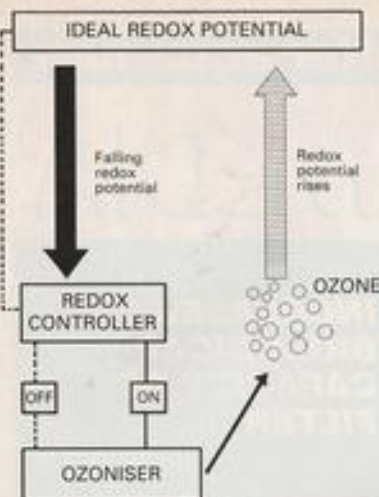


Diagram of the operation of a redox controller/ozoniser system. Falling redox potential is detected by the redox controller which switches on the ozoniser. The injection of ozone into the system increases the redox potential, and when the desired level is reached, the redox controller turns off the ozoniser.

from the system, they can also do some damage to the aquarist; respiratory problems, headaches and nausea can result from exposure to ozone.

## Applications

While ozone provides a method of water sterilisation because its oxidising activity allows it to kill bacteria and parasites, it is capable of more than this. The ability of ozone to oxidise organic pollutants means that it can be used to improve water quality; boosting the effectiveness of skimmers is one facet of this.

The net effect of ozone treatment is to raise the redox potential. This, measured in millivolts, is an indication of the purity of water; the water over a coral reef has a redox potential of about 350-400 millivolts; in a more contaminated system, the redox potential will be lower. Very high values, above about 450 millivolts can be harmful to aquatic animals.

In addition to ozone, protein skimmers, aeration and trickle filters also tend to increase the redox potential in an aquarium; overfeeding, overstocking and low aeration tend to decrease it. Sadly, there is no easy way to measure redox potential without using an expensive electrode and meter.

Being able to measure the redox potential in the aquarium is a great help when using ozone, because the major difficulty is judging the correct amount to use. Too much ozone is bad news, and using too little isn't really getting the best out of the system.

It is possible to calculate the correct amount based on tank size, but this is not ideal, because the requirement for ozone varies greatly. For example, in a tank which hasn't been fed for a few days, and

has just had a partial water change, the redox potential will be quite high, so there's no great need for ozone. On the other hand, if there's a dead fish quietly being decomposed/eaten behind a rock, or following a heavy feed, or the day before that partial water change, keeping the redox potential up (and therefore the water quality high) will need a lot more ozone.

The requirement for ozone will even vary during the course of the day; the highest redox potential (and therefore minimum demand for ozone) will be in the morning (most of the aquarium inhabitants will have been dormant at night, their metabolism slowed down), and the lowest in the evening, after a whole day of activity by the fish.

Manufacturers of ozonisers, of course, supply all the necessary guidelines.

## Redox controllers

To get the best out of ozone, the ozoniser should be coupled up to a redox controller. This is, basically, a redox electrode (which hangs in the aquarium) coupled to a switch which will turn on the ozoniser if the redox potential drops below a preset level, and switch it off when the desired value is reached. Unfortunately, these devices are expensive, but they do provide the safest and most effective way to use ozone.

Not every marine tank needs ozone, of course; reef aquariums in particular, thanks to low stocking levels for fish, plus good skimmers and trickle filters, often maintain very high water quality (and hence redox potential) anyway, and if a tank can support healthy, growing corals and anemones, and macroalgae (seaweed) growth, it's clear that the redox potential is obviously adequate.

A redox controller-ozoniser in this sort of situation would simply be providing extra insurance, although it is possible that a good enough skimmer, coupled to a redox controller/ozoniser system, might permit a larger fish population to be kept in a reef tank. In fish-only marine tanks, ozone helps to keep water quality high, and also reduces the chances of disease.

## No cure-all

Ozone and ultraviolet units are not the solutions to all fundamental fishkeeping problems. If the biological filter system is inefficient, for whatever reason, be it design or lack of maintenance, or the tank is overfed or overstocked, it's much better to address these issues if you want to prevent disease and improve water quality, rather than just fitting a UV unit or an ozoniser.

In their proper place, however, they can both be very useful; UV units are a great help in killing off disease organisms, and ozone can do this and a great deal more besides.

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# A TANKFUL OF LIONS

Gordon Kay outlines the golden rules of keeping Lionfish... safely!

**W**hen I first became aware of Coral fishes — more years ago than I care to admit — I resolved that my first marine aquarium would house a Lionfish. The first specimen I ever saw was a Voltans Lion, *Pterois volitans*. At that time, it was the most wonderful creature I had ever seen and I just had to have one.

Well, the best laid plans and all that... things didn't quite work out the way that I had planned. I discovered other species which I wanted to keep and, well, they just didn't go with Lionfishes, or so I thought.

A couple of years later, I discovered Butterflies and Angels and then Lionfishes had no chance. Therefore, it was only in 1990, after a catastrophe beset my 100-gallon fish-only aquarium, that I finally got to keep my first Lion. I now have two, in among a collection of 'nasties' — and that leads me nicely into the first aspect of Lionfish keeping.

Lionfishes have, perhaps, the nicest disposition of any coral fish. I can hear you sniggering from here, but that statement really is true. They just mind their own business and leave most other things alone. Oh, it's true that if you are small enough for it to eat, a Lion will do just that and if you attack or frighten one then it could poison you, but unless you're stupid, they are totally harmless. Honest!

## Basic rules

So, first rule: no fishes which would be small enough for a Lionfish to eat must be kept in the same aquarium.

Care should be taken in this regard. Any Lion can eat anything up to about two-thirds its own size. If you doubt that, then watch one extend its jaw as it feeds.

Bear in mind, also, that these beasts grow at a phenomenal rate. What would be perfectly safe while the Lion is small, would be swimming scared later. This even includes the Cleaner Wrasse, which would be able to swim in and out of the Lion's mouth with impunity during daylight hours, yet would be swallowed whole once night fell.

With regard to other animals bothering



The most popular of all the Lionfish is *Pterois volitans*.

it, worry not — they don't. Fish are stupid, but not THAT stupid! The spines along the dorsal (back) fin of Lionfishes are simply pipes through which it 'fires' poison. Add to that the prickly spines on the pectoral (chest) fins and you'll see what I'm talking about.

As far as tankmates are concerned, I always think that these animals look better with large, robust species like Triggers, Puffers, Wrasses, Moray Eels and Angelfishes... and with each other Lions are fine. My own fish-only aquarium presently houses a collection such as this.

That last rule should really have been my second, but the opening paragraph just led me into it and so what should have been the first rule is now the second. Anyway, wherever it comes, in my opinion, no Lionfish — other than the dwarfs — should be kept in aquariums smaller than about 75 gallons (340 litres). The reasons for this are two-fold.

First, although they spend lots of time just hanging around, Lionfishes need plenty of space if they are to swim around, feed and generally show themselves to best effect. They just look out of place in a small tank.

Secondly, Lions tend to be messy eaters and the company they will be keeping, if

you take the advice I gave earlier, will mean rapidly deteriorating water quality, or water changes every other day in a small aquarium. Changes in water chemistry occur much more slowly in larger tanks.

With the type of community I advocate, powerful filtration is a must. As well as efficient biological filtration (of whichever type), a high-turnover canister filter is always a good idea. This filter should contain activated charcoal, as well as a good mechanical medium. This will help your protein skimmer — which, of course, is also essential.

## Feeding Lions

Feeding your Lionfish in the early days could present a problem if your dealer or supplier hasn't weaned it off live food. When first caught, Lionfishes will not accept anything other than live fishes and — unless you can afford to buy these at least every other day — this can be really inconvenient.

If it's down to you to do the weaning, then you will have to go along with the live food for at least the first week. I can buy live River Shrimps at my dealer, and if you can buy them too, then they would make this part of the weaning process a little more pleasant.

If not, feed with live fish fry every other day for a week. Use a different species of fish each time so that the Lionfish doesn't become conditioned.



The Whitefin Lion is, in fact, very red.

## LIONFISH FACT FILE

Lionfishes (Family Scorpaenidae) are found in the Red Sea and the Indo Pacific. The following are the five most popular species.

Species	Common Name	Approximate Size
<i>Pterois volitans</i>	Voltans Lionfish	(i) 14in-35.6cm (wild) (ii) 9in-23cm (aquarium)
<i>Pterois antennata</i>	Spotfin Lion	(i) 10in-25cm (wild) (ii) 6in-19cm (aquarium)
<i>Pterois radiata</i>	Whitefin Lion	(i) 10in-25cm (wild) (ii) 6in-15cm (aquarium)
<i>Dendrochirus brachypterus</i>	Fuzzy Dwarf Lion	(i) 7in-18cm (wild) (ii) 4in-10cm (aquarium)
<i>Dendrochirus zebra</i>	Zebra Lion	(i) 12in-30cm (wild) (ii) 8in-20cm (aquarium)

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### Four Golden Rules of Lionfish Keeping

- 1** These animals are potentially dangerous — keep hands out of the aquarium until your Lionfish is totally at ease with you.
- 2** If you do get stung, place your hand in water that is as hot as you can possibly stand it. This will de-nature the poison and help minimise its effects.
- 3** After the above first aid — get to hospital fast, armed with the species name of your Lionfish.
- 4** Keep Lionfishes only with fishes too large for them to eat. Remember — they can eat fishes up to two-thirds their own size. Also bear in mind that Lionfishes grow very quickly!

Left, The smallest of the popular Lions — the Fuzzy Dwarf (this is a juvenile)  
 Right, Just look at those pectoral fins! This is the Zebra Lion.

In the second week, start mixing live and dead fishes, using frozen Lancefish for your dead 'feeders'. Gradually, change the ratio until your Lion is eating exclusively dead food. Food can now be all manner of frozen 'large' food such as mussel, cockle, shrimp, Krill and the aforementioned Lancefish.

### Breeding challenge

Next to nothing is known of the breeding methods of Lionfishes, and so I can offer no advice here. Still, who knows, if you keep two together then, maybe, you could write your own article on the breeding of Lionfishes in a few years time.

### Further Reading

*The Book of the Marine Aquarium* — Nick Dakin (Salamander)  
*Marine Aquarist Manual* — Comprehensive Edition — Hans Baensch and Dr. Paul Loosle (Tetra)  
*The World Encyclopedia of Fishes* — Alwyn Wheeler. (Macdonald)

# WHAT'S YOUR OPINION



BY BILLY WHITESIDE

## Congratulations!

I've been getting *A&P* every month since I was a young schoolboy in the early 1950s, and having kept every copy, I've had an ideal opportunity to see the evolution of the magazine.

I was reading through the Christmas 1993 issue and had identified six of my own photographs when I wondered why it had taken me so long to count them. The reason was quite simple: I'd spent a very long time studying the magazine, looking at the various photographs and reading numbers of the articles.

I'm sure you, too, have noticed the splendid improvements in the magazine's layout and presentation, as well as in content and numbers of colour reproductions. I particularly like the 'off-the-square' angles of some of the photographs and coloured backgrounds. When I think of the little, green-backed *A&P* of the early Fifties, and the lush and colourful *A&P* of 1983-1994, I feel a warm word of congratulations is due to editor John Dawes — and to his team (Thank you, Billy! Ed).

*A&P* was founded in 1924 as *The Amateur Aquarist*, which means it'll be 70 years old this year — the same vintage as *Radio Times*, a magazine which I do not think has improved with age, even though a best-seller.

Anyway, best wishes to our editor and team for a modernisation of *A&P*, which should certainly see it through to 2001 and beyond. I feel sure it'll be going strong in 2024 on its 100th birthday (We're banking on that! Ed).

## Thai delicacies

On the afore-mentioned trip to Thailand I looked at particular delicacies on sale from a street stall.

They looked like barbecued rats skewered on bamboo sticks — rather like large lollipops. I asked what they were and the food-seller pointed towards a

## CHATUCHAK

I hope you enjoyed my article about Discus breeding in Bangkok, published in January. On a return visit to Thailand I paid a visit to Chatuchak, a weekend market at the top of my list of things to see.

About an hour after flying into Bangkok, I was heading for Chatuchak market in the hope that I might see some aquarium fish on sale among all the other goods. I was certainly not disappointed.

I have a good story to tell, and a lot of interesting photographs, so perhaps our editor will consider it for publication as a separate article in a future issue as it is rather longer than this page will accommodate. I mentioned my Chatuchak idea to Eberhard Schulze, our former Discus expert, who now lives in



Thailand, and he was somewhat disappointed because he had plans to write the same article. Wise minds think alike!

A striking feature of one stall was quite the most hideous aquarium I have ever seen: it contained every appalling tank

An absolutely hideous aquarium in Chatuchak market.

decoration ever invented. The good thing about bad taste is: it makes one feel superior. I don't think I've ever seen flashing coloured lights inside a fish tank before!



Thai tropical water lily flowers — more than just decorative.

large basin of catfish, some of which were flapping round very far from dead. Needless to say, I didn't buy any!

I'd sampled roasted catfish in New Orleans in the summer of 1992 and decided that I'd give the Thai catfish a miss.

*Drop me a few lines if you have eaten any of the more esoteric forms of fish or aquatic life.*

I also discovered long-stemmed water lily flowers on sale in the same market as the catfish. I was amazed to learn they were not for decoration, but for use as a fresh vegetable. Travel certainly broadens the mind — as well as empties the pocket!

## Triton success

Having tried many varieties of fluorescent and tungsten tubes and bulbs over the years, I had

Finally opted for ordinary light bulbs at around three for £1.00. However, sometime ago, I obtained one of the then fairly-new Triton fluorescent tubes. I decided to install it over my coldwater aquarium until such time as the plants died off and I changed to the tungsten bulbs.

The ultimate test came a few weeks ago when my elderly Triton tube failed and, without any thought, I headed straight for a large, local pet store, with a very large aquarium department, and spent £8.99 on a new 'Twice-as-bright' Triton tube of 24in in length.

The Triton has produced excellent plant growth in my coldwater aquarium, as the photograph shows. It emits a white-coloured light, much cooler-looking than the yellow-orange light from tungsten bulbs. I can therefore certainly recommend Triton for plant growth.



My Triton-illuminated freshwater aquarium.

are also lots of dry goods on sale. My thanks go to **George Proctor**, the owner, and aquarium sales staff **Ronnie Stevenson**, **Colin Darling**, **Jeff Cunningham** and **Stephen Russell** who very kindly allow me to wander round with my camera when I please — as is also the case with **Aif Robbins**

and his staff at Belfast's **Grosvenor Tropicals**.

A year ago this month I had to buy a complete new camera outfit after the theft of my former outfit while I was on holiday in Holland. My new camera outfit is based on the award-winning Canon EOS 5 body, a camera which is a joy to use and excellent for aquarium photography — even if I have just had to post it back to Canon (UK) for the second time this year for repairs under guarantee. It's at the very edge of camera technology and the only camera I've tried that I can hold and operate with only one hand, leaving the other free to hold a flash gun.

In the past year I've got to know my EOS 5 and have run dozens of films through it. I'm about to land some hundreds of fish slides on our editor's desk, once I get them labelled.

If you want to know what tedium is, it's crawling round the floor with 1-2,000 slides trying to sort them into some sort of order, and then cataloguing them.

Thank goodness I had access to a Macintosh computer and a database. The slides are now sorted, catalogued and I've added my name to each — but the labels now have to be done. That should shorten my Christmas holidays, between bouts of marking examination papers!

## Plant line

Drop me a few lines about any tropical aquarium plant that grows particularly well in your tank.

I also look forward to receiving a short letter from you giving your views on any of the topics raised in this month's feature. Good-bye until next time.

### WHAT'S YOUR OPINION ON THE FOLLOWING:

- 1 The best fluorescent tubes for plant growth?
- 2 Large aquarium shows and allied tableaux?
- 3 Plants by mail order?

Send me your views c/o  
A&P, 9 Tufton Street,  
Ashford, Kent TN23 1QN.

## Photographic assistance

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# KOI TALK



BY  
John  
Cuvellier

## WEIRD WEATHER

As I'm writing this month's *Koi Talk*, the rain is siling down like stair rods (a good Yorkshire saying) and my three ponds are overflowing even as I watch. At least our fish don't seem to mind getting wet!

## Great decade

It was only recently that I realised just how long I'd been inflicting my long-suffering readers with my presence. Can you believe that it was way back in 1984 that my first *Koi* article

appeared in the August issue of *A&P*.

What a tremendous decade this has been for the *Koi* enthusiasts generally, and what great strides have been made in our knowledge of these graceful creatures that manage to provide us all with such pleasure.

One cannot help wondering how many new converts to the hobby of *Koi* keeping have joined our ranks (and, of course, the few which inevitably fall by the wayside for various reasons). I hope my readers will allow me to recall a few memories of the past ten years, some notable and some quite distressing.

## KOI DICTIONARY/pH

Potential Hydrogen — or pH for short — is a measurement of the acidity or alkalinity of a substance. The normal measure range is between 0 and 14 pH, the lower figure being acidic and the upper being alkaline. A pH value of 7 is considered to be neutral.

As the scale is logarithmic, each division increases by a factor of 10, a fact which many beginners to the hobby find difficult to appreciate, but with a little thought, it's easily understood.

The pH of water can fluctuate widely, from hour to hour, and day to day, depending upon temperature, the amount of sunlight, the number of fish etc. etc.

The monitoring of pH is probably the most important indication of the pond ecology; neglect it at your peril! A pond in good condition should ideally give a value of between 7.2 and 7.8 pH, although *Koi* have been known to survive a figure as high as 9 pH. A pond should never have a reading below neutral, otherwise there is a problem in the offing!



CLAS AB

## Ups and downs

For instance, there was the loss of 18 of my favourite *Koi* as a result of a breakdown at a local waterworks chlorination plant which gained me a one part per million residual chlorine reading. I had no way of controlling this until the level reduced. Even my

filter system suffered and was completely wiped out of bacteria.

On the plus side, we have seen many developments on the filtration side of things. The technological improvements in filtration have been quite staggering when you consider that most people started off with a tank of pea gravel or Canterbury Spar, but just look at us now!

## DID YOU KNOW?

There are more than 200 identified forms of algae present in water. When magnified (sometimes by up to 5000 times) the shapes of these tiny living organisms can be truly beautiful. An examination of any learned volume on water treatment will truly amaze you. Check out your local library.

As far as the *Koi* keeper is concerned, algae are pests, but should this be necessarily so? A thin coating of algae on the floor and sides of the pond can be an asset, even for aesthetic reasons, quite apart from your fish enjoying grazing around the area, so don't knock it too much!

We have hair rollers, floor and sundry other exotic creations in plastic. We also have sintered glass 'tubes' and ceramic mouldings. Where will it all end? The funniest part of all this is the way everyone thinks that their's is the best system to use, but that's the human nature for you.

The advent of water privatisation presented us with a whole new ball game. The fear of water metering was a very real problem; it has already landed in some areas, although the latest word is that this fear has retreated ... for the moment anyway.

Many *Koi* keepers have finally woken up to the fact that de-chlorination of source mains water is a must, as witnessed by the rash of suitable units now on sale, some of them costing an arm and a leg, but very necessary for all that. Even when you've bought the thing, you still need regular cartridge renewals, which aren't exactly cheap!

## Other goodies

And what of all the other 'goodies' which we are exhorted to purchase? Magnetic modifiers, ozonisers, swirl chambers, redox potentialisers, ionisers, the list seems endless, but it's all good for business ... and, if it keeps you and your *Koi* happy, that's all that matters.

The true enthusiast can wax euphoric when deciding on some new project or gadget for his or her pond and why not, provided the necessary funds are available!

We should not, of course, forget all the 'new' varieties which seem to keep appearing. I've felt for some time that somewhere in the world was a little man kept in the dark for the sole purpose of dreaming up new names for different patterns and colour combinations designed to make us drool with envy. But aren't they lovely? Anyway, that's enough reminiscing for now; time to move on to other things.

White spot is the most common disease problem in fish keeping

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# Books

## The Hobbyist Guide to Successful Pond Keeping

By: Dr David Pool  
Published by: Tetra  
ISBN 3-89356-135-8  
Price: £8.25

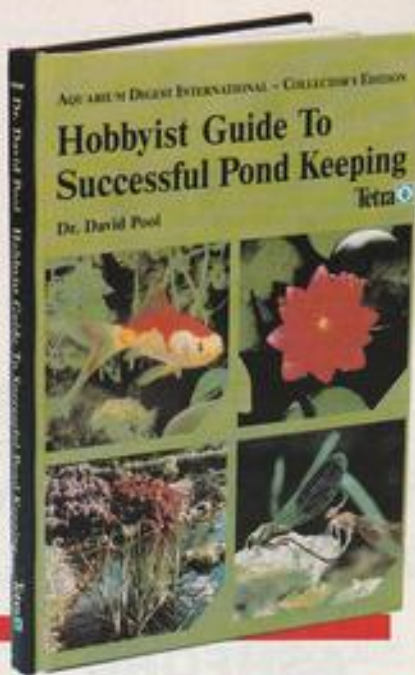
Following sound arguments for installing a pond, this excellent book swiftly gets into its stride with Garden Pond Construction, Water Movement, Filtration, the Importance of Water Quality (here, the often thought 'difficult' subject of pH comes across without any undue technical language) and Planting.

Probably everyone's idea of suitable pond fish are next discussed, with Goldfish, Orfe and Koi (all subtitled as Ideal Pond Fish) being followed by European and North American native species (Bitterling, Minnow, Rudd, Tench, Sunfish, Shiners). Not always included in coldwater books, but given imaginative coverage here, are some tropical species (White Clouds, Paradisefish, Platies) which will all benefit from a 'vacation' in the outdoor pond during warm summer months. Within this discussion, the European Catfish is strongly warned against!

Maintaining Healthy Fish is followed by a section outlining Some Diseases of Coldwater Fish, in which Diagnosis, Treatment and Prevention are examined. Still with 'problems', the evergreen difficulty of algae is comprehensively covered; a full year's Seasonal Guide to Pond Care includes valuable reference to the pond's other, more occasional visitors: amphibians, birds and insects. A Trouble-shooting section and a Further Information guide complete the work.

David Pool has put together a relaxing, yet stimulating read; the information will be equally understood by gardeners (even those to whom fish are unknown), and experienced fishkeepers alike. **Dick Mills**

Golden Dragons - Featured in Thailand Discus III.



# Video

## Thailand Discus III

Filmed and Produced by: Stan Kemp  
Available from: **Kingfisheries Ltd., 308 Croydon Road, Beckenham, Kent, BR3 4HR. Tel: 081 650 3716**  
Price: £9.95, plus 70p p&p

I have long been a fan of Stan Kemp's no-frills, laid back, straight-off-the-shoulder videos. Having seen his latest effort (Film No. 14 in the *Kingfisheries* series), I remain a staunch supporter.

The world appears to be full of would-be film-makers who — quite mistakenly — believe that owning one of today's ubiquitous super-duper video cameras will automatically result in a good film. Nothing could be further from the truth.

Tight scripting, staging of shots, carefully selected and positioned lighting, a steady expert eye for the 'right' picture, finely honed editing skills... and so on, are all ingredients which are normally deemed absolutely essential if a film is to stand a chance of being successful and 'worthy' in today's highly competitive marketplace.

So how come Stan Kemp's films succeed, despite the apparent lack of some of these vital factors? The answer is that Stan's almost-genetic instincts, added to

his expertise and profound knowledge of the subject, allow him to perform many of these functions at the subconscious level. The result is a film in which the odd bit of flash-back from aquaria, the odd dirty aquarium front glass, the occasionally dark shot, the puddles of water... and the numerous other 'imperfections' that many other film-makers would edit out... form integral and important parts of the whole package.

This is what commercial Discus breeding is all about. In fact, this is what all commercial fish houses are about. So when you buy a Stan Kemp video, what you get is not just an uninhibited commentary from someone who is crazy about fish and knows about them, but also a taste of the real flavour of the world which the fish we know and love come from.

And then there are the extra bonuses... the brand-new varieties (like the Golden Dragon), the hugely variable Pigeon Bloods, the numerous as-yet unnamed varieties, the insights into water quality, feeding, broodstock selection, fry rearing, fostering, etc., etc.

Like its predecessors, *Thailand Discus III* is not intended for the beginner who is looking for guidance on how to set up a tank and maintain it, but for anyone — whether beginner or 'veteran' — who wants to see what commercial Discus production is really like and thus enjoy a view through an otherwise impossible-to-open window into the fascinating world of Thai Discus professionals. **John Dawes**

# Tomorrow's Aquarist

BY GINA SANDFORD



## Win a year's membership to the Tetra Club

Welcome to a new regular **Tomorrow's Aquarist** feature. Each month, Tetra will be giving away some lovely prizes, and to start off the series, 10 lucky winners will each receive a year's free membership to the Tetra Club which provides up to date information on all aspects of fish and pondkeeping.

For starters, the winners will be sent a special welcome pack with samples, literature, badges, pens, etc and, three times a year, they will receive a 28-page colour magazine packed with seasonal advice and special features. Club members also have access to a special 'Tetra Hotline' for emergency advice.

To win a **Tetra Club Membership**, all you have to do is study the **Fish Wordsearch** and find the following nine words.

- |                                     |                                |                                |
|-------------------------------------|--------------------------------|--------------------------------|
| <input type="checkbox"/> Tetra Club | <input type="checkbox"/> Pond  | <input type="checkbox"/> Water |
| <input type="checkbox"/> Net        | <input type="checkbox"/> Tench | <input type="checkbox"/> Marsh |
| <input type="checkbox"/> Barb       | <input type="checkbox"/> Fish  | <input type="checkbox"/> Koi   |



The words may be horizontal, vertical or diagonal. Send your completed Wordsearch, with your full name and address, in BLOCK CAPITALS to: **Aquarist & Pondkeeper Competition, Tetra, Lambert Court, Chestnut Avenue, Eastleigh, Hants SO5 3ZQ.**

The closing date for receipt of entries is **28 February**, and the first ten correct entries to be drawn will each receive a year's free membership to the Tetra Club. Good luck!

## A DAY OUT

If you are looking for an interesting day out in the north-west then look no further. **Sunday 20 February** is the day for you. The Northern Area Catfish Group are holding their Convention at The Mill, Wigan Pier.

This year they have invited **Lee Finley** over from America and he is going to be giving two lectures, one about collecting a Blind Cave Catfish (*Ancistrus*) and the other on breeding *Synodontis* cats. As if this weren't enough to whet our appetite, the second speaker is **Chas Godfrey** from Boumemouth who will be regaling us with his exploits up the jungle in Borneo. I'm not going to miss it — are you?

For further details phone: **Trevor Morris** on 0942 42388 or **Brian Walsh** on 0254 778567.

## 10 TA CAT FACTS

- 1 In the wild, Common Plecs (*Hypostomus plecostomus*) excavate holes in the river bank or lake bank to spawn in. So, if you're trying to breed them in an all-glass aquarium you may have problems!
- 2 The primary use of the electricity produced by Electric Catfish (*Malapterurus* sp.) is believed to be for stunning prey. However, research has also shown that it may be used as a method of communication between the Electric Catfish and other species of catfish, especially during disputes.
- 3 Members of the family Claridae are often referred to as Walking Catfish. This is because of their ability to cross land. On humid nights, the fish leave the water and worm their way through the damp grass, using their pectoral spines. They are able to breathe by using an accessory structure situated in the gill cavity which allows them to take oxygen from the air.
- 4 One way of telling the difference between the Armoured Catfishes, *Hoplosternum thoracatum*, *H. littorale* and *H. pectorale* is by the shape of the caudal (tail) fins. *H. thoracatum* has a truncated tail (ie it has a straight edge); *H. littorale* has a slightly forked one and, in *H. pectorale*, this fin is rounded. So there ... now you know!
- 5 The native name of the South American Doradid Catfish, *Megalodoras irwini*, is 'Key-way-mamma' which, translated, means 'Mother of Snails'. There's no prizes for guessing what it likes to eat!



MIKE SANDFORD  
The Key-way-mamma ... snail-eater par excellence.

- 6 One of the first references to the term 'catfish' is from Georges Cuvier who referred to the North American species, *Ictalurus catus*, as 'Poisson-chat'. The term has been in common usage for this group of fishes ever since.
- 7 There are monsters among the catfish: in Asia, two Pangasids, *Pangasiodon gigas* and *Pangasius sanitwongsei* (no common names) have both been reported to grow to over 9 feet in length! However, reports state that the European Wels Catfish, *Silurus glanis*, beats this by attaining more than 16 feet in length. Some cats!
- 8 The Glass Catfish, *Kryptopterus bicirris*, loses its transparency when it dies. Therefore, one can only assume that the maintenance of transparency is a biological function ... But how do they do it?



MIKE SANDFORD  
The beautifully transparent Glass Catfish. But how does it do it?

- 9 Some of the Hill-stream Catfish of Asia, members of the Sisoridae, have strange folds of skin on their bellies which act as suckers to help the fish hold on to rocks in the swift-flowing streams they inhabit.
- 10 Trichomycterids, the South American Parasitic Catfish, have a bad reputation, mostly due to the antics of a single member of the family. The Candiru (*Vandellia cirrhosa*) is well-known for entering the gill cavities of large fish, attracted by the flow of water from the gills. They keep station in the gills using the backward projecting spines on their gill covers. The Candiru is equally well-known for entering the urethral tract of man — attracted by the flow of water (urine)! The spines also make it very difficult and painful to remove. So, when fishing in Brazilian rivers beware of Trichomycterids!

# SEAVIEW

BY GORDON KAY



## Impressive retailer

I was out with my friend, Stephen Smith — he of **Coldwater Jottings** — just before Christmas. He took me to see a new retailer just down the road from where he lives and, I have to say, I was well impressed.

Ian Tallis and Ruth Daly took over **Uilesthorpe Garden Centre** in Leicestershire last April when it was, to be fair, rather run down. The previous owner had left the place in a bit of a state when he went bust, but — with inherited staff, long hours and plenty of hard graft — the pair have achieved miracles in the last nine months or so, until it is now the sort of place where the whole family can spend a few hours.

For the family, there is a comprehensive Garden Centre selling everything from plants and shrubs to ceramic ornaments, a super coffee shop in a conservatory overlooking the grounds and, new for this year, a play area for the children.

However, for us, there is a comprehensive aquatic centre that is well worth traveling for. They have a great selection of all manner of healthy fishes and a super range of dry goods.

The really interesting part, though, the marine section, is superb. The selection of animals is terrific — sensibly priced, too

— and I didn't see a single unhealthy specimen. The fishes are presented in a centralised, 1,500-gallon system which shows them at their best in a 'tiered' aquarium display. Invertebrates are sold from separate aquaria.

Uilesthorpe Garden and Aquatic Centre is open all weekend, so by it as the next family weekend venue. You will find it just outside the village of Uilesthorpe, Leicestershire, which, itself, is just a few miles off the A5, near to Hinckley.

And finally, a message for Ian and Ruth: thanks for the hospitality.

## Skip Moe's latest

You may know how highly I have rated Martin Moe's book called *The Marine Handbook — Beginner to Breeder* in the past.

I have always enjoyed 'Skip Moe's' human style of writing and have found that he has the wonderful knack of presenting potentially mind-blowing stuff in such a simple, reader-friendly way that everyone can learn from him. Yet, he does this without being in the least bit patronising. Believe me, that is no easy task.

Now, after some ten years of being one of the definitive books

on the topic, the original work has been revised and expanded by 144 pages to include an enlarged disease and treatment chapter, a detailed 'trouble-shooting' guide, additional breeding information and — almost obligatory now — quite comprehensive information on new 'reef' technology.

Make no mistake, this is no glossy, coffee-table book. There are no colour-prints of fish species to drool over, and it can get heavy at times. For all that, however, it is one of the best works on marine aquarology that I know and I'm sure that any of you would enjoy reading it.

It costs £16.99 and should be in the shops now. I have no hesitation in recommending it unreservedly. For further details ring **Coral Reef Technology** on 0932 355121.

## Monaco 'Mesocosms'

1993 saw the tenth anniversary issue of *Seascope*, the freebie colour leaflet from **Aquarium Systems of America**. I must say I have thoroughly enjoyed reading this short, but very worthwhile publication, which has always carried short items of a more

'serious' nature.

One of its regular contributors is **Thomas Frakes** — remember? I've talked about his work before. He has now written a very interesting piece in the anniversary issue. Entitled **Red Sea 'Mesocosms' in Monaco**, it tells of work done by **Prof. Jean Jaubert**, of the University of Nice, with hermatypic corals. These are corals which require strong light levels to survive.

Dr Jaubert has devised an extremely simple system for the culture of, not only these corals, but also clams, urchins, crustaceans and fish. The system consists of undergravel plates, covered with 2in or so of coral sand, an air stone for circulation and light — lots and lots of light. In fact, natural daylight supplemented by metal halide.

Over the past five years, however, Prof Jaubert has, with the staff of the aquarium at **Musée Océanographique in Monaco**, been working on other reef type systems to form **Red Sea Reef models**.

These models, which Dr Jaubert refers to as **Mesocosms**, replicate the Red Sea habitat and are quasi-natural ecosystems in which water is not forced through the filter bed in the normal way. Instead, though water above the plate is well oxygenated, there is a body of water beneath the plate where anoxic (oxygen-poor)



**A Powder Blue Surgeon, Acanthurus leucosternon; a collection of Humbugs (White-tailed Damsels), Dascyllus aruanus; and, behind the lettuce-leaf, a Rock Beauty, Holacanthus tricolor, were some of the impressive specimens photographed at feeding time during our visit to the marine life centre at Uilesthorpe Aquatic Centre.**



conditions prevail. Anoxic is not anaerobic — where there is no oxygen at all — there is about 1 part per million oxygen.

The theory is that — with a gradient of water with high to low oxygen levels — organic waste is broken down in the sand. No, I

don't quite understand it either, but it seems to work; nitrate levels, for instance, are generally well below 0.5mg/l. All very

intriguing, and, as always, I don't have the space to go into detail here. Try and get a copy. Seascope — Fall 1983.

## SNIPPETS

**1**

There are over one billion individuals in a group of Krill — usually.

**2**

The total weight of Krill in the world's oceans far exceeds the total human weight on earth!

**3**

Despite the international ban on whaling imposed by the International Whaling Commission, Norway slaughtered 226 Minke Whales in '93. A further 300 will have been slaughtered this winter by the Japanese for 'scientific' purposes.

**4**

The new hatchery at Richard Sankey's Tropical Marine Centre should be finished and working by the time you read this. We should be seeing fry produced there in the shops by April.

**5**

In winter, ice closes in on the Antarctic continent at the rate of 40,000 sq miles a day, doubling the size of the continent.

**6**

A common symbiotic relationship is the one between the Common Hermit Crab, *Pagurus bernhardus* and the anemone *Calliacis*



Common Hermit Crab with resident anemone. (see Snippet no. 6)

**7**

The Baleen Whales have a large head with enormous jaws and several hundred baleen plates, hanging in two rows from the roof in the mouth, which act as filters. Baleen is a horny substance — also known as whalebone.

**8**

Weddell Seals avoid decompression sickness — the bends — by diving very rapidly with only partially filled lungs. On returning to the surface, the seal breathes heavily to ventilate the lungs completely.

*parasitica*. However, the anemone is not found exclusively on Hermit Crab shells and may be found also on molluscs or even on the carapace of other crabs. Despite the scientific name, the anemone doesn't always live on the backs of others either — it also lives on rocks.

## FASCINATING FISH FACTS Two-eyed Four-eyes

Four-eyed fish (*Anableps*) swim with the top half of their eyes protruding above the surface of the water, and the bottom half permanently submerged. This gives the fish the unique opportunity of seeing above and below the water surface at one and the same time.

However, in order to do so effectively, each half of each eye must be made to function as if it were a whole one, since aerial and underwater vision require different types of lenses.

The Four-eyed Fish has only one lens per eye, though, but it is quite unlike that of any other fish, the majority of which have spherical lenses (the ideal shape for underwater vision).

In the Four-eyed Fish, the part of the lens which is directed downwards into the water is, indeed, rounded. So is the corresponding part directly opposite, thus allowing light rays coming in to be focussed accurately on the 'underwater' retina. The part of the lens that faces upwards, i.e. into the air, is, however, flattish (as in land-living animals). This allows light rays coming from above the water to be focussed accurately on a second, 'aerial' retina.

Then, to round things off, there is a horizontal strip of coloured skin that separates the top half of the eye from the bottom half, thus giving this amazing fish what look like four eyes but are, in reality, only two ... but with very special qualities.

Close-up of a very special type of eye.



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Jason hand feeds the Tower Aquarium fish behind the scenes. Winners of the competition will be able to tour this area.

# CENTURY OF FISHKEEPING

1994 is a big year for the Blackpool Tower and Aquarium. May, in particular, will feature some very special attractions for all aquarists, and you could join in the celebrations, courtesy of 'Aquarian', simply by answering three little questions. Interested? Read on...

Behind the scenes at the Undersea World. This is one of the giant turtles being introduced by Tower Aquarist Jason Skitterall to Marinus Pannevis, head of Aquarian's Waltham Aquacentre.



## THE STORY

Dr Cocker opened his 'Aquarium and Menagerie' to the public on the Golden Mile at Blackpool back in the 1800's. Some 20 years later it was decided to build a tower to rival the one newly opened in Paris, and the site became Dr Cocker's Aquarium.

The famous Blackpool Tower was built and opened on 14 May 1894, and the original Aquarium has been under that tower ever since. It is now called UnderSea World and is home to many species of fish, from 50lb Pacu, to shoals of coral fishes, plus a massive 34,000 gallon seawater tank for their incredible giant turtles.

There will be great celebrations this year to commemorate the Tower's centenary (it will also be the centenary of the Tower Bridge in London). The Tower will be painted gold (should be underway by the time you read this column) and there will be celebrations every month of the year, but especially the weekend of 14 May.

The month of May has been designated a 'Fish Festival' with lectures for aquatic clubs, photographic displays of the Aquarium through its 100-year history, and, behind-the-scenes tours of the Aquarium and the adjacent Sealife Centre (aquarists are really spoilt for choice in Blackpool).

'Aquarian' and the Tower authorities are sponsoring the displays with an invitation to all fishkeeping clubs to attend the Festival. There will be a lecture by **Dr David Ford** on Friday 6 May in the Tower's Hornpipe Room, with another by **David Sands** on 20 May. These will include free entry to the Tower Aquarium and family vouchers for many of Blackpool's entertainments. The Federation of

British Aquatic Societies has sent details of how to apply to every UK aquatic society — ask your Secretary for further information.

## THE PRIZES

### FIRST PRIZE

The top winner will receive **two free nights** at a three-star Blackpool hotel for a family of four, plus **free entry** to the Tower and the Sealife Centre. (Note that travel to Blackpool is not included). **Free vouchers** for many other Blackpool attractions will be included, plus **breakfast** on the two mornings. The dates are for the **Friday and Saturday nights, 13 and 14 May 1994**, which is the main celebration weekend of the Tower's centenary, with fireworks, cavalcade of historic vehicles and live broadcasts by BBC Radio 2, not to mention the launch of the world's tallest and fastest rollercoaster ride at Blackpool Pleasure Beach!

### CONSOLATION PRIZES

There will also be **50** runner-up prizes, each consisting of **'Aquarian' products** and **free vouchers** from **First Leisure Entertainments** (owners of the Tower, Piers, Superbow! etc).

## HOW TO ENTER

All you have to do is answer the following questions and send your entry to **Aquarian, PO Box 67, Elland, W. Yorks HX5 0SJ**. The first correct answers drawn from the collected mail will win the free weekend prize.

- Q.1** In what county is Blackpool?
- Q.2** Which flaked food is used by the Tower Aquarium?
- Q.3** What colour will the Tower be painted in 1994?

## THE RULES

1. Write your answers to the competition questions on a postcard or stuck-down envelope.
2. Write your **FULL** name, i.e. including full first name and address, in **BLOCK CAPITALS** on your entry.
3. Send your completed entry to: **Aquarian Century of Fishkeeping Competition, P.O. Box 67, Elland, West Yorkshire, HX5 0SJ**.
4. Closing date: entries must be received by **2 March, 1994** at the latest.
5. Only **ONE** entry per household will be accepted.
6. No correspondence will be entered into regarding the competition.
7. The judges' decision will be final.
8. No responsibility is accepted for entries lost, delayed or damaged in the post, and proof of posting will not be accepted as proof of delivery.
9. The first correct entry drawn on **3 March** will be awarded the top prize.
10. The next 50 correct entries will each receive a consolation prize.
11. The winners' names will be announced in the **April 1994** issue of *Aquarist & Pondkeeper*.
12. This competition is open to all UK readers of *Aquarist & Pondkeeper*, but not employees or their families of *Aquarist & Pondkeeper*, *Dog World Ltd.*, *Pet Business World*, or *Pedigree Petfoods*.

## New heater/stat

Most fish can tolerate some fluctuations of temperature (they have to in nature, don't they?) so a general purpose setting of say 24°C should suffice for most applications.

According to **KING BRITISH**, many hobbyists are uncertain about maintaining correct temperatures when they have to adjust units themselves. With this in mind, **King British** have released the new **UNO ELECTRA**, a pre-set heater/thermostat. All it needs is plugging in; it comes with a fitted 13 amp plug.

However, this is not just a basic heater/stat, for it has a built-in out-of-water sensor which switches off the unit when it's removed from water. The latest surface mount technology is used in the electrically-switched thermostat so that radio frequency interference is avoided.

Four sizes are available — from the smallest, 100 watt (10-gallon aquarium) to the 300 watts (30-gallon aquarium). Designed to meet all EC technical requirements for 1994, the **Electra** will keep **UNO** at the forefront in the market place for heaters. **KB** obviously listen to their customers' needs and intend to continue doing so.

Details from: **KING BRITISH AQUATICS LTD.**, Haycliffe Lane, Bradford, West Yorkshire BD5 9ET. Tel: 0274 573551 & 576241; Fax: 0274 521245.

## Three-way skimming

The efficiency of any bubble-using protein skimmer is directly proportional to 'contact time'; the



# WATER'S EDGE

BY DICK MILLS

time that the aquarium water is in contact with the stream of air bubbles in the reaction chamber. Usually, this is achieved by ensuring that water flow opposes

the rising bubbles but now the **BERLIN PROTEIN SKIMMER** from **RED SEA FISH PHARM** has taken the principle one stage further.

## No messing about

As most of us are predominantly lazy, given half a chance, none of us relish clearing out mucky filters, even less so when removing internal types from the aquarium is likely to leave a dripping trail to the kitchen sink.

However, the new **PICK UP FILTER** from **EHEIM** (or the 2005, to give its Model number) is a delight to handle, even when fully laden. The advanced design means that the canister part of the filter (together with the impeller) can be lifted straight off its mounting bracket, leaving the motor behind. The cartridge is easily removed for rinsing, or for replacing with a carbonised form should medication-removal be required. Water flow is from bottom-grill intake to vari-directional, wide-angle top nozzle return.

Designed for the smaller aquarium (up to 45 litres/10 gallons) the compact unit takes up little valuable swimming space and consumes only 3.5 watts. As its output can be adjusted between 50-180 litres/hour (11-39 gallons/hour) it is ideally suited to whatever small species inhabitants you care to keep.

While world-renowned for their equipment, **Eheim** is less well known for 'complete systems' but, with the **EHEIM PROFESSIONAL**, all this is about to change. The modular design allows for extensions to be made to the basic set-up, although it must be said that, for most aquarists, even the basic systems look pretty good.

The hood comes with several design attractions: a built-in electronic timer for accurate lighting control; the hood itself can be left open in any attitude (very handy when maintenance is undertaken) and there are provisions for a plug-in automatic feeder.

External and/or internal filters can be accommodated very

correctly on special hangers and interfaces, and the tank-supporting plinths have built-in, slide-out trays for filters, while hooks and pockets are to hand for tank nets and documents respectively. These new aquariums can be progressively equipped as and when you need, without any fuss at all, and without ever looking cluttered.

A range of aquarium hoods, for less ambitious aquariums, have just been released by **John Allan** too. The **SAPPHIRE** range comes in black/white,



mahogany' white in the standard size is, 24 x 12 in and, surprisingly, 18 x 12 in. The more elaborate **CLASSIC** has a built-in compartment for fluorescent starter gear and integral sliding condensation cover which has its own handling knob.

Full details from: **EHEIM, JOHN ALLAN AQUARIUMS LTD.**, Eastern Way Industrial Estate, Bury St Edmunds, Suffolk IP32 7AB. Tel: 0284 755051; Fax: 0284 750960.

The reaction chamber is a three-stage affair, and the bubbles have to work their way up, down, and up again, before the super-clean water (without any bubbles) is released back into the aquarium. This action not only makes for super-efficient skimming, removing even the smallest amounts of waste, but also ensures that in the event of ozone being used (as is quite common), none of this potentially harmful gas returns to the main tank.

The unit is 21in (53cm) tall and includes a carbon air filter on top of the collection cup; air is drawn into the system by means of a venturi and a water pump impeller, such as the **Eheim Hobby 1060** is recommended.

Because of its advanced design, it is claimed that this model is able to outperform units twice its size.

Details from: **CORAL REEF TECHNOLOGY**, 82 High Road, Byfleet, Surrey KT14 7QL. Tel: 0932 355121; Fax: 0932 349718.

## NO<sub>3</sub> to N<sub>2</sub>

O.K., so nitrates are generally harmless and are likely to be utilised by plants. Well, not necessarily, and certainly not to the same extent in marine aquaria.

**SERA** has released its new version of the **BIO-DENITRATOR** which will remove nitrates in both fresh- and saltwater systems by converting them to free nitrogen gas. It does so by using bacteria within a slow-running trickle filter box (only 1.5 litres per hour of water maximum). The consequence of lower nitrate levels (even assuming you use pre-treated, lower nitrate level tapwater to start with) is better plant growth, less algae and, of course, healthier fish, and invertebrates, should you keep them.

Both starter food and continuing foods are provided, and the system requires no more regular maintenance than the average power filter. In fact, it should run for six months before any serious attention needs to be given, other than feeding and testing the water for nitrate levels.

Judging from the comprehensive instructions, the hardest part will be getting the drip-rate finalised. Readers familiar with the earlier, back-of-the-tank, slim model may be surprised to learn that the new model is 'bulkier' in design; this means finding a slightly larger space for it near to the power filter.

Details from: **JOHN ALLAN AQUARIUMS** (see box on left for address).

## YAF DATE CORRECTION

The YAF '94 dates are Saturday 9-Sunday 10 April, and not as published in last month's *Society World*. Apologies to all concerned.

## Exhibition response

Dunfermline and District Aquarist Society received a fantastic response to the society's stand at the Recreation and Hobbies Exhibition.

Gillian Lawlor, secretary of DDAS, reports that the first meeting after the exhibition was filled to capacity and no less than ten new members joined that night.

Full details of DDAS and its activities may be obtained from the Secretary, 120 Law Road, Dunfermline, Fife KY11 4XA.



The Dunfermline stand at the Recreation and Hobbies Exhibition.

# SOCIETY WORLD

## Packed house

A&P's 'Coldwater Jotter' Stephen Smith attracted a packed house at the first meeting of the Midland Aquarists and Pondkeepers Society.

Over 40 people packed into The Conservatory at Ullesthorpe Garden and Aquatic Centre, Leicestershire, to see the first showing of a series of slides

depicting Stephen's visit to Aquarima '93 in Singapore and fish farms in Malaysia and Singapore.

Future speakers include Gordon Kay (A&P's regular *Seaview* columnist), and Bertl Gestling, chairman of BioPlast (UK), who will be the main speaker at the society's meeting on **Thursday 10 March (7.30pm)**.

Further information is available from Keith Watson, 39 St Marks Court, Pool Close, Rugby, Warwickshire CV22 7RW, Tel: 0455 202144 (daytime), or 0788 811587 (evenings).

## Grocklemania

The fifth 'Grocklemania' takes place at Whitecliffe Bay Holiday

Park, Bembridge, Isle of Wight (Saturday and Sunday 22-24 April 1994).

Grocklemania...? No, this is not a derogatory term; the word 'Grockle' is an endearing reference to visitors or holidaymakers to the island — 'Grocklemania' is the name of the Fishkeeping Weekend organised by Isle of Wight AS.

The society's annual Open Show will take place on the Sunday, while major attractions over the weekend include the final of the 'Aquarian' Aquacub Quiz; lectures, displays, fish sales, and the show's first fishkeeping forum, where several top celebrities from the hobby will carry out an informal 'Any Questions' session.

The apparently coveted (and mysterious) 'Thomas Crapper' trophy will also be competed for (you'll have to attend to find out), and dancing and cabaret will be provided on both nights.

For further information, contact: Paul Corbett, The Orchard, Gatcombe, Isle of Wight PO30 3EF, Tel: 0983 721246 — evenings.

## New catfish group

A new group has been formed in Northampton tailored specifically for catfish enthusiasts. The Northants and District Catfish Group has been formed as an area group of the Catfish Association of Great Britain, and meets every third Thursday at the Pet and Aquatic Centre in Kettering Road, Northampton.

To date, the society has visited London Zoo Aquarium and Tamworth and District Aquarist Society, and the group also runs a Catfish Helpline.

Membership is £5.00 per annum and further details are available by contacting Michael Emerton at 30 Horsewell Street, Moulton, Northampton NN3 7XB, Tel: 0604 642 679, which is also the telephone number for the Catfish Helpline.

## Diary Dates

### Sunday 6 March

**Bury-in-Wharfedale AS** — Open Show at Collingham Village Memorial Hall, Collingham, Nr Wetherby. Booking in: 11.30am. Judging and auction will begin at 1.00pm. For more information, contact Mrs J. Thurlby 8 Norwood Avenue, Bury-in-Wharfedale, Ilkley, W. Yorks LS29 7EG. Tel: 0953 862643.

### Sunday 13 March

**Skelmersdale and District Aquarist Society** — Grand Auction at Skelmersdale Labour Club, Westgate,

Old Skelmersdale. Booking in: 12.30am and refreshments will be available.

For information, contact G. Lester, Tel: 0695 25734.

### Sunday 17 April

**Strood and District AS** Annual Open Show is moving to a bigger venue. This year's event will be held at Cliffe Memorial Hall, Cliffe, Kent.

For information, contact secretary John Pell, 44 Leakewood Drive, Wigmore, Gillingham, Kent ME8 0NS. Tel: 0634 389362.

**Swale AS** — First Open Show will be held at Boughton Hall, Kent. Perpetual trophies will be provided for

each of a proposed 35 classes of fish. Information from the chairman, K. Woby, 7 Viners Close, Sittingbourne, Kent ME10 4QZ. Tel: 0795 472261.

### Sunday 24 April

**Bishop Auckland and Wear Valley Aquarist Society** — Silver Jubilee Annual Open Show is at Crook Junior School, Croft Avenue, Crook, Co Durham.

The society will also be holding a coldwater Open Show on **Sunday 16 October** at the same venue.

For details, contact John Corrigan, Show Secretary, 8 Clifton Green, Sunnybrow, Crook, Co Durham DL15 0NP. Tel: 0388 745674.

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Introducing:

# THE KAYUNI STATE FARM KILLIE

Jaroslav Kadlec introduces a beautiful, as-yet unnamed, Killifish which — as an added bonus — is particularly easy to breed.

Photographs by the author.

## TANK TIPS

- 1 Light tank from the side.
- 2 Use dark substrate, such as peat or lignite.
- 3 Feed live foods.
- 4 Keep temperature within the 22-27°C (71.5-80.5°F) range.

## BREEDING

**Tank size:** 10-30 litres (2.2-6.6 gal)

**Sex ratio:** 1 male to every 2 females

**Note:** If small tank (5 litres-1.1 gal) is used, introduce a single trio.

**Egg storage:** Store in damp peat.

**Incubation:**

- (i) 10 weeks at 25-26°C (77-79°F)
- (ii) 14 weeks at 20-22°C (68-71.5°F)

**pH effects:** At pH 5.9-6.3, each batch of eggs produces only 20-30% males.

## KAYUNI KILLIE FACT FILE

**Locality:** Kayuni State Farm, 10 km north of Monza, c 180 km southwest of Lusaka, Zambia, on the main road to Victoria Falls on the River Zambezi

**Size:** In the wild, males grow to 5.5 cm (2.2 in); females grow to around 4.5 cm (1.8 in)

**Colour:** Two colour forms (males):  
(i) rusty-red with a little blue  
(ii) rusty-red with a lot more blue.

Recent years have been very rich in importations from Africa of new populations, and possibly new species, of the Killifish genus *Nothobranchius* Peters 1868. New species described during this period include the Blue Notho, *N. cyaneus* Seegers, 1981, the Slender Notho, *N. elongatus* Wildekamp 1982, and *N. eggerti* (no common name) Seegers 1982.

Along the western side of the great African mining area in Shaba Province (formerly Katanga), there are Killifish species and populations whose exact status is unknown, but which may be scientifically described, and which belong to the sub-genus *Zonothobranchius* and the Rachow's Notho *N. namohorui* complex.

Further north, in the region of Upembassa we find *N. brieni* Poll 1938. This part of Africa is also the source of the relatively newly discovered species *N. malaisi* Wildekamp 1978, found in the central basin of the Luapula, as well as *N. symoensi* Wildekamp 1978 from the area around Lake Bangweulu, and *N. polli* Wildekamp 1978 from the neighbourhood of Lubumbashi. *N. polli* was bred in Europe during the 1960s, but was misidentified as *N. brieni*.

## New killie

There are further populations of Northos to the South, from Shaba Province in Zambia, to the Caprivi Strip in Namibia. These include the subject of this article — an undescribed species — perhaps a variety which may possibly be a form of *N. polli*. It is currently being referred to as *N. spec.* "Kayuni State Farm".

In the southern part of Mozambique and the northern part of South Africa. We



Male Kayuni State Farm Killie. Note the blue sheen on the posterior half of the body and the blue and black bands in the tail.



The more modestly coloured female.



Rachow's Notho (note the orange and black bands on the tail, with which the new killie compares very favourably in terms of coloration).

find probably the most colourful *Nothobranchius* species, Rachow's Notho, *N. rachovi*, whose habitat represents the southernmost limit of the distribution of the species, and forms of the sub-genus *Zonothobranchius*.

The Kayuni State Farm Killie has been imported by the Danish killifish breeder John Rosenstock, who visited Zambia at the end of 1979 and stayed at Kayuni State Farm, situated 10 km north of Monza, and some 180 km south-west of the town of Lusaka, on the main road to the famous Victoria Falls on the River Zambezi.

John Rosenstock originally caught juveniles of 6-8 mm (0.24-0.3 in) in temporary pools in the immediate vicinity of Kayuni State Farm, and sent them back to Denmark to Mogens Juhl, an expert on *Nothobranchius*. Only one specimen died during the flight. Juhl subsequently obtained two breeding pairs from these juveniles, and, in all probability, these were the ancestors of all the tank-bred Kayuni State Farm Killies currently in captivity.

This population is most closely related to the scientifically described species *N. poëti* and *N. rachovi*. There is also a possibility that it is identical to *N. spec. "Kafue River"*, but Dr. R.A. Jubb, the South African *Nothobranchius* specialist, thinks otherwise.

In the wild state, males grow to 5.5 cm (2.2 in), while females are about a centimetre shorter. Males have a characteristic hump on the forehead. There are two slightly different male colour forms. In one, the predominant colour is rust-red, with a small percentage of blue, while in the other, the blue coloration is significantly more marked.

My first juveniles of Kayuni State Farm Killies were obtained from eggs sent to me as a swap by Mr Rosenstock, the discoverer of this population. Unfortunately, the first batch produced seven females and no males. It was not until he later sent me a second batch that I was able to obtain a breeding pair.

## Aquarium colours

The basic body pattern in males is the same in both colour forms: a rust-red background on the body and large scales with a slight blue iridescence, mainly on the posterior part of the body. The throat is red, and this colour is particularly intense when the fish is excited.

The pectorals (chest fins) in males are transparent and the pelvics (hip fins) red-blue. There are red and light iris spots on the anal (belly) fin, whose lower edge has a narrow black border and whose base is rusty, gradually becoming fainter and then shading into blue without any clear boundary between the two colours.

The dorsal (back) fin is extremely beautiful, with alternating large irregular spots of brown-red and light blue. The blue of the expressive eye is golden yellow.

Females have an uninteresting coloration, with no significant spotting. All the fins are transparent, and the only striking feature is the eye, whose iris is, again, golden yellow.

The splendid coloration of this population — which is, of course, found only in males — is best seen when the breeding tank is lit from the side from which viewing takes place, and when the tank has a dark background and substrate. A substrate of peat or chips of lignite is recommended.

These killifishes normally take live food and can withstand relatively low temperatures; 22-27°C (71.5-80.5°F) is suitable.

## Health precautions

Unfortunately, the Kayuni State Farm Killie is susceptible to *Oodinium*, a disease which seems to be the particular scourge of *Nothobranchius* breeders.

The following precautions are particularly recommended: the food should be of good quality; the tank should not be overpopulated; and the water should be regularly treated with ozone (once or twice a week is sufficient) and a small amount of

marine or cooking salt added — 1 gm salt per litre is adequate.

No single one of these precautions is a reliable protection against attack by these parasites, and even when they are used in combination, there is no guarantee of their effectiveness.

In the event that the fishes are attacked by *Oodinium* — white patches appear on fins and body, while vitality and appetite gradually decline — a cure can be attempted by raising the temperature by 3-4°C (5-7°F) and by daily 75% water changes and periodic ozonisation. It is difficult to give more exact advice on ozonisation, as the dosage depends, not only on the quantity, but also the quality of the water.

I should add that there is only a 50% probability of this treatment proving effective. In my opinion, the older the fishes, the less likely a cure.

## Breeding procedures

Breeding follows the same general pattern found in the better known species, with the pair diving into a bottom layer of peat in which the eggs are buried. Breeding the Kayuni State Farm Killie presents no problems. Males are not particularly aggressive among themselves, so a large breeding tank — with a capacity of 10-30 litres (2.2-6.6 gal) — can accommodate several males and females, preferably in a ratio of 1:2. A small breeding tank (5 litres — 1.1-gal capacity) is suitable for a single trio.

Water quality has no appreciable effect on hatch rate — I use the same water as for breeding.

Once laid, the eggs are removed from the tank and stored in damp peat. The development of the embryos takes 10 weeks at an average temperature of 25-26°C (77-79°F); 14 weeks at 20-22°C (68-71.5°F). After the necessary time has elapsed, I pour aged hard water over the peat and eggs. The fry measure about 4 mm (0.2mm) on hatching. For the first few days, they can be fed on infusorians, newly hatched *Artemia* (brine shrimp), or *Cyclops* nauplii.

Given a rich and varied diet, male coloration develops at an age of about five weeks and, at this time, the first spawning attempts take place. Full size is attained at an age of two-three months.

If breeding takes place in water with a pH of 5.9-6.3, a rather unpleasant fact comes to light: these conditions generally produce 20-30% males, ie more than twice as many females as males. I have raised three generations to sexual maturity, a total of more than 500 young fishes, and the results have always been the same.

The Kayuni State Farm Killie is very attractive as regards both coloration and body shape. It will undoubtedly retain its current popularity among killifish breeders, and can readily be compared with its universally well-known relative Rachow's Notho.

# SHOWTIME!

## PART 1

### HOW TO PRODUCE WINNERS

Derek Lambert has been winning prizes at shows for nearly 20 years. Follow his advice and you, too, could end up being a winner.

Photographs by the author

**F**ish shows are held throughout the UK most weekends from March to early November, and many thousands of entries compete for prizes ranging from a certificate, to cash, expensive filters and various fish foods by the ton.

Pat and I started showing fish about 20 years ago, winning our first certificates in an Open Show on 14 June 1975 with a Marble Angelfish and 'Breeder's Teams' of Platies and Siamese Fighters. We even know who judged the fish and how many points they gained. How do we know? Well, even after all this time, we still have the certificates.

In Part 2 I shall deal with what a fish show is and how to take part, but this month, I shall deal with *how* to produce show exhibits.

#### Show fish sources

Good exhibits come from various different sources, the commonest probably being a normal aquarium shop where an exhibitor just happens to walk in and see a particularly good specimen for sale. Some shops are well known on the show circuit as being good sources of such fish, and exhibitors will regularly visit these in search of that elusive winner.

Often, the fish concerned will need feeding up and conditioning for a few months before it is ready to show, but this is the quickest and easiest way to obtain a good show fish.

Another option is to buy some young fish and grow them up. Many of the top exhibitors do this. Although they are always on the lookout for show fish in shops, they usually produce far more good show fish from their own tanks.

The third way to produce show fish is to breed them yourself. This is relatively rare on the show circuit, but some of us prefer to do it this way. Personally, Pat and I always prefer to breed our own show winners. We regularly produce fish which win as part of a 'Breeder's Team', then as pairs and, finally, as single fish. Most of our Best Fish in Show Awards have come

from our own-bred fish, rather than from other sources.

The methods needed to produce fish for showing are the same, whether you are starting with fry you have bred yourself, or an adult fish you purchased in a shop and which needs preparing for the show bench. Therefore, I will take you right from the beginning to the finished product.

#### Winning formula

Firstly, you will need to obtain your initial stock. Since certain species tend to do well on the show bench, in preference to others, it is wise to look around at the winners and pick out a species which is already doing well. If you are planning to breed your own, then buy some young adult fish and breed from them. If you are starting with shop-bought youngsters, then buy the fish as young as possible. This will allow you to give them the best conditions in which to grow to maturity.

Once you have your babies, they will need to be fed live baby brine shrimp several times a day (egg-layers which you have bred yourself may need feeding smaller foods to start with, but once large enough, they should be weaned on to newly-hatched brine shrimp). Microworms can also be used to add variety and, as soon as the babies are big enough, we add fry food to the diet as well.

With such heavy feeding, the water quality must be carefully monitored and large partial water changes carried out on a regular basis. This very heavy early feeding is of absolute importance, because you are laying down the foundations on which to build a show exhibit.

Once the fry are about 1cm (0.4in) long, we place a maximum of 20 in a 15-gallon (68-litre) tank or larger. Even if we have hundreds of young, we still isolate these 20 fish and concentrate on rearing them for showing. The larger the tank size in relation to the number of fish you are placing in it, the better.

As they grow, larger foods are fed, but



To show tall-bodied fish like Angelfish, a high tank is needed. This fish will never make a show-winning exhibit because the leading rays of the anal fin have been damaged and grown back with a large notch in the fin.



This *Labidochromis zebra* has been a regular show winner for the past three years and has had several Best in Show awards. The plump appearance and perfect finnage are due to good feeding and the fish being maintained in seclusion.



A show-winning Breeder's Team of *Caribbassia stuarti*. Once again, these are relatively deep-bodied fish so the show tank is tall to help the exhibit deport well. The matching on this team is particularly good because both females are exactly the same size, as are the slightly smaller males.

we still feed the young as often as possible with as much food as they will eat in five minutes. We feed live foods at least once a day, and supplement this with two or more feeds of flake food. At this stage, we use growth food instead of adult food, because it is higher in protein and the fish need more of this while they are growing.

## Breeders teams

At about 3-4 months of age, the young have usually reached a suitable size for entering as 'Breeders Teams'. These consist of four or six fish from the same brood and bred by the exhibitor.

Ideally, they should be sexed out and there should be equal numbers of males and females i.e. 3 males and 3 females. Some fish which take longer to sex out may be six months old before we show them for the first time as a 'Breeders Team'.

Generally, we will only show a team for two to three shows, and then we 'retire' them and concentrate on rearing them on for the pairs and single fish classes.

## Matching pairs

When the fish are about 3/4-grown, they are ready for showing as part of a pair.

The points lost on size can be made back on matching, so it is important to make sure the male is the correct size in relation to the female. Many exhibitors make the mistake of putting a full sized male with an undersized female. They do gain a point or two on size, but lose twice as much on matching.

## Single fish

Ideally, your 20 fish will have produced at least one bigger fish which will be nearing show size. This can be separated from the other fish and placed in a 10-gallon (45-litre) tank by itself. Good food ... and plenty of it ... combined with regular water changes, will raise this fish to the peak of condition.

Since there are no other tankmates pre-

sent, the finnage will become perfect and when placed on a show bench next to other fish, the exhibit will display better than most. If you buy a potential show winner from an aquarium shop, it should be treated in this way in preparation for showing.

One problem which may arise with this isolation of your best fish is that it mopes around the tank 'feeling sorry' for itself. Some shoaling fish are prone to this and will have to be placed in a community tank to do well. However, Malawi Cichlids and many predatory fish make much better fish with this final polishing.

## Show training

One last stage which you may have to go through with your fish is training them for the show bench. Most fish adapt quite readily to being shown, but certain fish dislike the upheaval involved, and sulk once on the show bench.

One way to solve this problem is to put your show fish in the tank it is to be exhibited in and take it for a drive in the car or a walk around town in an insulated dark bag! When you return home place the fish on a shelf or table in a busy room or near the television. After about 10 minutes put some live food in the tank; *Daphnia* is probably best for this. Providing the fish is in good health, it will normally feed, even in the show tank. After a few hours, return the fish to its normal home and repeat the process twice a week for a couple of weeks.

At the end of this time, most fish will deport much better in the tank and will be more successful on the show circuit. However, certain fish will dislike going to an aquatic show and never make good show fish.

## Other 'formulae'

In this article I have tried to cover the methods Pat and I use for raising our show fish. Other exhibitors do it other ways. One good show-man I know is Andrew Waller, and just about all his show fish came out of one tank in his bedroom. This was a mixed community tank

containing many different species which were reared from youngsters to beautiful show fish in this one tank.

Looking around various aquarists' tanks, I often see fish which would make beautiful show fish if they were ever shown. The aquarists concerned often don't realise that they have a show fish in their tank.

If you give your fish good conditions and feed them well, then you probably have a fish which will make a good show fish, right in your living room community tank.

In the next article, I shall be dealing with the different types of shows that there are and give you some tips on how to start exhibiting your own fish.

(TO BE CONTINUED)



A female *Oryzias melastigma*. This fish won as part of Breeders Teams, Pairs and finally as a single fish adult. This line has produced four generations of show winners.



A male *Poecilia catemacensis*. This fish was caught as a youngster in lake Catemaco and grown on for a year before it became a show fish. The lovely colours and perfect finnage made it a winner.

The perfect combination for successful fish keeping



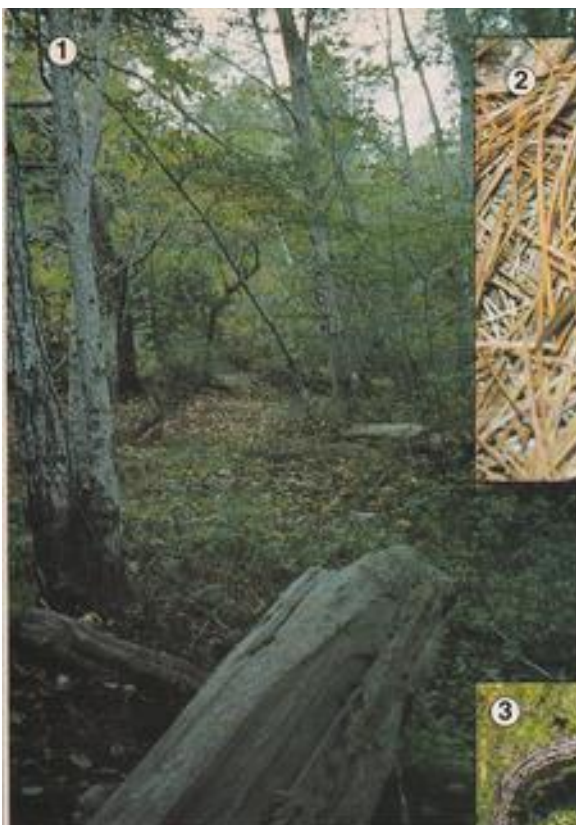
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1

1  
 Fallen logs provide ideal retreats for the salamanders of Monterey, especially the popular '17 Mile Drive'.



2

2  
 The timid Northern Alligator Lizard (*Gerrhonotus c. coeruleus*) is endemic to the cool uplands of Central California. It was especially abundant in the Del Monte Forest.



3

3  
 The Relictual Slender Salamander (*Ambystoma r. relictus*) has rarely been seen, never mind photographed, yet it was abundant locally in the Del Monte Forest.

4  
 Californian Slender Salamanders (*Ambystoma s. attenuatum*) could actually be seen walking around in daylight in more shady areas of the Del Monte Forest, particularly where mist was evident.

5  
 The Monterey Painted Salamander (*Ensatina eschscholtzi eschscholtzi*) is one of the most distinct American salamanders and, fortunately, still quite commonly observed skulking in between the fallen leaves of the Big Sur coastal Redwood forest.

6  
 The cool, mist-shrouded scorched pine forest of the Del Monte Forest, Monterey, home to a wealth of amphibians and reptiles.



5



4

7  
 A potential hazard of salamander searching is the many scorpions which inhabit the underside of damp logs and rocks.



# SAN FRANCISCO CALIFORNIA FORAY

Marc Staniszewski flies out in search of salamanders ... and everything else he can find in the forests of Central California.

Photographs and maps by the author

Franciscan Alligator Lizard (*Gerrhonotus coeruleus coeruleus*). This is a species which thrives in cool, moist, but occasionally sunny, conditions that are characteristic of these isolated mid-elevation habitats. Due to its preference for such an environment, the Alligator Lizard, so-called because the tail and body show shape similarities with that of crocodilians, was extremely sluggish and easily caught. The abundance of small, black crickets seen throughout the forest were equally slow-moving and must have formed the principal diet for this and most other herpetile species here.

The numerous rotting logs concealed large numbers of the protected Relict Slender Salamander (*Batrachoseps relictus relictus*) — the form from which the other nine species are derived. The flattened, elongated body and tail that these inquisitive creatures have evolved enable them to conquer a life under rocks and logs, tight crevices and even within leaf mould itself.

As with many other Plethodontids (lungless salamanders — the predominant American tailed amphibian) the tongue is long, sticky and can be flicked out like a chameleon to snare prey and, coupled with a surprising agility, they are easily able to pursue and capture spiders and other terrestrial invertebrates.

## Other lizards

Other herpetiles abounding in this forest included Western Skinks (*Basiscopes skiltonianus*), with their dazzling blue tails, which skittered through the fresh grass beginning to emerge through the charred forest floor.

I also found a single specimen of the common lizard of the lowlands the Western Fence Lizard (*Sceloporus o. occidentalis*), a nervous species not normally associated with the cool uplands, but still extremely difficult to approach, even in this cool atmosphere!

landscape that unfolded soon made me forget San Francisco, yet this merely represented a visual taster for what lay in store.

Occasionally, I stopped off at some favourable looking localities and, under the many tree remains that littered the roadside (courtesy of the huge earthquake that had recently shocked the coast), there was an abundance of California Slender Salamanders (*Batrachoseps attenuatus attenuatus*). These three-inch long creatures are one of the most numerous Californian amphibians and, to escape when disturbed, they coil up their earthworm-like bodies and suddenly jettison into the air like a watch spring before disappearing in the surrounding undergrowth.

## 17-mile finds

Monterey is a large fishing port approximately 98 miles south of San Francisco, yet its peaceful, tranquil atmosphere couldn't have placed it further from the pollution and clamour of its greater neighbour. Overlooking the town are a group of hills and plateaux which, together, form the Del Monte Forest, including a popular tourist route known as the '17 Mile Drive'. Here, the rich and famous such as Clint Eastwood reside, nestled within a sprawling forest of black pines and grassy undergrowth creeping down towards an endless golden beach that eventually slips past Carmel — surely one of the State's most beautiful towns.

This route reaches elevations of nearly 2,000 feet but, because of hot summers, much of the forest here consisted of smouldering, black stumps shrouded in a blanket of foreboding, dense sea mist which enables a mossy, bright green lichen to thrive on the branches of its dead or dying hosts. Despite the ravages of fire, a myriad creatures survive beneath the charred wood, ash and scarred surface, revelling in the constant moisture and soft soils.

Almost every log or rock lifted revealed a scorpion, salamander or lizard and, on occasion, a shy, rarely observed San



The United States of America is a vast country comprised of many climates, strange, challenging and breathtaking landscapes, a rich and varied flora and fauna and, of particular interest to me, an unrivalled number of salamander species. A short while ago, I was fortunate to find myself on a Jumbo bound for San Francisco, where I would occupy the next fortnight hiking mountains, wading through freezing water and stumbling through great forests in search of these curious, secretive amphibians.

## Quick getaway

On arriving at San Francisco, my intention was to escape the city immediately because what I saw was a metropolis filled with smog, traffic and people — the definitive sprawling concrete jungle. Heading out south on the curving coastal Highway 1 (accurately termed 'The Scenic Highway') the

## Misty wilderness

Big Sur, 45 miles south of Monterey, is what the real American wilderness is all about; crystal clear waters coursing through tree-lined valleys cleaved out by the movement of ice thousands of years earlier. In the crisp, still air, the noisy squawking of Bald Eagles hovering high above the Santa Lucia Mountain ridges, and the eerie howling of a coyote, perhaps tracking hares in forest undergrowth, heightened the strange aura lingering over the entire setting.

I discovered an ideal base for my short stay here — a quaint wooden chalet deep in the midst of a Giant Coastal Redwood (*Sequoia sempervirens*) forest, with a shallow brook passing just beneath the rear balcony. Standing beneath the tallest of all living trees is an awe-inspiring experience, for these 350-foot, modern-day relics are perhaps 2,500 years old.

The lush green upper branches are effective in impeding the sun rays and this, along with the close proximity to the Pacific Ocean, engenders the cool, moist climate essential to their survival. In addition, this creates ideal conditions for many amphibians such as the Red-legged Frog (*Rana aurora*), Western Toad (*Bufo boreas*) and the extremely vociferous Pacific Treefrog (*Hyla regilla*), whose call could be heard both day and night.

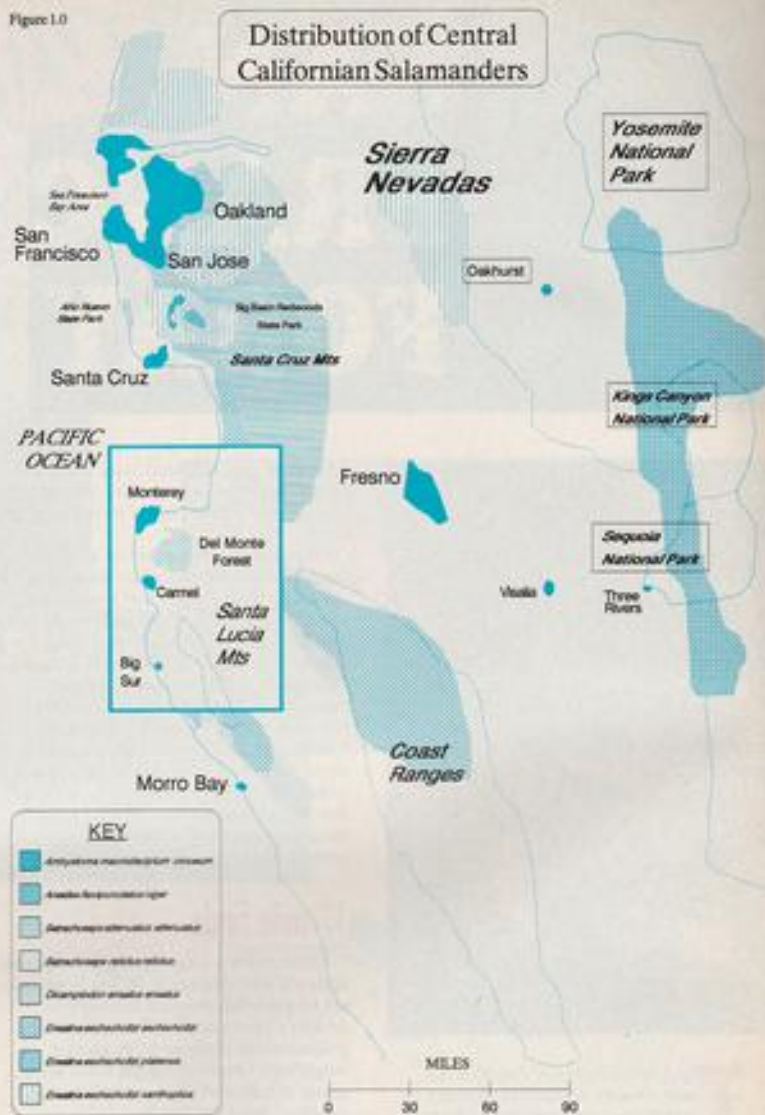
Relictual Slender Salamanders were again abundant beneath most decomposing logs, rocks and leaf mould. Several gravid females were captured and the developing eggs could be clearly seen through the venter. Males are easily distinguished from females by the visible teeth called premaxillaries which protrude through the upper jaw. It is thought that these are used in mating behaviour, with the male stroking and nipping the cloacal region of the female to entice her to move across and receive his barbed spermatozoa (tiny sperm packets coated with a sticky secretion and tiny hooks).

Alongside the cold, bubbling waters of the Little Sur River which bisects Big Sur valley, the river bank consisted of many small boulders in between which the autumnal leaves of White Oaks had settled. Many hours were occupied searching beneath these rocks but only one, two or sometimes as many as five, Slender Salamanders would be found.

## Squeaking escape

Just as the sun began its descent behind the western ridges, casting a purple fluorescence across the whole valley, I lifted up a large, charred log that was partially submerged in the river to reveal a bright orange-red, stocky-looking salamander with huge dark eyes. The Monterey Painted Salamander or *Ensatina* (*Ensatina eschscholtzi eschscholtzi*) is a medium-sized Plethodontid denizen of cool, damp evergreen and deciduous forests from British Columbia, to extreme south-west

Figure 1.0



California, but tends to be locally abundant, rather than common.

As I went to capture it, it immediately began squeaking angrily, adopting a rigid posture, raising the body high off the ground, arching the back and waving the tail in a slow, definite motion. Should this defensive behaviour fail, the salamander scrambles away lifting its tail high in the air. Therefore, if caught, the tail is the most likely to be grasped first, at which point self-amputation comes into play.

This process involves contraction of the muscles in one of several line weak regions, thereby causing separation. The muscles continue to contract, prompting the detached tail to wiggle for several minutes, allowing the salamander a better chance of escape. A new tail composed of a cartilaginous arrangement soon grows, but is always more stunted and different in colour.

After much searching along the river bank, the area was found to be crawling with these salamanders in among the carpet of fallen leaves, rather than the many logs and stones.

As night fell, the air temperature plunged dramatically, urging a low, lingering mist to unfurl throughout the forest. It is this year-long contrast in temperature and conditions that enables these ancient forests with their unique wildlife to continue their magnificent, albeit precarious, existence. Reluctantly, I forced myself to move on — other beautiful wilderness areas with many more salamanders beckoned.

(TO BE CONTINUED)

Watch out for Part 2 of Marc's Californian expedition in a few months' time.