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COVER STORY

Photograph: Nishikigoi International



Every garden should have one. We refer to a pond, of course. Gone are the days when constructing and maintaining an attractive pond and water garden was a task that only the strong-hearted could undertake. Today, the range of products and designs which are widely available is such that there really is no excuse for having a water-less, 'incomplete' garden.

Then, of course, there are the fish and plants themselves, to say nothing of the wildlife that is irresistibly attracted to even the most modest of water features.

All of these, plus a great deal else, will be exhibited this month at the Hampton Court International Flower Show (see advertisement in this issue of *A & P* for fuller details). Come and visit us sometime during the show. We'll be on stand AQ6 in the Aquatic Village.

Editorial

TONY JOE AND THE EARTH SUMMIT

I used to be an ardent Tony Joe White fan. Recently, Gina Sandford, our *Tomorrow's Aquarist* contributor, and her husband Mike, re-introduced me to the swamp-music maestro's latest work entitled *Closer to the Truth* (Polydor).

I am now, once more, helplessly engulfed... only more so than I was ten years or more ago. This time round, it's not just the earthy, solid music that's got to me... it's also the lyrics. Take this example from the title track:

*They're taking down the rain forest
Changing it to a room without a view
And the big trees fall like dominoes
And we move closer to the truth*

Or how about the following from *Bi-Yo Rhythm?*:

*The 'gator rides low in the water
But his eyes see everything
He watches the city moving closer
Turning his home into a four lane
He moves - he moves with the sound
He waits until it all comes down*

Here's one more, this time from *The Other Side*:

*They shook the redman's hand
And forever changed his destiny
Put him on some Godforsaken land
And took away his dignity
Now he floats in dreams where eagles fly
Sinking in the stream of wasted lives
They're just standing by
Until they reach the other side*

As I write these lines, the world is gathering in Rio de Janeiro, Brazil, for what Maurice Strong, the Summit Secretary-General, calls "the most important meeting in the history of mankind". Between 3-14 June, the **Earth Summit or United Nations Conference on Environment and Development (UNCED)** debates global environmental issues concentrating on:

1. A new framework convention on climatic change.
2. A new framework convention on biological diversity.
3. A declaration on forests.
4. Agenda 21 (an action plan detailing the steps needed to achieve sustainable development).



What will the Earth Summit produce with regard to habitats such as this one in the Brazilian rain forests... pious rhetoric or sensible, workable guidelines?

JOHN DAWES

5. The Earth Charter (which will set out the rights and responsibilities of individuals and governments).
6. Alongside the above, a Global Forum — the non-government part of the Summit — will tackle all manner of perspectives on 'the environment'.

World leaders — after a great deal of pre-summit public wrangling and well-publicised 'splits' and threats — will be debating and formulating pronouncements on the future of our planet, from coral reefs to rain forests, from extinctions of animal species to the rights of tribal peoples, plus a whole host of other vitally important topics that touch upon our very existence.

So let's be optimistic and hope that we get much more than just pious statements with no teeth. Let's hope that practical steps are taken so that the trees do stop falling "like dominoes"; let's hope that those who live in harmony with their environment have their undeniable rights recognised... and let's hope, too, that we can give the 'gators their dues and save the fast-dwindling aquatic habitats of the world.

A tall order? Possibly so...



John Dawes
Editor

News Desk

International Acclaim for A & P

Rarely does this publication 'blow its own trumpet', but *News Desk* could not fail to reflect upon the enthusiasm with which *Aquarist & Pondkeeper* is received overseas. From the response received at the recent Interzoo exhibition in Nürnberg, Germany, it would appear that *A & P* (which has subscribers in virtually every corner of the globe

— from Sri Lanka, to Canada, to Thailand, to the US, to Singapore and Australia) is also a big hit throughout Europe.

Explained Gwen McNeil, from our advertising production department: "The show was extremely successful for the magazine. We were approached by literally hundreds of serious visitors to the stand, with enquiries from overseas com-



Gwen McNeil of *A & P*'s advertising department enjoys a chat at Interzoo with Adrian Exall of Interpet and John Neo, Project Manager for *Aquarama '93*, scheduled for next June in Singapore.

panies about the possible sale of *A & P* abroad, in countries such as Malta, USA, Canada, Sweden, and Saudi Arabia.

"People were full of high praise for the magazine, and came out of their way to say how much they enjoyed it," Gwen concluded.

And to think that neither Gwen nor our editor, **John Dawes**, would even have reached the show but for the kindness of the aquatic trade. Transport strikes in Germany just prior to, and during, the exhibition made it impossible to fly to Nürnberg, so other means were sought. **Andrew Stagg** and **Ken Digby** of **New Technology** were able to provide a lift for Gwen and **Margaret Ferris**, editor of *A & P's* sister trade journal, *Pet Business World*, which with our other publication, *Dog World* also enjoyed a very successful show; while John 'hitched a lift' with **Pisces Aquaculture Tewin Ltd** . . . along with a ton of Koi and Goldfish!

Lowara at Hampton

The Hampton Court International Flower Show is not just about flowers. One of the biggest draws is the Aquatic Village — (where *A & P* among others; will be having a stand — AQ6).

In the heart of the village will be the company that "makes it all happen": **Lowara (UK) Ltd**, for in the centre of each water display, there will be a **Lowara** pump generating the water movement.

As well as carrying out the obvious tasks of powering fountains, cascades and water falls, **Lowara** pumps also perform more mundane tasks like circulating water and aerating it for the fish in the ornamental ponds. Last year, submersible **Lowara** pumps produced a fountain display in the famous Long Water leading up to the Hampton Court Palace. This year, a **Lowara** borehole pump will create the main feature outside the Rose Marquee.

Well known for their large industrial pumps, **Lowara (UK) Ltd** has found an increasingly important role in supplying the water garden market. In **The Pump House**, **Lowara** will feature its tried and tested **DOC** range of submersible pumps, the larger higher capacity



Some of the Lowara pumps that will be on display at Hampton.

DN/DL range and a selection of surface mounted pumps.

These are exciting times for **Lowara**, with no fewer than five new products due to be launched this year. They hope to have at least some of these new pumps on show at Hampton Court. **Lowara (UK) Ltd**, Millwey Rise Industrial Estate, Axminster, Devon EX13 5HU. Tel: 0297 33374; Fax: 0297 35238.

Second English-German Open Fish Show

The International Mutual Community for Labyrinth Fish (IGL) is holding its second English-German open fish show, at Ruesselsheim, Germany (19-20 September). The show will be held in conjunction with the autumn meeting of the IGL Regional Group Rhein-Main-Neckar and a show held by the International Betta Club from St Avoird,

France.

The official judge for the show will be **Kevin Webb**, from York, assisted by **Patricia James** from Scarborough; while, during the autumn meeting, a lecture, *Transonia* will be presented by **Hans-Joachim Richter** from Biesen Saxonia.

The IGL was formed in 1985 in partnership with the Anabantoid Association of Great Britain (AAGB), Scarborough and District Aquarist Society, and the Yorkshire Association of Aquarist Societies.

For more information, contact **Heinz Saddey** at Duesseldorfstr. 21, D 6090 Ruesselsheim, Germany. Tel: 061 42 4 67 88.

Pet Show Success

Attendance figures in excess of 10,000 are reported by the organisers of **The Pet Show**, held at London's Earls Court, 2-4 May and sponsored by **Pedigree Petfoods**, manufacturers of 'Aquarian' products.

"We believe we have laid the

foundations for a really great show," commented **June Barker**, managing director of show organiser **Barker Brown**.

She concluded: "We have been overwhelmed by the enthusiastic response within the pet industry and have already been inundated with enquiries about plans for next year".

FBAS News

As a result of its ever-increasing close associations with the aquatic trade, the Federation of British Aquatic Societies is pleased to announce even better awards for the hobbyist in 1992. In a recently completed agreement with the Federation, **Interpet Ltd** have extended their generous sponsorships to 1995. **Interpet**-sponsored awards include:

Best in Show Trophy, **FBAS** Championship Class Trophies, **FBAS** Supreme Championship, and **British Open Fish** Championship.

Additionally, **Interpet** are sponsoring this year's **Supreme Festival of Fishkeeping** (Pontin's Sand Bay Holiday Chalet Hotel, 6-8 November) at which there will be a **European Open Show** to add to the already crowded list of attractions.

Rolf C Hagen support will continue to include the following:

Open Show Awards Pack — Nutrafin Sweatshirt and Powerhead for Best in Show. Nutrafin Sweatshirt for specially-nominated Classes. Nutrafin Foods for Class



Arnd van Nieuwenhuizen presents the trophy for the Best Junior Exhibitor to **Daniela Nicolici** at the first German-English fish show held by IGL at Ruesselsheim, Germany, in September 1990.

winners. Additional gifts (direct from Hagen on receipt of special application form) for previous sweatshirt winners.

Powerhead Offer — Societies affiliating to FBAS for 1992 will receive FREE Fluvial Powerhead.

Hagen Helpline Advice Centre — at major aquatic events: next appearance at Scottish Aquarists Festival.

Application details for Open Show awards and show packs as detailed above

Distribution of Interpet Gold Pins, Best in Show Trophies

Society show secretaries (with Open Shows yet to come) should apply to FBAS trophy officer directly, enclosing a copy of their draft show schedule. Winner of 1992 Best in Shows, at shows already held, send evidence of award (winner's card or photocopy) to receive Gold Pin direct.

Distribution of Hagen Open Show Packs

Apply as above, sending a copy of their draft show schedule.

NOTE: In both cases, societies' final show schedules must carry relevant advertising material from sponsoring company. This is available on application from FBAS trophy officer.

Aquarian have generously sponsored the new Fish Measuring Calliper for judges' use at Open Shows and, more recently, aquarists visiting the Ilford AS Convention will have benefited by the company's support for this event, too. At the end of the year, again at Weston-super-Mare, the final of the Aquarian/Practical Fishkeeping AQUACHAMP competition will be held. Judges and speakers who haven't yet seen a copy of the new FBAS Fishworld magazine are in for a treat from next year: Aquarian are sponsoring complimentary copies during 1993. To make sure of your copy, please send your current address details to the FBAS general secretary (address below).

It's never too early to book accommodation at the Supreme Festival of

Fishkeeping — the rates are even the same as last year, too!

Adult rate is £57 per person; child rates are split into two age groups: 11-15 £35, 2-10 £20. Deposit required is £15 per person regardless of age group. Day visitor admission is £1.50 per adult, 50p per senior citizen and children under 15.

A comprehensive brochure/booking form outlining the various aquatic attractions is available from:

Colin Richards, Beechwood Cottage, Long Grove Wood Farm, 234 Chartridge Lane, Chesham, Bucks HP5 2SG. Tel: 0494 773094.

Contact addresses:
FBAS Trophy Officer — Alan Henderson, 5 The Nook, Corby Village, Northants NN117 1XA.

FBAS General Secretary — Adrian Dempsey, 194 Greenhill Road, Greenhill, Herne Bay, Kent CT9 7RS.

In The Teeth of Victory



Twelve-year-old fish fan Clare Ogbourne is presented with her aquarium prize by Tetra representative Dave Wardle at Avon Aquatics, Bitton, near Bristol.

The correct definition of the word "piranha" (toothed fish) won a 12-year-old Bristol girl a top prize presented by Tetra.

Clare Ogbourne, from Southville in Bristol, responded to a competition on the children's Saturday TV programme *Moo-moo* to win a £150 aquarium, together with £50-worth of Tetra products and an honorary membership of Tetra's new fishkeeping club for children, the Tetra Kids Club.

Quality Assured at Frosts

A quality assurance policy — guaranteeing all fish purchases for seven days from date of purchase — is one of several innovations at Frosts Water-life, part of Frosts Garden Centre at Milton Keynes.

The scheme was introduced in February and is reported to have been well-received by customers. "This is a visible sign of the company's commitment to quality and value," remarked

Rosemary Towers, of Frosts Garden Centre.

The company has recently completed a £200,000 investment over the past year, incorporating a large water gardening display area to complement a tropical and marine section opened in 1991. Shrubs, alpines, and ornamental trees grown in Frosts' own nurseries, complement a broad selection of water lilies, goldfish, orfe, and Koi, as well as other pond species.

Frosts Garden Centre, Newport Road, Woburn Sands, Milton Keynes MK17 8UE. Tel: 0908 583511.

Innovative In-Pond Filter System

Some of the best ideas are often the simplest, and a new product which provides the basis of an economical pond filter is just such an example.

The product is an in-pond filter system which incorporates all the fittings to attach to your existing submersible pump, in place of the pump strainer, and works either as a filter in its own right or as a pre-filter.

The unit is sold as a flat pack, which unfolds to a box 20 x 14 x 10in high. All you need to add, apart from your pump, is the filter medium, and the box has been designed to hold the weight of Lytag or even Canterbury spar.

According to the manufacturer, Pondguard Products, the unit, manufactured in high-strength polypropylene, holds 40 litres of filter medium, and does not require cleaning for at least six months, when used in a reasonable pond. "We have been running these in ponds for over 12 months without the need for cleaning," remarked Tony Wood, director of Pondguard Products (who, incidentally, also invented another ingenious device, the Heron Scarer).

The Pondguard In-Pond Filter System retails for £79 including filter medium, at Pondguard's associated company Egmont Water Gardens, and is also available at aquatic outlets throughout the UK.

PondGuard Products, 12 Tolworth Rise South, Surbiton, Surrey KT5 9NJ. Tel: 081 337 9605. Contact: Tony Wood.

Trade Talk

New Managing Director at Interpet

A new managing director has been appointed by pet and aquarium products manufacturer Interpet. Mark Senior joins the company from a garden products manufacturer and has a degree in economics, together with experience in the garden, hardware, and packaging industries.

Commenting upon the appointment, Interpet chairman Dr Neville Carrington said, "Interpet has achieved a high reputation throughout the UK and overseas as one of the leading companies in its field and Mark's arrival will provide a further dynamic element in the development of the company".

The appointment of a new managing director follows the decision of former MD Maurice

Martin to stand down after over 26 years' association with the company. Maurice will maintain his interest in Interpet as an export consultant and as a non-executive director. "I am looking forward to channelling my experience in other directions," remarked Maurice, who has several community interests and is chairman of his local football club.

Dr Carrington concluded: "I have always known Maurice as intelligent, versatile, able, scrupulously honest and thoroughly reliable. He is retiring from his post as managing director on a high, when growth of the company has risen, and his efforts have been a major contribution to our success over the years. We all welcome his continuing interest in the business".



Mark Senior, right, recently appointed managing director of Interpet, is welcomed by Interpet chairman Dr Neville Carrington, centre, and Maurice Martin, who is standing down as managing director after a 26-year association with the company.

Huge Demand for Sparsholt's Aquatics Students

Sparsholt College has reported a significant increase in demand for students who have completed the one-year National certificate in Aquatics and Ornamental Fish Management.

Course tutor Jane Lloyd explains that demand has come

from all fields, from wholesalers, retail outlets, garden centres, nurseries, public aquaria, and product manufacturers: "I have received twice as many job offers for students than we had students in the last year," said Jane.

"The variety of employment available means that everyone — male or female, young or mature, able-bodied and some disabled people — are able to find a niche in this progressive industry," Jane continued. "And who said that all work

with animals is poorly paid? The wages for this year's recruits range from £8,500 to £13,000. Not bad for a starting salary!"

According to Sparsholt, the expansion of larger companies has produced a demand for management-level personnel so, in 1990, the college started a two-year National Diploma in Aquatics and Ornamental Fish Management, which has special emphasis on retail and business, as well as the aquatic knowledge and practical skills to manage a retail outlet. "We are waiting with anticipation for the response of industry to those students when they graduate next summer," concluded Jane.

A series of short courses is also organised each year for those already settled within the aquatic industry, and these courses have been extended this year to a three-week programme of one- or two-day courses. Subjects include: water chemistry, filtration, diseases, anatomy, ecology, and specialist fishkeeping (tropical marines, Koi, and Rift Valley cichlids).

For further information, contact: Jane Lloyd, Sparsholt College Hampshire, Sparsholt, Winchester, Hampshire. Tel: 0962 72441.

New Packaging for Flake



The distinctive packaging of King British Goldfish Flake is designed with the lid labels facing outwards in a display tray.

A rich source of minerals and vitamins is promised by King British Goldfish Flake, which has been launched in a new packaging format.

The packaging has been designed with the lid labels facing outwards in a display tray, and features an illustration of a Goldfish on a green background. King British managing director Keith Barraclough remarked: "The tropical flake packaging has been exceptionally well-received, and we are sure that Goldfish Flake will also be very popular".

Northern Expansion For Bach

Bach Aquatics has expanded its service to the Midlands and the north through exclusive distribution agreements with two major suppliers of cold-water fancy fish.

K. G. Products of Stoke-on-Trent and Belle Vue Koi of Driffield have both agreed to represent Bach Aquatics' expanding interests in the regions, with the Midlands and north-west service by K. G. Products and the north-east supplied by Belle Vue.

Bach managing director Joe Kindler explains that rapid growth last year led the company to increase its northern presence: "With two established businesses servicing the northern trade, we are now able to maintain our commitment to overnight deliveries and faxing of availability lists to the whole of the UK".

Tomorrow's Aquarist

By Gina Sandford



ADAPTABLE EXOTICS

Reading through a recent copy of *New Scientist* (No. 1821, 16 May, 1992) I came across a piece about a colony of scorpions, *Euscorpius flavicaudis*, that have survived the cold winters on the Isle of Sheppey in Kent for more than 120 years. By chance, there also appeared a piece in the *Daily Telegraph* (16 May, 1992) about the same creature.

This adaptable scorpion, which is common in southern Europe, has managed to survive the rigours of our winters. And it is not just a single colony in Kent; they can also be found at Ongar underground station and at sites in Colchester and Harwich, as well as there being thriving colonies in greenhouses across north London!

If scorpions can survive, then what about fish?

On an angling programme shown on television some time ago, there was a competition to see who could catch the most species of fish, and the entrants even caught such things as Swordtails (*Xiphophorus helleri*). Indeed, the continents meet in the cooling water canal at the glassworks in St Helens, Lancashire, as many tropical fish can be caught from South American, African and Asian species proliferating in the warm waters.

These fish were probably released into the canal by unscrupulous fishkeepers, whereas in other instances, fish may have found their way into watercourses by escaping from fish farms. At one time, it was possible to catch your own tropical fish from a stream that ran beside the premises of an importer

near Heathrow, and local children were quick to take advantage of this.

This colonisation by escapees is not a new phenomenon. Take, for example, the Common Carp (*Cyprinus carpio*) which is now considered a native. I quote an extract from 'Aquarial Fish' by Keith Banister:

A tract written about 1829, largely for the instruction of water bailiffs and gamekeepers says "every prudent man stocks his ponds, pools, lakes and reservoirs from his fisheries with bream and perch, but not with pike, tench or eels, which devour an inordinate number of fish."

Carp are not mentioned, yet they are mentioned in the first book devoted to angling dated 1496 by Dame Juliana Berners, an abbess at St Albans, as being scarce, and in about 1530, a couplet from the chronicle of Sir Richard Baker reads:

"Hops and Turkey, Carps and Beetr
Came to England all in a year."

Therefore, if the Common Carp was introduced, probably as a food fish, and 'captive-bred' in the monastery ponds, it would then have been just prior to 1496. At times of flood, it would have been simple for the fish to escape the confines of the monastery pond and slowly colonise the surrounding waterways.

One wonders how many of our present escapees will survive to become 'natives'. Certainly, the possibility of some of the Chinese coldwater fishes currently being imported stand a greater chance of survival than the tropical species but, if southern European scorpions can adapt to live in Britain, then why not fish? They could join the growing number of 'invaders' such as Goldfish, Koi and Crucian Carp.

SEX IN THE SUMMER

Thought that would get your attention!

The summer months are ideal time to spawn some of the gouramis. One of the main problems encountered when rearing fry is trying to keep the



Pearl Gouramis (one male is on the left, another one behind; the female is on the right) make an excellent choice for breeding during the summer months.

air space above the water humid enough. During the summer months, I like to use some vats under my greenhouse staging to breed these fish. They require no heating and only gentle aeration — usually an air-operated poly-filter which kills two birds with one stone, providing water movement and filtration.

I have had great success with Blue Gouramis (*Trichogaster trichopterus*), Pearl Gouramis (*Trichogaster leeri*), Fighters (*Betta splendens*) and Dwarf Gouramis (*Colisa lalia*), but not all in the same season.

With gouramis, I usually use a pair or maybe a trio (one male, two females) per vat. Plants are provided: potted plants, clumps of fine-leaved plants and floating plants, and these are often ripped to shreds to put in the bubbler. Once the fish have spawned, the eggs have hatched and the fry are free-swimming, I remove the adults and grow the fry on in the vats.

Other fish which respond to this method are White Cloud Mountain Minnows (*Tamichthys albonuber*) and several of the smaller barbs. These are shoal spawners and, provided there are copious amounts of fine-leaved plants for them to spawn among, you will be rewarded with plenty of youngsters. The adults are left in the vats and they spawn regularly during the summer; the young are taken out at regular intervals to grow on elsewhere, otherwise the vat becomes overcrowded and the young are stunted.

The next thing to think about is the amount of small foods you are going to need to cope with the young fish. It's one thing to get them to spawn, but another to raise them, and feeding can be a major problem, especially if you are faced with 500-plus tiny, but hungry fry, three times a day. The cost in brine shrimp alone can be prohibitive.

A word of warning: before you go out and buy breeding stock, don't forget that you have to have sufficient holding space to cope with these fish during the winter months, or have the facility to heat the vats — and that's expensive in a greenhouse! You also need to be able to sell or swap all the youngsters, but that shouldn't be a problem, as fish clubs up and down the country hold auctions and bring-and-buys.

What experiences have you had breeding fish during the summer months? Write in and tell us about it.

AND FINALLY...

I have just received a letter from Adrian Dempsey, General Secretary for the FBAS, in which he states that the response to the TA which featured details of the FBAS was very good; he has had some 60 enquiries!

Adrian writes "Should any more of your readers (both junior and adult) wish to join their local society, I will be pleased to forward details. Wherever possible, this will include information of contact name, address, telephone number and meeting place. If no society exists locally, I will be able to forward information on how to start one and keep it running!" Adrian's address is 194 Greenhill Road, Greenhill, Herne Bay, Kent CT6 7RS. The inclusion of an SAE would be appreciated.

Adrian adds a note for Society Secretaries: if the particulars listed change, please let him know so that the correct information is distributed to readers. I would add that if any other Federation or Association Secretary cares to let me have details of their organisation, I will do my best to include them in a future issue of TA.

Jason Endfield

Preaching, Pasties and Proverbs

Sometimes, as Jason Endfield discovered, it's not easy to convince someone that fishkeeping is fun . . . sometimes, its downright impossible!

There's a lot of pent-up frustration in me today (for a change), and if I don't get it 'out of my system' then I feel like I'll explode (that wouldn't be a pretty sight because I've just had a cheese omelette and two chocolate eclairs). So, for this feature I'll be letting off some steam and relaxing after a very frustrating experience. I would be grateful if you would read this — you know, 'a problem shared is a problem halved'. So, where should I begin . . . ?

Well, it all started earlier today when I was at work having a nice, informal chat with a colleague; being a basically aquatic person (me that is, not my colleague . . .), I inevitably steered the conversation away from work rotas and targets towards a more fishy orientated destination, so to speak. Very soon we arrived in 'fishkeeping country' and I began with my missionary work of trying to convert normal people into aquarists (a valuable crusade, very much underfunded — all donations gratefully received).

I started out by elaborating on the usual merits of keeping fish — you know — variety, interest, therapeutic value, etc; the usual things, and, as sometimes happens, this proved to fall slightly short of total conversion.

My colleague was a bit sceptical: "Fish are just stupid, dumb things with fins, whose only virtue, in my opinion, is that they taste good," he said, (see what I mean about being sceptical?). I reeled — but only a bit — I've done enough reeling in my time to be quite used to it.

I hit back with plan B — intelligence! (No, not mine, but that of fish). "Did you know," I asked, "that fish are highly intelligent?" "Sure," he replied, "they're also very good at finding their way into nets and on to books, and (ha, ha, ha), onto dinner plates," he added with a chuckle that invited my fingers to assault his nose (I resisted).

I wasn't getting very far, but then, in the nick of time, I remembered a seventeenth century proverb that says wisely: 'share your knowledge and those you educate will be

forever in your debt'. With the proverbial words ringing in my ears (and because my colleague already owed me for two days' lunches . . . talking of 'debt' . . .), I continued with my crusade to educate this person with an attitude problem.

One hour later, and with very little work having been done in the office (so what's new?), I had left 'fishkeeping country' and was fast approaching 'exasperation-ville' (a place I'm quite familiar with these days). My lunch from two hours earlier sat cold on my desk, untouched except for a nasty moment when, in a passionate pro-fish speech, I slammed my fist down hard in the middle of a cheese and onion pasty.

It seemed that I had little chance of converting my colleague to become a fishkeeper, though I came a little nearer when I played my trump card and revealed that "even the humble Goldfish can see more colours than a human being" — a supposedly scientific fact, which alas, I couldn't prove at the time, despite several sketches of fishes' eyes which looked more like fried eggs, and which caused much amusement in the office.

Despite that promising information, which was designed to add weight to my 'fish are intelligent' point, it proved to be an exercise that did little to enhance my argument — indeed it 'de-hanced' it considerably, and, after a further half hour, I surrendered — defeated, humiliated and confronted by a cold, squashed cheese and onion pasty that cost me fifty-five pence — just to make matters even worse. There's something about a cold cheese and onion pasty that somehow sums up one's resignation completely — many's the time I've felt like one — sort of crumpled and flaked out.

It's the first time that I haven't been able to convince someone to, at least, give fishkeeping a try, and it's left me shattered and exhausted. I am, however, not a weak person (just don't make me touch a spider or eat oysters) and my missionary work will continue.

I feel that it's my duty to carry on, but I do need your help, dear reader, and this is how you come in: tell your friends, your family — even total strangers in the queue at Sainsbury's — that 'fish are fun'. We can convert the world. Yes, we can convert nearly everyone — except maybe my colleague, of course.

You know, I'm sure that there are some people who are put on this earth to aggravate us 'good' people, don't you? I don't like mentioning any names, but just take Roland Rat for example; remember him? Yes, I wonder what happened to him; someone poisoned him probably.

Well, getting back to the point, I'm grateful to you for having read this — I feel better having told you about it and 'getting it off my chest'. Thanks.

Now something else is bothering me — it's that seventeenth century proverb. You see, I did try to share my knowledge with my work colleague but it's impossible to share anything with him (except money) and I didn't actually succeed. So does that mean that he is forever in my debt, or that I'm forever in his debt — or are we even? And what about the two lunches that he owes me for?

Oh why is life so confusing . . . ?



PRODUCT ROUND-UP BY DICK MILLS

PET INDEX (Part 2)

Gesting Associates

Despite sounding like some new fancy wound-dressing, **BIO-PLAST** is, in fact, the brand name of a range of very serious aquarium support hardware and treatments. Their latest (from **GESTING ASSOCIATES**) **BIO-PLAST FILTER MEDIUM** looks like misshapen chunks of white aerated chocolate or pumice stone. Of course, it's the holes that are just as important as the surrounding material which keeps them all together for they provide endless passageways through which water flows and, even more importantly, even more surface area which bacteria can colonise. Both aerobic and anaerobic bacteria can perform their cleaning processes within the same medium.

The range of **Bio-Plast** products include lighting (mercury-vapour lamps and fluorescent tube light enhancing reflectors), substrate heating

system (using water circulation, not cable heating), CO₂ systems and plant fertilisers, water test kits and treatments, including the **SOCHTING DOSATOR** and **OXYDATORS** (now available for ponds as well as aquariums).

Full details from: **GESTING ASSOCIATES**, 6 Ryshworth Bridge, Crossflatts, Bingley, West Yorkshire BD16 2DX. Tel/Fax: 0274 569200.

Garner Marketing

Do you remember that slogan "I've got millions" used by a live foods supplier in his *A & P* ads in days gone by? Well, it could equally well be applied by **GARNER MARKETING** to **FILTER START**; this contains literally millions of live actively nitrifying bacteria with which you 'seed' your aquarium to ensure that no time is lost in maturing the biological filter which, in turn, means a better

environment for your fish.

Available for freshwater aquariums (two sizes of pack — 16 gallons and 33 gallons), ponds (150 gallons and 2,000 gallons) and for marines (33 gallons), **Filter Start** could almost be suffering under a misnomer as it will continue to 'repair' bacterial colonies damaged by normal regular aquarium maintenance, such as filter cleaning, or by medication, and generally assist filter efficiency should overstocking occur.

For further details write to: **GARNER MARKETING**, 118 West Street, Faversham, Kent ME13 7JB.

Bronze Work

Very often, even the very best-designed garden pool needs that certain 'something' just to 'finish it off', but this needn't always be of an aquatic nature. Such a something can be found in a colour brochure from **BRONZE WORK**: **Bronze** is a very attractive

material for outside works — it even ages gracefully — and the selection of wall-plaques and sundials (also in brass) from the brochure will be more than suitable to every occasion — there's even one entitled **Guardian of the Koi**.



Further details from: **BRONZE WORK**, 22 Paget Road, Wolverhampton WV6 0DX. Tel: 0902 29168.

Underworld Products

You might well think that the advertising agency has really gone right over the top when you read the slogan 'the best synthetic salt available' and then notice it has been applied to two different salt mixes from the same manufacturer!

However, you should also realise that **AQUARIUM SYSTEMS** (manufacturers of **Instant Ocean** products) know exactly what they're doing. The answer to the paradox is quite simple: the company believe that each salt mix is the best for its own particular application or usage in the aquarium.

Whereas **Instant Ocean** has a longstanding (25 years, no less) record of success as a synthetic salt mix used in both research



laboratories and in the marine hobby, **REEF CRYSTALS**, the latest formula, was only launched in late 1990 (in the US) to cater especially for reef tanks. This newcomer is not intended to supersede its long-

running relative, but is more suitable for the specialised needs of living invertebrate life (corals, anemones and even algae) which often predominate over fishes in the reef tank scene.

Rather than try to find a way through the maze of 'essential additives' for your particular collection, **Reef Crystals** contain the lot, right from the first bucketful and at every water change, being the first enriched sea salt with extra measures of calcium, vitamins and trace elements. If you think that mixing up water is a continual chore, then you'll be pleased to know that the special crystal structure of **Reef Crystals** reportedly makes it the fastest-dissolving salt available, giving you even more time to enjoy watching the fish.

Details of all **Aquarium Systems** products from: **UNDERWORLD PRODUCTS**, Units 1 & 2, Belton Road West, Loughborough, Leicestershire LE11 0TR. Tel: 0509 610310; Fax: 0509 610304.

Ski-System

OK, admit it, you're reading this bit with extra interest because you want to know what skis have got to do with fishkeeping.

Interpet

Sounding similar in name to the 'designer-label' on one of the latest drinking waters, AQUALIBRIUM from INTERPET is, in fact, a multi-purpose physiological tonic salt for aquarium use.

When used at its lowest dosage of 1 gramme per litre, Aqualibrium reduces stress by virtue of reducing the fish's osmotic regulation requirements. Trebling the dose (still only a meagre 3 grammes per litre) helps in handling and transportation of fish, or where fishes have been bullied; the toxicity effect of nitrites is also reduced by the effect of sodium and chloride ions in the treatment.

Aquarists noting the combination of sodium and chloride may leap to the conclusion that the old-established salt treatment — sodium chloride, — will do just as good. But Aqualibrium contains magnesium, potassium and calcium in addition to 'salt'; it also provides a mild pH buffering effect and is therefore a more effective and better alternative.

And we're not finished yet ... tripling the dose again, at 9 grammes per litre, the treatment provides an ideal support to anti-bacterial medications when treating ulcers. The 258 gramme pack size will treat up to 60 gallons (272 litres) depending, of course, on dosage used.

Interpet's EASY TEST NITRATE KIT may be causing some worries among first-time users especially those used to

The SKI-SYSTEM is the brainchild of Dr Cedric Woods who has developed the Six Kingdom Inventory System to classify by computer (to one's own requirements) all species from the six biological king-

doms. The IBM computer-compatible system allows you to enter the first three letters of the common names (although brainboxes can use scientific ones if they want to) and then selects the classification step by

step, as fast as you want.

A demonstration disk and further information is available on receipt of £5 (refundable with order) from: SKI-SYSTEM, 16 Crawford Street, London W1H 1PF.



measuring nitrate levels using (dare we suggest it?) some other test kits. Adrian Exell, product development manager explains: "Previous kits only measured the nitrogen fraction of nitrate, referred to as NO₂-N. However, the complete nitrate level is far more relevant to fishkeepers and provides a far more accurate indication of water condition".

Adrian also explains that because Easy Test measures the total nitrate, NO₃, readings may be initially interpreted as being higher than expected. You might be getting a less flattering picture of nitrate content, but it is an accurate reflection of the real nitrate level in your aquarium. NO₂-N test kit results often show less than a quarter of the real nitrate level. Apparently, water scientists and enlightened hobbyists now all refer to complete nitrate levels.

Adrian quotes Albert Thiel, the celebrated marine aquarium expert, as recommending a level

of less than 10mg/litre (ppm) total nitrate, NO₃ (2.2mg/litre [ppm] on an NO₂-N test, if they can measure to that accuracy). If you want to find the nitrate fraction figure, simply divide the Easy Test result by 4.4.

Hard on the heels of Interpet's success at Petindex (see *A & P*, June 1992) comes news of a new range of POWERFLOW INTERNAL FILTERS. Designed around a

common style, the cylindrical filter fits snugly into a suction-pad-held corner bracket. Immediate directional flow adjustments can be made by turning the unit within the bracket, while, for finer directional control (through a larger three-dimensional spreading area), a deflector nozzle is used. Flow-rates are also variable, as is extra aeration from the outside atmosphere.

The range comprises of four models: IPF1, 2, 3 and 4. Respectively, they are suitable for aquarium capacities — 6-37 gallons (c 27-170l), 8-100 (c 36-450l), 22-143 (c 100-650l) and 27 gallons (122l) upwards. Corresponding flow-rates are 26-37 gal/hr (120-170l/hr), 33-100 gal/hr (150-450l), 88-143 (400-650) and 108-185 (490-840).

A nice practical touch is that each unit can be removed for cleaning without spillage occurring, all the dirt remaining inside the holder. The hollow filter-sponge support has a limited capacity for extra filter medium, say, carbon, while the larger unit has a two-part filter sponge for convenient periodic cleaning without completely destroying any useful bacterial colonies which might well be resident within the sponge material.

Modestly-priced at between £14 to £35 (depending on model), Interpet also give a guaranteed five year supply of spares availability.

Full details from: INTERPET, Vincent Lane, Dorking, Surrey RH4 3ZYX. Tel: 0306 881033.



Airport Aquaria

A new service is being offered by AIRPORT AQUARIA — MAIL ORDER POND PLANTS. Having recently seen not only the scale of expansion of the outdoor coldwater display area, but also the quality of the aquatic plants displayed there, readers should have no qualms about ordering from this source, bearing in mind

that some of the species are seasonal in supply.

Airport Aquaria do not supply pre-selected packs of plants (it absolves them from blame for any disappointments over choice of species), nor do they wish to enforce their ideas on to your requirements for your pond. But don't despair, there's a great range to choose from: the Catalogue is divided into several sections — Marginals (over 80 species); Moisture-

loving species (36); Deep Marginals (8); Floating Plants (8); Oxygenating Plants (13) and Water Lilies (50-plus).

The Catalogue also gives notes on how many types of plant to order per pond size (water surface area), how to care for the plants upon arrival before and after planting and, where necessary, species descriptions include planting depths required.

For hobbyists unable to visit

personally, sending off a large SAE (A4 size) will bring you a catalogue by return and then, from the comfort of your own armchair, you can plan for next year's great pond show. Well, even perfection takes a little time to mature!

AIRPORT AQUARIA, Heathrow Garden Centre, Sipson Road, West Drayton, Middlesex UB7 0HR. Tel: 081 897 2563.

Gold Line Feeds

When 'designing' a fish food, many factors affect the final product. Of course, the best raw materials must be used, but how they are formulated, blended, processed and even packed all play their part in ensuring the customer gets the very best. PHOENIX 2000, from **GOLD**

LINE FEEDS is a case in point.

Although more expensive, herring meal is preferred to ordinary white fish meal because it contains a higher proportion of n-3 and n-6 polyunsaturated fatty acids which allow a better digestibility of the food (around 97.6%, giving a very high energy content). Similarly, the latest form of Vitamin C is used, being more

stable during the manufacturing process. Amino Acids also play a very important part and there is a full complement of these essential elements built into the food, along with all vital vitamins, minerals, trace elements, etc.

Despite being a floating food, Phoenix 2000 is sold by weight (not volume) so you are not buying air. The colourant used

is Canthaxanthin, again one of the most modern types available. Analytical breakdown: crude protein 34%, oil 5%, ash 5.7% and crude fibre 2.65%.

Further information from: **GOLD LINE FEEDS**, Pinfold Farm, Welham, Retford, Nottinghamshire DN22 0SQ. Tel: 0777 702131; Fax: 0777 706800.

Batsford

SIMLAWOOD has long been in the forefront realistic-looking aquarium ornaments but without any of the risks attached which using natural substances might have.

The latest models from **BATSFORD** include a **SUNKEN CHURCH**, an **OVER-TURNED BARREL** and a rather good-looking **STRATIFIED CLIFF WALL**.

While the actual choice of design often causes some aes-

thetic arguments among hobbyists, the whole range is available in safe, non-toxic materials to enhance your underwater scene. If they attract and maintain your interest in the upkeep of the aquarium, then these popular

aquarium decorations are fulfilling yet another very useful purpose too.

Details from: **BATSFORD**, Holly Lane Industrial Estate, Atherstone, Warwickshire CV9 2HA. Tel: 0827 713730.

Coral Reef Technology

Whether or not you've ever seen an iceberg for real, you will be aware that there's much more below the surface than above. Much the same can be said for **CORAL REEF TECHNOLOGY** whose range of products far exceeds expectations gathered from their advertising materials.

In fact, they market two main ranges of products — **THIEL AQUA TECH** and **RED SEA FISH PHARM**. As the company name suggests, most are aimed at the marine fishkeeper, although some may well prove to be valuable in freshwater areas too.

Albert Thiel justifiably enjoys a reputation as a marine expert and the products bearing his name can be trusted, not only to prove effective, but also to be necessary, as determined by practical research over many years. Unfortunately, within the space of these columns it will be impossible to do much more than list the comprehensive aquarium additives, but maybe drawing readers' attention to their very existence will be of value in itself.

Starting at the beginning of any marine system, **SUPERZYME** gets the necessary bacteria in the biological filter off to a flying start; the powder is added to saltwater in two separate doses — half the bottle at first, mixed with seawater (a separate freshwater version is available), followed by the rest a week later. Similarly, **GOLD START** will provide the ammonia-based 'FOOD' for the

bacteria in a newly set-up tank (before fish or animals are introduced); it can also be used to calibrate your ammonia test kit.

Once the tank is established, additives are available either to enable water to reach peak conditions, or to keep it that way. **LIQUID GOLD** (no, not the building society's advert!) is a supplement of desirable trace elements which is constantly being refined as new evidence of improvement demands (they'll even accept unused portions and replace it with the latest formula, should the shelf-life be exceeded).

MACRO-ALGAE and **CORAL NUTRIENTS** additives are self-explanatory, as are **MARINE VITAMINS** and **TRACE ELEMENTS**. **SEASPICE** is added at regular water change times, or when evaporation-losses are made good. **KSM SUPPLEMENT** (Kelp, Strontium and Molybdenum) will help greatly to maintain healthy live corals, particularly *Casalaphylla*, *Goniopora* and *Euphylla*. Hard-skeleton invertebrates will benefit from regular additions of **TECH-IODINE**. **KALKWASSER** (Lime water) is a most important additive as far as stony-skeleton corals are concerned.

There are areas into which some minds haven't ventured, and I have to admit that that of Redox potential is one of them as far as I'm concerned. However, I am duty bound to report that **REDOX + LIQUID** will, to some extent, control parasitic infestations, although it is not a medication as such. It can be

used up to six times in 24 hours — the purple colour it produces will disappear after an hour or so (can't you tell I'm quoting from the label?).

I can grasp the idea behind the **RESIDUAL OZONE TEST** solution and that of **REEF KH CARBONATE BUFFER**, **X-NITRATE**, **X-PHOSPHATE** (the latter two both removal agents) and **COCONUT SHELL ACTIVATED CARBON** filter medium. Finally, two Test Kits must be mentioned — **IRON TEST KIT** (Iron is an important nutrient for freshwater plants and marine algae) and **TECH KH TEST** (Carbonate hardness testing).

Now you're beginning to see the proportions of the 'iceberg' beneath the surface, we'll move on to the next range of products from **Red Sea Fish pHarms**.

These products fall nicely (from the viewpoint of the reviewer) into, mainly, freshwater and saltwater areas.

The basic marine requirement of quality water is easily achieved using **CORAL REEF RED SEA SALT** (despite its title, the resulting mix is suitable for fish from every ocean). Freshwater Test Kits include **HARDNESS**, **pH** and **NITRITE**; a marine **COPPER TEST KIT** will prove to be an invaluable asset when used in conjunction with **MARINE PARACURE**, the associated copper-based remedy (you can also use it to test for copper in freshwater systems if new piping has been fitted to your household's plumbing system recently).

Remedies cover **FUNGI-**

CURE, **MYXOCURE** (Finrot), **BACTOCURE** (general treatment for bacteria, Flukes and Oodinium) and **ICHOCURE** (White Spot). **AQUAFLORA** is a fertiliser for aquatic plants. Straddling the boundary between freshwater and marine are the **ARTEMIA SENSATION** (Brine Shrimp eggs without shells, for faster and bigger hatchlings) and **BRINE SHRIMP FOOD**.

Foods for marine algae and invertebrates are supplied by **REEF GREEN** and **INVERTEBRATE DIET** respectively.

Effects provided by **REEF BUFF**, **REEF VITA** and **REEF TRACE** are easily deduced, being — in turn — a marine buffer, a vitamin additive and a trace element supplement.

As we go to press, news has just come through in respect of **Red Sea Fish pHarms**' dramatic increase in the number of test kits: they've doubled them to include marine tests for ammonia, nitrate, phosphate and calcium, while the freshwater range has iron and carbon dioxide added to it (marine ammonia and phosphate test kits are also suitable for freshwater use). **Red Sea** now has a range of twelve test kits introduced since the company's products were first formulated only eight months ago.

Now, to paraphrase the captain of the Titanic, shouldn't you be looking out for icebergs?

Full details of Thiel Aquatech and **Red Sea Fish pHarms** product from: **CORAL REEF TECHNOLOGY LTD**, 62 High Road, Byfleet, Surrey KT14 7QL. Tel: 0932 355121; Fax: 0932 349718.

The Deep End

Although it may sound like a condition of life we're all in at any one time, the DEEP END is, in fact, a flourishing aquatic business in Yorkshire. They have just released their (wait for it) DEPENDABLE PHOSPHATE REMOVER.

Hair Algae have been causing problems, especially in reef tanks, and for some time, the

only solution seems to have been for hobbyists to "literally tear their hair out" to rid their tanks of the stuff. It is now well-established that phosphate levels are largely responsible for this latest algal plague. Phosphate not only comes from fish excretion and when other solid wastes (uneaten food, etc) are broken down by bacteria, but may also be present in tapwater in certain areas of the country.

The Phosphate Remover takes the form of small beads which can be installed in a power filter; the bead size is fairly critical — too small and waterflow is impeded, too large and not enough contact time is allowed. DEPENDABLE's version is aimed to satisfy these criteria and is also virtually dust-free. A pack of Phosphate

Remover (approximately 1 litre) will treat up to 100 gallons (c 450 litres) depending on initial phosphate levels and bio-load.

Available from aquatic outlets or direct from: THE DEEP END, 1 Bracken Road, Ingrow, Keighley, West Yorkshire BD22 7DF. Tel: Fax: 0535 608030.



THE DEEP END

Hanna Instruments

Perhaps you're justifiably wary about using electronic test instruments around water (I once dropped a flashgun into a tank but we both survived!) so it's reassuring to know that manufacturers worry about such things too.

HANNA INSTRUMENTS have, with a great sense of safety, issued new versions of their pHep pH METERS — they're completely waterproof. Additional features include automatic calibration and temperature compensation; they even switch themselves off if left on accidentally. Prices start from as little as £24.95 so you can even save money as well as



yourself. Details from: HANNA INSTRUMENTS LTD, Eden Way, Pages Industrial Park, Leighton Buzzard, Bedfordshire LU7 8TZ. Tel: 0525 850855; Fax: 0525 853668.

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WHO'S WHO AT HAMPTON '92



By John Dawes
Photograph by the author

It's amazing, but in three short years, the Hampton Court Palace International Flower Show has grown into the largest event of its kind in Europe. The 27-acre site is, of course, incomparable, but that alone can't — and couldn't — ensure success.

A large team of 'ever-working' organisers, consultants and ancillary staff, backed by generous sponsorship from Network South East, and what can only be termed as a hugely positive response from exhibitors, have all had major roles to play.

Aquatic Consultant Chris Skilton of C J Skilton Aquarist, is the driving force behind the huge success enjoyed by the fast-expanding Aquatic Village located, most strategically and appropriately, by Hampton Court's world-famous Long Water.

Sharing this prime site with *Aquarist & Pondkeeper* this year will be the following exhibitors:

Walton Koi Centre (Stand AQ1)

Walton are setting up a display entitled *Visions of an Oriental Pool*. This will incorporate a Koi pool in an oriental landscape. The pool itself will be stocked with 'tame' Japanese Koi, so feeding time should provide a great spectacle.

The Reptilium (Stand AQ2)

Under the title *World of Amazing Amphibians*, this large display will consist, not just of amphibians, but also of reptiles, both displayed to promote the company's captive breeding project.

The animals will be exhibited in natural settings which will incorporate a good selection of artistic woods from all the continents.

Dorking Aquatic Nursery (Stand AQ3)

Dorking are back with another great exhibit: *A Walk on the Wild Side*. As its name suggests, this display will consist of a wild garden in a water meadow setting.

A stream which will link up with the meadow will include a selection of cultivated aquatic plants from Dorking's own nurseries.

Anglo Aquarium Plant Co (Stand AQ4)

Back from another successful show, Anglo Aquarium are mounting a display called

The Water Works.

Including an elegant Edwardian conservatory from Everest, this exhibit will contain a large selection of Anglo's own-grown plants, the whole display being masterminded by last year's award-winning Steven Day.

Aquatic Design Centre (Stand AQ5)

This year, *The Garden Under the Sea* will feature two large octagonal aquaria.

One will be (despite the title) a freshwater tropical garden in which "the exotic fish complement the lush plant life", while the other will be dedicated to marines.

Aquarist & Pondkeeper (Stand AQ6)

Our water feature this year will be *My First Pond* — a Plasticall pond display mounted in association with *Minster Water Gardens* and designed to show first-time pond owners just some of the things that are possible.

In our main marquee, we'll, of course, have this issue of the magazine on sale, along with our much-sought-after *Supplements* and posters, plus back issues of *A & P* and a selection of books... and experts on hand to answer aquatic queries.

Interpet Ltd (Stand AQ7)

Our next-door neighbours will feature *The Aqueduct*, created by representatives from DASH (Disablement Association, Hillingdon) and designed by *Airport Aquaria Ltd* in association with *Interpet*.

This water garden will be laid out to show how disabled people can, not only enjoy, but also maintain, a successful water feature in their own gardens.

Renaissance Castings (Stand AQ8)

These leading designers and smelters of lead statuary, ranging from 'period' to modern, will be installing a *Musical Water Garden* whose aim is to provide "a tranquil display with music and water as the theme".

Federation of British Aquatic Societies (Stand AQ9)

On *The Lily Pad*, the FBAS will be welcoming a number of experts, including *Dr David Ford* from 'Aquarian', *Dick Mills* — our regular *Product Round-up* contributor, and *Harry Hooper* from the Interna-



Tony Howells' 1992 wildlife garden display looked as if it had been there for years!

tional Water Lily Society.

The FBAS's extensive range of literature, including their quarterly magazine, *Fishworld*, will also be available on the stand.

Tetra UK Ltd (Stand AQ10)

On Stand AQ10, visitors will be able to talk to *Dr David Poole* and others about all matters aquatic, including the *Tetra Club*.

The Tetra stand will also include a 'Stepping-stone Pond' from *Tony Howells' Water Gardens*. Tony had a most impressive wildlife pond display at last year's event.

Gary Sharpe (Stand AQ11)

Gary, of *Howe Green Garden Services*, will be 'erecting' *The Pump House* — a formal patio incorporating a cobbled water feature which has been jointly designed with the show's Aquatic Consultant, *Chris Skilton*.

The design on show can fit just as well into an old, established garden, as a brand new one.

Powering this, plus "all the moving water in the Aquatic Village", will be various models from the *Lowara* range of pumps (see also *News Desk* item elsewhere in this issue).

Heritage Stone (Stand AQ12)

Entitled *The Slate Garden*, this display is intriguingly labelled as being "just amazing". It has been designed and built jointly with *Water Management* by *Ian Lauriston*.

The Hampton Court Palace International Flower Show will be open to the public from **Thursday, 9 July to Sunday, 12 July**, with a press and preview day attended by the Queen and Prince Phillip on **Wednesday, 8 July**.

Admission prices are £12 for adults, £9 for senior citizens, and £6 for children, with reductions of up to £2 on tickets purchased with a rail ticket. Tickets are available in advance (ring Ticketmaster on 071 379 4444), or on the day, from Waterloo and most manned British Rail stations.

Opening times: Thursday to Saturday — 10 am to 7.30 pm; Sunday — 10 am to 6.30 pm.



An adult Pikehead. The tail is only rarely held fully splayed out as in this specimen.

THE PIKEHEAD

Part 1

German author and aquarist **Michael Kokoscha** introduces a remarkable and highly predatory relative of the Gouramis

Photographs by the author



The characoids also include 'pike-like' species such as *Boulengerella*.

We often apply the term 'Pikes' to all fishes which remind us of our native Pike, *Esox lucius*. The body of such fishes is torpedo-shaped, with dorsal and anal fins positioned well to the rear. This in no way implies any relationship between the various species, of course, but is the result of their adaptation to a similar life-style.

Most of these fishes are 'attack' predators, lying in wait for a passing fish, and seizing this prey in a rapid sally. Accordingly, their body form is designed for rapid acceleration from a stationary position, rather than for continuous swimming over longer distances.

Pike-shaped fishes are found in a great variety of orders and families: the primitive 'bony pikes' (*Lepisosteus*), the characins of the genera *Boulengerella* and *Ctenopoma*, the 'Half-Pikes' or Garfishes, of the family Belontiidae, various dwarf pikes among the egg-laying toothcarps, *Belonesox belizanus* (the Pike-top) among the live-bearing toothcarps, and *Luciocephalus pulcher* among the Labyrinth Fishes.

The German name "Hechtkopf" is, like the English equivalent, "Pikehead", an exact translation of the Latin "Luciocephalus". The species comes from the southern part of the Malaysian peninsula, Sumatra, Borneo, and the intervening islands of Bangka and Biliton. Korthaus (1978) describes a locality for this species in Kalimantan, the Indonesian part of Borneo: the water was coffee-coloured, the conductivity 15 μ s (microsiemens) at 27°C (80.6°F) and the pH less than 4.8.

MAIN CHARACTERISTICS

The basic colour of *Luciocephalus* is brown with dark longitudinal stripes, which may, however, depending on mood, merge together into a single dark band or break up into a pattern of spots. The dorsal fin is set well back and contains no spines. Like the pectorals, it maintains a constant rapid fanning motion in order to stabilise the fish while it lurks, and to enable it to move slowly forwards.

The impetus during an attack is provided by the tail; the entire body is first bent into an S-shape and shoots forward rapidly as it is straightened out again. Normally, however, the tail is kept folded. The anal fin, which, like the dorsal, contains no spines, is divided, and almost gives the impression of being two fins. The function of this divided fin is unexplained. The pelvic fins (ventrals) contain a single spine and five soft rays; the second of these is elongated into a filament, as in many labyrinth fishes.

Like these other fishes, the Pikehead has an additional respiratory organ (the labyrinth) which enables it to breathe in air at the surface in oxygen-poor waters. In contrast to what has been stated in various places in the literature, *Luciocephalus* possesses a well-developed swimbladder, which, in shape and size, resembles that of the Labyrinths (Liem 1967).

Without doubt, though, the most strikingly feature of the Pikehead is its extremely



Close-up of highly efficient predator.

extensible mouth. The only comparably extensible (33% of head length) mouth is that of the South American Leaf Fish, *Monocirrhus polyacanthus* (Lauder and Liem 1981). Although upwards-pointing when closed, when opened, the mouth of *Luciocephalus* points slightly downwards.

The premaxillary process (the 'intermaxillary' bone) which moves, like a guide-bar, in a groove on the upper side of the skull, becomes fully extruded and the skull itself is lifted with the assistance of a link between the first and second vertebrae of the spine (Lauder and Liem 1981). In this way, even very large prey items can be engulfed.

Looking at the extended mouth one might suppose that the Pikehead catches its prey by sucking it in. But this is not the case. Lauder and Liem (1981) were able, using high speed photography (200 pictures per second), to demonstrate that *Luciocephalus* extends its mouth over the stationary prey, rather than sucking it into its mouth. The entire process normally lasts only 1/20 of a second, and *Luciocephalus* attains a speed of 150 cm per second during the attack.

But the mouth has an additional function: Pikeheads are paternal mouthbrooders. A 10.6cm (4.2in) Pikehead caught by Korthaus and Foersch in Borneo in 1978, spat out about 90, 12mm (0.5in) long fry. According to Liem (1967) it is probable that the high degree of specialisation of the mouth for seizing prey animals is a secondary development in a primary mouthbrooder.

UNCLEAR RELATIONSHIPS

Although nowadays there is little doubt that *Luciocephalus pulcher* is related to the Labyrinth Fishes, its exact systematic position remains unclear. In general, the literature follows the classification used by Greenwood *et al* (1966), according to which *Luciocephalus* is the sole genus in the sub-order Luciocephaloidei, which, together with the sub-order Anabantoidei (Labyrinth Fishes), belongs to the order Perciformes (Perch-like fishes). Various authors (Weber and de Beaufort 1922, Gosline 1968, Nelson 1969 as quoted by Lauder and Liem 1981)



Luciocephalus possesses one of the most protuberant mouths imaginable.

are of the opinion that the Pikehead is more closely related to the Labyrinth Fishes than any other group belonging to the Perciformes.

Liem (1963, 1967) cites the membrane-covered exoccipital foramen (a cavity in the posterior head) as a particular character in common, and one which, like the air-filled labyrinth, is a highly specialised organ not found in any fishes apart from *Luciocephalus* and the Labyrinth Fishes. Moreover, the shape and size of the swimbladder and labyrinth correspond in the Pikehead and the Labyrinth Fishes. The obvious differences — such as the absence of a maxillary process on the parasphenoid and basioccipital (two bones in the skull); the presence of a third joint between the point of attachment of the jaws and the skull, and a link between the first and second vertebrae; as well as the existence of a gular-like (throat-like) ossification in the lower jaw — can all be referred to the high degree of specialisation of *Luciocephalus* for the engulfing of large items

of prey. The absence of spines from the dorsal and anal fins is a character also seen in various Fighting Fishes.

Thus, the Pikehead might be assigned to a fifth family of Labyrinth Fishes, which would be termed the Luciocephalidae. According to Liem (1967) this would, because of the absence of the maxillary process in *Luciocephalus*, require a broadening of the definition of the Anabantoidei.

I, myself, would postulate an even closer relationship between the Pikehead and the Labyrinth Fishes. The structure of the eggs of *Luciocephalus* closely resembles that of the sinking eggs produced by Labyrinth Fishes of the sub-family Macropodinae (see further details in Part 2).

Particularly notable among the fishes of this sub-family is the Pointed-head Gourami, *Ctenopoma nobilis*, on account of its highly extensible mouth. The pointed snout is formed, as in *Luciocephalus*, by the much developed and 'unconnected-to-each-other' nasal bones. Among the Labyrinth Fishes similar bone structures are otherwise found only in the Croaking Gouramis (*Trichopsis*) and the Chocolate Gouramis (*Sphaerichthys*) (Liem 1965).

Like *Luciocephalus*, *C. nobilis* is a mouthbrooder (Armitage 1987, Bischof 1987). As the specialisation of the Pikehead is probably a relatively recent (and, according to Liem, secondary) development, I can imagine that *Luciocephalus* and *Ctenopoma* are derived from a common mouthbrooding ancestor. If this were the case, then the Pikehead would have to be assigned to the sub-family Macropodinae.

Footnote: A full list of references will appear in Part 2.

(TO BE CONTINUED)



As this specimen 'yawns', one can begin to get a good idea of just how large the mouth is.

No matter how long one has been involved in any activity, there are usually at least a few aspects of that activity which one fails to recognise or neglects. In the West, aquarists are well versed on most facets of keeping and breeding both fresh and salt water fish. Attention is paid to water quality, the curing and prevention of diseases, and the preservation of the species.

The eighties brought new concepts and technology to the hobby which have made it possible to keep almost anything that lives in water in a private aquarium. Aquarists today don't just keep fish alive, they provide an environment in which fish prosper.

'SPIRITUAL' FISHKEEPING

So what about the spiritual side?

What spiritual side? The side that is given consideration in the part of the world from which most of our aquarium fish come. The fish farms of Asia are world-famous and Asians are avid fishkeepers. However, the motivations behind the hobby in the East often differ significantly from those of western aquarists.

In Mandarin Chinese, the word for "bounty" (excess) and the word for "fish" are pronounced the same, and the expression: "Nien, nien yeou yu," "May you have bounty every year!" is equal to, "May you have fish every year!"

Red banners with this saying are pasted on doors during New Year, along with red paper fish, in order to assure bounty in the coming year. One should also think twice before being the first to eat the fish at a New Year's dinner, as it is often left uneaten to signify excess.

Linguistic implications alone would be enough to explain why virtually no Chinese home is complete without an aquarium, if purchasing one is within their means. However that is only a part of its significance.

GEOMANCY AND FISHKEEPING

The term "Fung Shui" (literally: Wind-Water) is known in English as geomancy. Geomancy is the practice of placing objects in harmony with natural elements. It is evident in Chinese graveyards where tombs are located on hillsides — preferably facing a body of water, and it can be seen in offices by the placement of furnishings and even the till.

Most homes require a water element which is usually supplied by an aquarium.



The Eastern Side

Galen H Valle, director of a language school in Chiang Mai, Thailand, shares some fascinating insights into keeping fish the 'Eastern' way.

Paintings by Thai artist John Gallery

Placement of the aquarium is determined by a geomancer — using methods passed down by his ancestors — to choose a location of maximum fortuity. Growth of algae is not usually taken into consideration, and it is not unusual to see a fortuitous (and green) aquarium sitting next to a window containing a very well-fed 'Pleco'.

In the case of geomancy, it is the water which has the significance; the fish are an added bonus. However, it would be unwise to keep a tank populated with four fish, as the word "four" and the word "die" have the same pronunciation, making it a bad idea to have four of anything — including a fourth floor in buildings.

BENEVOLENT DRAGONS

One fish which has a great deal of significance to Asians is *Scleropages formosus*, often referred to as the Asian Arowana, or Dragon Fish (gold or red) to the Chinese. The dragon of Chinese folklore is not the bad-tempered fire-breathing reptile westerners are familiar with.

It is, rather a benevolent creature which happens to have the responsibility of being one of the four guardians of the universe. The dragon guards the East, and the phoenix, tortoise, and tiger guard, respectively, the South, North, and West.

The dragon is also the God of Water, and it possesses myriad magical powers. These powers, combined with the Red Dragon Fish's coloration — which is greatly enhanced by the feeding of live cockroaches — make this fish most sought-after by wealthy Chinese aquarists.

Red is considered the most lucky of colours, and it is easy to see why Red *Scleropages* fetch such a high price (CITES regulations aside).

OTHER SPECIAL FISH

Other species of note in Asia are the catfish and carp. In Japan, it is believed that catfish have the ability to forecast earthquakes by rising to the water surface and shaking their bodies — a useful service that the Red-tailed Catfish club in 'earthquake-plagued' England should consider promoting! The carp is a symbol of strength, and young Japanese can be seen carrying carp-shaped banners on boys' day (5 May).

The *Pangasianodon gigas* Chevey, found in the Mekhong river which forms the border between Thailand and Laos, is treated with near reverence by villagers, and it is featured in countless folktales. Although a bit large for most private aquariums, this 300 kilo-

gram (660lb) fish is known to bring good luck and prosperity to its owner — an understandable belief with the flesh selling at nearly £10 per kilogram.

MERIT-GENERATING ACTS

Ponds have a definite place in eastern religious practices, as is made evident by the temple ponds throughout the continent. Wat O-Mong in Chiang Mai (Northern Thailand) has a prolific man-made pond that was built about 30 years ago.

When asked about the pond, Pra Santi, a resident monk, replied, "Releasing fish is a merit-making practice in the Buddhist religion. People come here on birthdays, marriages, New Year, and other special days to release fish into the pond. It is giving freedom to a living thing."

Pra Santi mentioned further that merit can be made by supporting groups such as Amnesty International and Greenpeace.

Another way of making merit is the feeding of fish. Packets of food are available, and feeding the fish is very popular with local residents (I'm pretty keen on the idea myself!).

The water is brown and murky, making it possible to see the fish only at feeding times. The feeding frenzy is truly remarkable, as is the diversity of species in the pond: several species of catfish, cichlids, Common Carp, Koi, Paradise Fish, and even Fancy Guppies all seem to be co-existing in harmony.

SPIRITS AND WATER

Homeless spirits are also known to occupy water, and an aquarium is no exception. According to Animist and Brahmin religious beliefs, most objects are (or could be) inhabited by spirits.

One type of spirit which inhabits a medium is called a "Kha" spirit in Laotian. This type of spirit enjoys abusive language and taunts. Laotian and North-eastern Thai villagers believe that the way to make this spirit feel comfortable is to speak to it in abusive language. It is possible that this spirit would feel more than at home in the tanks of many Discus owners!

Spirits require proper sacrifices, and one way to determine what an individual spirit prefers is to pick up a handful of rice and count the grains: an odd number indicates a preference for chicken, and an even number indicates pork (or beef-heart?).

There are some concepts which transcend cultural boundaries — the concept of fate is well-known to all aquarists — and it is worth considering the unimaginable when the unexplainable takes place in an aquarium. It is also worth pondering that some people rely less on technology, and more on traditional beliefs when enjoying their hobby. It is also even conceivable that there might just be more to New Tank Syndrome than the nitrogen cycle!

We have other equally fascinating articles from **Galen H Valle** waiting in the wings and will be publishing them on an occasional basis over the coming months. So — watch this space!



of the Tank

Coldwater jottings

By Stephen J. Smith



Aquatic accessories manufacturer 'Aquarian' are offering a three-foot aquarium set-up as a prize in a special Coldwater Jottings competition.

The prize incorporates a three-foot tank, plus top, lights, powered undergravel filter and stand, and delivery will be arranged by 'Aquarian'.

PRIME PUMP

With the pond season now in full flight, many pondkeepers and gardeners have turned, or are turning, to getting on with that pond project they have been promising themselves for years.

Whether you are building a full-size Koi pool, or intend to construct a simple water feature within your garden layout, the 'heart' of your pond is, without doubt, the pump.

And choosing a pump is not necessarily the easiest part of the project. Having recently embarked upon an ambitious Koi pool project myself, I was startled by the many options and types of pump generally available.

Each of them appears to be reasonably efficient for its specific job — and thereby hangs a warning: before you choose, think carefully about the use you have in mind for your pump, and buy one which is specifically designed for that purpose.

A plethora of books on pond construction is available to guide the pondkeeping newcomer through the pump

WIN A COLDWATER SET-UP FROM AQUARIAN

50 runners-up will each receive an 18 gramme tub of 'Aquarian' Goldfish Flake Food.



COLDWATER QUESTIONS:

1. What is the Latin name for the Goldfish?
2. How many fins should a Shubunkin have?
3. What is the name of the aquatic personality who heads the 'Aquarian' Advisory Service?

minefield; while manufacturers provide detailed information on all their products and their use.

Broadly speaking, and as a general guide only, pondkeepers have a choice of two main types of pump, and each is designed for a different purpose: a 'sump' pump for intermittent use (i.e. emptying a pond or cellar) and an amphibious or submersible pump for continuous use.

While it would appear that both could, quite happily, be used for either purpose, a pump designed for short-burst use could work out rather more expensive to run if put to continuous use. So, my own preference has been to use a 'sump' type of pump when emptying ponds for cleaning; while a large amphibious pump is destined to be installed into the filter system of my half-completed Koi pool.

UV OR NOT UV

I have just put the 'phone down after a most pleasant lengthy chat (show me a fishkeeper, and I'll show you a friend of British Telecom!)

with an aspiring pondkeeper, who is hoping to expand his collection of Goldfish, and who is concerned about 'green water' in his pond.

His main question was: "Should I use a UV filter?" His pond is, apparently, about the size of a large table-top, and provides a pleasant feature in his rockery. However, I heard distinct alarm bells when he informed me that he has no filtration at all at present, and wishes to use a UV unit instead of installing a filter system.

Now, let's get something straight: a UV (ultra violet) light unit is a popular means among specialist Koi keepers (and a growing number of other pondkeepers) of controlling parasites and reducing algae. However, these units, while extremely efficient at producing clear water, will do nothing to promote clean water.

Whatever the size of your pond, green water is virtually inevitable. (I say 'virtually' because not many ponds have achieved the perfect balance of flora and fauna to ensure consistently clear water all year round.) Fish, especially Koi and Goldfish, produce enor-

To win, simply answer the following three questions and send your answers to: Aquarian Competition, Coldwater Jottings, Aquarist & Pondkeeper, 9 Tufton Street, Ashford, Kent TN23 1QN.

Closing date is Friday 31 July, so do get your answers in as soon as possible, and don't forget to include your name and address (in BLOCK CAPITALS) with your answers. The first correct entry drawn after the closing date will receive the first prize, and the following 50 entries drawn will each receive an 18 gramme tub of 'Aquarian' Goldfish Flake Food.

mous amounts of solid and liquid waste, which must be removed from the water at the earliest opportunity. So, some form of mechanical and/or biological filtration is essential. And it pays not to skimp, as you really cannot over-filter your pondwater.

Correctly installed and maintained, a filter will, given time to mature, provide you with the water quality you are looking for. As for the use of a UV unit, this should be used as a supplementary device to your pond filter and, in my opinion, unless you have set your heart on using one, this could turn out to be an unnecessary expense.

Recommended reading for advice and guidance about all aspects of pondkeeping: *John Davies's Book of Water Gardens*, TFH Publications (ISBN 0-86622-662-1); *The Art of Koi Keeping — A Complete Guide*, Peter Cole, Blandford (ISBN 0-7137-2141-3); *The Interpet Bumper Guide to Garden Ponds*, compiled by Dick Mills, Salamander Books (ISBN 0-86101-636-X); *The Interpet Encyclopedia of Koi*, Salamander Books (ISBN 0-86101-405-7).

POOL KOI BOOK

A further tome which was passed to me by Dr David Pool of Tetra at a recent exhibition is *Hobbyist Guide to Successful Koi Keeping*, written by David himself.

My first impressions were that this is a tidy little volume, with lots of information and photographs. And closer examination served to strengthen this view — until, that is, I looked for the index.

Now, in my opinion, a reference book without an index is not a reference book. (I had wished to look up UV for Dr Pool's thoughts on the subject for the preceding musing; luckily, I did find it on page 29, and bumped into it again on page 76, David.) Perhaps an index will be considered for the reprint...?

And a reprint could be likely, in my opinion, for this book is bound to find favour among the gamut of Koi keepers — from seasoned Koi specialists, to the 'first-steps' beginner. The contents page promises sections on water quality, pond filtration, Koi nutrition, Koi health, and breeding Koi; as well as guid-

ance on pond maintenance, a seasonal guide to Koi care, buying and handling Koi, and keeping Koi in aquaria.

Each of these subjects are dealt with in detail, with sound advice and information from an experienced aquatic authority, and with the acknowledged assistance of Kenji Sakamoto of Tetra in Japan and Nigel Cad-dock of Nishikigoi International.

A sensible selection of some fine colour photographs, several of which are credited to A & P's Koi contributor John Cuvelier and former Your Questions Answered contri-

butor, Roger Cleaver, illustrate the text.

And if you are looking for a 'picture parade' of types of Koi — forget it. Dr Pool has avoided the easy option of extensive identification of Koi varieties and stuck to the basics. After all, if you like your fish, does it matter whether you know, or can even pronounce, its Japanese name...?

The cover of the book declares that this is an "Aquarium Digest International — Collector's Edition". I reckon that there will be a queue of collectors who will have snapped up this Tetra offering.

Hobbyist Guide to Successful Koi Keeping by David Pool. Published by Tetra Press; price £7.95 (ISBN: 3-893 56-134-X).

STAR APOLOGY

Cries of consternation were caused by my recent mention of Star Fisheries, who were spotlighted in *Coldwater Jottings*. While they were, of course, delighted to receive the 'Jottings' treatment, they reminded me that the proprietors of the company are, indeed, Andrew and Frank Green, who are alive and very much kicking!



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OUT AND ABOUT

THE WATER ZOO

By John Dawes

Photographs by the author

The last time I visited The Water Zoo — or Peterborough Aquatic Centre — was back in 1986 when the shop was just about to open. The feeling I got then was that I was in a shop that seemed destined to point the way forward with regard both to sophistication and attention to detail in its 'caring' approach to the handling and welfare of its livestock.

A return visit was way overdue, and so it was that a few weeks back I returned to Peterborough's aquatic 'paradise'. How the place has developed! It was very good even when I saw it the first time round ... it's now superlatively good!

The Water Zoo just has to rate as one of the very top aquatic retail outlets in the country. It is not just immaculate and beautifully laid out, it's also got the best aquatic plant display I've personally come across in a shop. 'Embracing' the counter in the livestock section, it forms a wonderful, and very green, centrepiece that is likely to tempt even the most 'non-plant-aquarist' to buy — an excellent example of psychology and commonsense working together to great effect.

The quality and range of fish species is also top-grade. This is backed up by an extensive behind-the-scenes quarantine/acclimatisation area that ensures that no fish or invertebrate goes on sale unless and until it is fit to do so ... and feeding. This rule applies just as stringently to a Guppy as to a Moorish Idol, a 'rudely' healthy and voraciously feeding specimen of which was among the colourful array of marines I saw during my visit.

Such is the confidence that Roy Scott and The Water Zoo team have, that they offer a written 'Livestock Guarantee' which states:

The Water Zoo hereby guarantees that the livestock supplied is healthy and feeding. Should death occur within 7 days of purchase we undertake to pro-

Frank — the shop's large Red-tail Cat ... with appropriate welcome above!



Good — the rarely seen Amazonian Slim or Narrow Hatchetfish *Triportheus angulatus*.



The selection of marines is not only pretty extensive ... it is also very healthy, as this Clown Trigger demonstrates.



The Water Zoo's superb shop-centre aquatic plant display.



The Water Zoo's brackish selection.



Part of the impressively laid out dry goods area.



vide, free of charge, a replacement to the same value.

Clearly, this guarantee can only be given subject to the shop's 'Livestock Policy', details of which are strategically displayed outlining the conditions — all of them perfectly sensible. Then, it's just a question of filling in a claim form and that's all there is to it.

Recently, a new coldwater section, plus an outdoor pond plant and a small Koi 'department', have been added to the existing facilities, probably taking The Water Zoo as far as it can in terms of floor space available. However, while there

may not be too much more room for expansion, there can be no doubt that the commercial potential of the new space will be typically and creatively exploited to the full as the time goes on.

Livestock and dry goods are kept quite separate at The Water Zoo. In my opinion, this is the right approach to take, since it allows the dry goods area to be developed fully without having to 'make allowances' for the aquaria. The result is, as one would expect, an impeccable, tasteful and wide-ranging display that makes shopping a pleasure.

If I lived anywhere near Peterborough, I would have a problem: I would spend so much time in these delightful premises that I'd never get my editing and writing done!

Opening Hours:

Monday to Thursday — 10.30 am to 6 pm; Friday — 10.30 am to 7 pm; Saturday — 9 am to 6 pm; Sunday — 10.30 am, to 5 pm.

For further details, contact Roy Scott, Jason Scott or Brian Tate at The Water Zoo, Peterborough Aquatic Centre, 439 Lincoln Road, Peterborough PE1 2PE. Tel: 0733 312142; Fax: 0733 897935.

WATERGARDENING FOR ALL

Are you thinking of taking up watergardening? If so, *A & P* editor **John Dawes** offers some words of encouragement.

Photographs — unless otherwise indicated — by the author.



My main pond. I call it an exercise in 'controlled' informality. My wildlife pond, by contrast, is much more informal than this.

"Aqua, cuna vitae": Water, the cradle of life. What a wonderfully appropriate description for this magical compound — one, in fact, that is so universally applicable that we adopted it as the *A & P* logo many years ago. Water is, indeed, an amazing substance. It covers most of our planet, comes in numerous guises and has a truly remarkable range of properties.

For example, it can dissolve anything, even seemingly impervious rocks and such apparently 'undissolvable' materials as glass. Water is everywhere — it even accounts for 70% of our body weight. It gives life... but it can also kill (we need to look no further than our polluted rivers and seas, or the acid rain we create, for spectacular, disturbing evidence of this).

We know a great deal about water. Equally, there's a great deal still to be learned. One thing we do know is that our lives are inextricably linked to, and dependent on, it. Perhaps this is why so many of us are driven to spend so much of our time in and around water. Perhaps, too, this is also

the reason why almost everyone finds the gentle, gurgling sounds of a babbling brook, or the refreshing spray from a fountain or cascade so relaxing.

'WATER' INVOLVEMENT

Whatever the reasons may be (and they are likely to be many), one thing is certain: more and more people are coming to appreciate the beauty and value of possessing some form of water feature, be that at home (indoors or out), or at their place of work.

Some ten to fifteen years ago, one UK home in ten was involved in aquatics, a term that embraces both aquarium and pondkeeping. By 1987, this figure had risen to around one in seven (2.8 million homes), with an undeniable underlying upward trend. Three years on, the 1987 forecasts were more than being fulfilled, with the then estimated figure of 1.5 million pounds probably running at around the 2 million mark. The most recent figures are now indicating that possibly as many as 3.5 million homes are involved in aquatics to a greater or lesser extent.

Long gone, thankfully, are the days when a garden pond was almost synonymous with a round or square hole stuck in the middle of a lawn or patio, containing pea-green water, a solitary 'statutory' water lily and a small selection of rarely-seen goldfish lurking somewhere in the murky depths of the pea soup.

An extreme picture? Well, perhaps so if you were among the relatively few dedicated pondkeepers and watergardeners who were prepared to put in the considerable time and effort required to construct and maintain your pond properly.

CHANGED CONCEPT

The last ten years have seen a number of changes in the watergarden concept, at least, as it applies to the majority of home-owners who may have limited time and/or space.

Large, elaborate formal designs are still there, of course. In fact, if anything, their numbers have grown. Where most of the changes can be detected, however, are near the other end of the spectrum. Here, improved technology, advances in aquacultural techniques, expansion in the number



With a little effort and flair, any patio pond can be converted into a relaxing, scent-filled spectacle.



Hostas, Astilbes and conifers provide a striking background to the water lilies and submerged aquatic plants in this small corner of an 'informal' water garden.

and varieties of both fish and plants available, better fish and plant foods, revolutionary approaches to the displaying of water features — even a widening of the definition of what we mean by water gardening — have all contributed towards the increased popularity that the various water-associated, spectacular forms of horticulture are currently enjoying.

Take the term 'watergardening' itself. It means different things to different people. For instance, to many, it means precisely 'gardening with water'. Those who adhere to this definition will therefore only consider a particular water feature as representative of watergardening if it is done on a comparable scale to 'normal' gardening.

Many others (a growing number), though, tend to look at the term along the same lines as they regard window boxes, or patio, or tub, or trough gardens . . . or any other accepted form of horticulture. This approach has been particularly evident in recent years with the increased availability of small attractive features, such as tub ponds and pebble fountains. As a result, anyone and everyone can now enjoy 'new-concept' watergardening in one or other of its many varied and colourful forms, whether the space available is a tiny patio or a multi-acre estate.

EQUIPMENT EXPLOSION

With the advance mentioned above, has come a veritable explosion in types, sizes and shapes of ponds, pumps, fountains and all the associated hardware and know-how. The choice facing anyone about to embark on this rewarding and pleasurable area of leisure activity today is therefore vast, and expanding every season, with systems to suit every conceivable taste and pocket.

If there is a problem at all, it's in knowing where to start or what to choose. However, help is never far. In fact, it's no further than the nearest garden centre or bookshop.

For some time now, garden centres everywhere have been expanding their aquatics sections, to the point that we are fast

approaching the stage where no such enterprise can consider itself complete without, at least, a watergardening department. Along with this expansion, has come a noticeable improvement in the standard of advice available, particularly since the setting up of specialist aquatics franchises, staffed with their own trained personnel, started gathering momentum some years ago.

This trend has also resulted in other branches of the aquatic hobby being brought to the notice of a wider public. Add to this a steady growth in the number of specialist watergarden centres up and down the country, and you can begin to see why pondkeeping, watergardening and aquarium keeping are all experiencing a very measurable surge in popularity.

CHOICES

The focal point of every water or patio garden is, of course, a pond or some other suitable alternative. If space is no problem, then the sky's the limit, as they say. If space is restricted, however, this need not mean that a water feature is out of the question. Far from it.

Virtually any non-toxic waterproof (or 'waterproofable') receptacle can be transformed into a small water feature of great beauty. Half-barrels, water butts, ceramic



Water lilies come in a dazzling array of colours and sizes to suit virtually every type of water feature, from tiny tub ponds to large lake-sized ponds.

sinks and baths — even refrigerator linings — can be, and have been, used to great effect.

The field is wide open for the keen DIY enthusiast. If you are not that way inclined, then fear not, there are some excellent commercially-produced tub and sink ponds around, as well as millstone and pebble fountains in kit form. All of these are ideal for any small corner.

The former can be planted with dwarf water lilies and other equally spectacular alternatives, while the latter will provide all the soothing qualities of moving water, but without the plant and animal life. Some models will even allow for the installation of coloured underwater lights to bring an added dimension to any patio during our all-too-rare balmy summer nights.

Turning to ponds, the choice is excellent these days. Cement, concrete, blocks, plastic, fibreglass, liners — even wood — can be used to build a pond and associated waterfalls, water courses or cascade. In the case of fibreglass and some other compounds, you don't even need to design the system yourself. It comes ready-made, leaving you to choose where and how to install it.

Concrete

Concrete and cement, for instance, can be worked into any shape. They are therefore considerably more flexible than their final stone-hard finish would indicate. Concrete and cement are also very long-lasting.

On the debit side, though, it takes a special type of expertise to work with these compounds. They are also highly toxic to aquatic plants and animals. This need not, however, be a problem, because there are highly effective sealants on sale which will provide an impermeable non-toxic coat that will allow such ponds to be safely stocked within days of construction.

Liners

Should cement/concrete/bricks/blocks not be your scene, there are always pond liners. Here, the choice is between polythene, PVC (polyvinyl chloride), nylon- or terylene-laminated PVC, or one or other of several types of butyl or rubber-modified polyethylene. All can be used to line excavations of any size or shape, but butyl is about the most durable of the lot. It is also the most expensive.

Prefabricated Ponds

Prefabricated ponds come in a range of materials, shapes, sizes . . . and prices. The three main compounds used, in order of price, are plastic, fibreglass and polyester.

In terms of durability, fibreglass and polyester can be regarded as more permanent than plastic. They also have other advantages. For example, ponds constructed from these materials can be larger and deeper than plastic ones, this last factor being a very important one in terms of winter survival of fish.

All of the above, from concrete to liners, can be worked into formal or informal

designs, so the scope is, essentially, as wide as one wants to make it.

Thematic Approaches

Once a pond has been designed and constructed or installed, pumps, filters, fountains, pond ornaments and a whole host of other ancillary equipment will help keep things on an even keel. Some ornaments are purely decorative, but many are both decorative and functional and, depending on personal taste, can bring a western, eastern, or any other, flavour to a garden, especially if the plants and other features are selected with care and a little flair.

This 'thematic' approach has been steadily gaining prominence over recent years. As a result, we now have a growing number of Japanese-looking gardens scattered over the UK, some of which are authentic down to the last detail and look as good as anything one is likely to find in Japan itself.

Another thematic approach takes the form of 'wildlife watergardening' — light years removed from the formal Koi/Japanese design, and using only native plants and animals as stock, but every bit as beautiful and creditworthy in every other respect. What's even better about these set-ups is that they provide our beleaguered amphibians and other forms of aquatic life with safe havens away from the ravages of so-called progress.

In between these two rather different approaches lie a multitude of other permutations. Every kind of watergarden — from



And then, of course, there are the fish — in this case, very friendly Koi.

the strict, majestic formal designs found in stately homes, parks and an increasing number of privately-owned gardens and patios, to the 'controlled informal' ones found in many of our public parks and private gardens, to the 'totally informal' layouts preferred by the laid-back gardener — has its own ardent army of supporters.

The great thing is that, whatever your leanings, you can put them into practice in watergardening. If you like a formal pond and surrounding garden, but prefer 'informal' fish such as Tench or Orfe, that's fine. If you like an informal-looking watergarden but would prefer to keep Koi, then

that's fine as well. If you are a bit more of a purist and feel that formal systems require 'formal' fish, then this, too, is perfectly valid.

Biological Rules

The fact is that there are no hard-and-fast rules as far as this aspect of watergardening is concerned. There are, however, very strict biological rules that must be adhered to. Disobey them, and the perfect watergarden of your fantasies will become a bit of a nightmare. Follow them, and you will undoubtedly be bitten by the water bug(!) that is currently 'biting' several million other people nationwide.

We cannot — and must not — demand from a system what it is incapable of supplying; least of all when the very survival of other living creatures is at stake. But, given a sensible approach, a willingness to seek advice and read up on the subject, a number of visits to garden centres that display complete working systems, with a wide variety of fish and plants and experts on tap... plus just a little bit of patience, there really is no reason why any patio or garden, irrespective of size or design, cannot end up as a pulsating, colourful, personal and richly rewarding 'cradle of life'. ADP

ACKNOWLEDGEMENTS

This article is based on texts published in *The Garden Centre Magazine* and the *Hampton Court International Flower Show Magazine*. We extend sincere thanks to both publications.

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Back in 1980, an aircraft engineer whose heart lay more inside the mountains than inside aircraft engines, came back to England with about 100 dead fish and 56 living ones. The fish were white and eyeless. The collector, Andy Dunsire, worked in Oman, and his hobby was caving. On a visit to the south flank of the remote Jabal Akhdar mountains (= 23°N, 57°E) he and colleagues discovered a lake of crystal water deep inside the desert mountains. There they found blind cave fish.

Considering the difficulties of transport from the cave near Al-Hamra, back to their airbase in Oman and, finally, to one of us (KEB) in London, it was miraculous that over 50 arrived in moderate to good condition.

This is the story of the survivors, of their significance, and, after 11 years, of the breeding of four of the remaining seven individuals.

CAVE SPECIES

Throughout the world, there are about 48 species of blind fish that only live underground. Not all live in lakes in caverns the size of St Paul's Cathedral, as did the subjects of the story, though. Some live only in water-bearing rocks and are not discovered until an artesian well is sunk into their sponge-like environment. Even then, many individuals are killed by their journey through the well pump to come to human notice.

Only one cave fish is well known in the hobby, that is the Blind Cave Tetra, *Arymanax mexicanus*, formerly known as *Anoptichthys jordani*. This was one of the first cave species known, and its lack of pigment and eyes was considered sufficiently significant for it to be placed in a genus of its own.

It was only many years later that, in this case, realisation dawned. The *Anoptichthys jordani* was just one expression of the many forms which the highly variable *Arymanax mexicanus* could assume in order to survive. Later research showed that the "*Anoptichthys*" could interbreed with the eyed, pigmented *Arymanax* and produce a whole range of offspring with no, reduced, one or two eyes, and all with variable degrees of body pigment.

This may seem unexciting, but it presents one hell of an evolutionary problem which may be summarised as: "What is going on?"

IMPORTANT DISCOVERIES

When all the counts and measurements necessary for the identification of the Oman fish were made on those specimens that did not survive the journey, they conformed with those of a surface living species, *Garrus barreimiae*, that also lived in Oman, but not particularly close to the blind 'white' fish locality. Keeping in mind the *Arymanax* situation, the Dunsire fishes were therefore described scientifically just as a blind, subterranean population of *Garrus barreimiae*.

All this may seem unremarkable, but it is far from being so, because two important

Omani Blind

Fish Consultant Dr Keith Banister, and Justin Bell and Michael Crumpler from Chester Zoo Aquarium, report on a challenging 'new' — and endangered species — of blind cave fish recently bred in captivity for the very first time.
Photographs by Mike Sandford



chances to understand one aspect of evolution had been offered by these Omani fish.

'Startling' Eyes

Firstly, the dead fishes were not wasted. They were examined and revealed some startling information. The very smallest fish (about 12mm — 0.47in) have a tiny, variably developed eye in the orbit. At about 24mm (0.95in) the eye vanishes and above that size, there is no sign of the eye at all.

Yet, when a fish of 36mm (1.42in) was dissected to examine the brain, there was the eye, right down at the base of the brain . . . which was exactly where it had been in the smallest fish! Therefore, it seemed the fish grew 'round the eye' and left it where it had been at about the time of hatching.

New Questions

This observation immediately posed some questions that could only be answered by the living fish, and then, only if they could be bred.

As the eyes start off in a normal position, would they remain where they should be if the fry grew up in the light? In other words, how much does the environment influence such a fundamental feature?

Meeting the Challenge

There were about 50 living fish and little chance of obtaining more. Even if it

had been possible to get more, it would have been irresponsible, as the world population is very low in number and confined to one underground lake. Taking out more is immoral.

Early Losses

To avoid one catastrophe killing off those alive, the colony was split up. One group were flown to the Steinhart Aquarium in San Francisco. They were even given a seat of their own (courtesy of British Airways) so that their carrier (KEB) would keep an eye on them during the long journey.

They arrived in good condition, were handed over, and placed in the prepared tank. Most were lost the same night as someone had forgotten to cover the tank and, being active, they jumped or wriggled out. A further colony was kept in the animal houses at one of London University's colleges. A power failure over a cold Christmas killed them all. Another colony died when they all reached sexual maturity but the trigger for them to release the eggs and sperm could not be found.

Final Gamble

With ageing and natural deaths, we were left with just seven individuals 11 years after their arrival. That seven had been kept in the fish house of an aquarist [Gina Sandford — our *Tomorrow's Aquarist* columnist, Ed] who, until she encountered *Garrus barreimiae*, had

Cave Fish



Left, adult Omani Blind Cave Fish in typical resting posture. Above, at one month the eyes are still clearly visible.

an excellent record of breeding fish.

We (the three authors) met up in February 1991 at Chester Zoo and decided on a final gamble. The aquarium there had the facilities and a remarkable breeding record, so four fish were taken up there.

Success!

In July 1991 the fish bred. There were three females and one male. A detailed record of conditions was kept and somewhere in the following information are the vital triggers (as yet, unknown) needed to breed these cave fish.

12 June. The fish arrived and were placed in a 24 x 15 x 12in (60 x 38 x 30cm) tank with an Algarde Biofoam 200 with twin sponges. The tank was bare, apart from a layer of glass marbles on the bottom, except for one corner where a 2in (5cm) high glass divider left the bottom of the tank clear for feeding.

The water was from their previous tank and the same conditions were maintained: pH 7.2, temperature 68 °F (20°C) alkalinity 80 ppm, hardness 120 ppm. Within the variability of the test strips, these conditions were maintained.

21 June. Three gallons (c13.6 litres) of water were changed using well water. Before the change, the pH was 7.6, the temperature 70°F (c21°C), alkalinity 0-80

ppm. After the change, the readings were pH 7.2, alkalinity 120-180 ppm and hardness 120-150 ppm.

6 July. There was a violent thunderstorm in the morning and the fish started behaving more actively than usual. A 10% water change using cold well water reduced the temperature from 76 °F to 74 °F (c24.4-23.3°C). Two fish were actively swimming round each other in mid-water.

10 July. A power head was fitted to the Algarde filter to increase water flow.

11 July. The power head increased the water temperature to 80 °F (c26.7 °C) and the fish changed colour from their usual pink to grey. Six gallons (27.3 litres) of water were changed for well water at 54 °F (12.2 °C) and the tank temperature dropped to 73 °F (c22.8 °C).

13 July. 8.04 am. The fish started to spawn. At first, it looked like a group spawning, but it was not. Although all three females interacted with the male, only one would release eggs at any one time, even though all of the fish would dive into the marbles simultaneously. After 20 minutes the fish stopped actively spawning and were removed to protect the eggs from predation.

The fish were placed in another tank with half of the breeding tank water. They spawned again but, in the absence

of marbles, the eggs were scattered on the bottom of the tank.

To save the eggs, the fish were again removed and kept in a jug, while a third tank was prepared. They spawned in the jug!

The parents were placed in the third tank, along with just two gallons (9 litres) of the first tank's water. As the water level in Tank 3 was being slowly topped up with well water, a fourth spawning occurred.

These eggs were left with the parents and had been eaten by the following day. The eggs were surprisingly large, some 2.5mm (c0.1in) in diameter.

The eggs were placed in two tanks topped up with warmed well water. As part of the experiment, one tank was blacked out completely (to imitate the cave conditions), while the other was kept in non-direct daylight.

14 July. Egg fertility was 100% and, after only 24 hours, there were full-formed embryos moving inside each egg. By 2.30 pm that day two types of embryos could be distinguished, those with a white body and those with a translucent body.

15 July. The first-hatched fry were seen in the tank exposed to light.

16 July. About half the eggs had hatched. Those in the daylight tank swam in the water column for 20-30 seconds and then rested. Those in the blacked-out tank rested more and swam for shorter periods.

17 July. Practically all the eggs had hatched and the older fry had lost their yolk sacs. Both tanks of fry were fed with Tetra fry food and finely screened, freshwater rotifers.

19 July. To avoid any risk of introducing parasites from the rotifers, that part of the diet was changed to marine rotifers, well-rinsed in freshwater.

The fry in the daylight tank spent most of their time on the bottom and only swam when food was introduced. Those in the blacked-out tank swam more actively until the covers were removed for feeding, when they shunned light by swimming into the marbles.

20 July. It is already noticed that the eyes are not as conspicuous as when the fry first hatched.

22 July. The fish now took *Artemia nauplii* (brine shrimp 'larvae') easily. There had been no mortalities.

The vital trigger to induce spawning could have been the thunderstorm, the water temperature change, or both. Not one of these criteria was present when a previous subcolony died after being unable to shed their eggs and sperm. What matters is that they have been bred.

NEXT STAGES

As the fish grew, it became necessary to split up the colonies. In so doing, we found there were about 600 young, which, for all we know, is equal to the world population. There are now six substations in different towns where carers are maintaining the fish

in the appropriate light or dark conditions.

The scientific study of the brain changes and the eye disappearance will soon start when the fish have grown enough to be able to demonstrate clearly the changes and, hopefully, find the reasons for them. But we

are also planning something equally exciting. We intend to return 200-300 back to their cave in the Jabal Akhdar to maintain the wild stock, and remove about 20 to maintain genetic breadth in the captive population.

At the time of writing, logistical information has come in from Oman about the state of the cave, the finding of likely new areas for colonisation and the setting up of the structure for their return if the signs are good for a fruitful venture. MAP

POSTSCRIPT

About a month has elapsed since the body of this article was written and two events have occurred in that time that are, (at our editor's insistence), included to update the story.

The first event is that the environmental adviser to the Sultan of Oman has been advised by his adviser (every word of this is true!) that the augmentation of the wild stocks is not a good idea. The arguments used in his letter struck me as extremely unconvincing and a vigorous response has followed.

It seems they were unaware of other caves in the region that my sources opine could support the fishes, so that we would actually be extending their range, which would increase the chances of the species' survival. However, a colleague of the adviser to the adviser would like the sample I was planning to return for research purposes. Maybe an ecological versus an experimental trade-off can be arranged.

The second even is even less explicable, but has the advantage of being biological, rather than anything else. The keepers of

two of the subcolonies report that two distinct 'forms' or 'morphs' are developing as the fish grow.

The fishes are now between $\frac{1}{2}$ and $1\frac{1}{4}$ inches (1.9-3.2cm) long, which is still too small for the serious investigation of the non-development of the eyes. But they are developing totally unexpected colour differences.

The original sample brought back in 1980 were all uniformly pigmentless; only the red blood showing through the tissues, especially those of the gill region, providing any hue. But the video film of the fish *in situ* in their cave showed two forms. One form was clearly that of those now housed in the UK, but the other seemed larger, moved more actively and was pale brown in colour.

My original thought was that there had been two species in the cave. Two co-habiting species of cave fish is not unknown. They have been recorded from Yardee Creek Wells, Northwest Australia; the Zagros mountains, Iran; water below

Haditha, Iraq, as well as there being the likelihood of joint occupation of other aquifers.

The two forms were pointed out to one of the collectors who promised to have another collecting trip. Although subsequent small samples of the fishes, dead, were received, there was still apparently only one, uniform species.

Yet now, two of our colonies show the formation of the two types seen in the wild. We know that all our babies had just one father and three identical mothers, and that each of these colonies has received exactly the same treatment. As each colony occupies one tank, it could hardly have been otherwise.

So we have another mystery, hitherto unconsidered, to deal with. Or, was there a hint of some unorthodox biology as far back as July 14? On that day it was noted "... two types of embryos could be distinguished, those with a white body and those with a translucent body". We have the observations and the questions but, as yet, no answers. ...



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Herpetology matters

By Julian Sims



STAR GAZY POND

In a recent letter, Terry Egan from Wembury, Devon drew attention to the extra-amorous behaviour of male Common Frogs (*Rana temporaria*) in the spring of this year. Terry described how the male frogs in his garden ponds kept their heads above water, on the lookout for females. These protruding heads with glinting eyes reminded him of a "star gazy pie" — fish heads sticking out of the potato crust of a fish pie.

Once a female frog had been found, she was paired with in a spawning embrace called amplexus. Unfortunately, as waiting male frogs outnumbered visiting females, some males paired with unsuitable partners. For example, Terry described instances of male frogs grasping goldfish, the feet of the frogs being pushed into the eye sockets of the fish.

However, such frenzied examples of amplexus by male Common Frogs are not that unusual. In the April 1990 edition of *Herpetology Matters*, I drew attention to the problems which can occur if Common Frogs and Common Toads (*Bufo bufo*) breed in the same pond. Common Frogs usually spawn a month or two earlier than Common Toads but some male frogs might still be at the water's edge when female toads start to arrive. Common Toads tend to reach their spawning sites in late March or early April and male frogs can pair with the first female toads to arrive.

Male Common Frogs tend to be larger than male Common Toads and this difference in size can prove fatal for female toads. Male frogs can actually drown female toads during a 'mistaken' pairing. Even after the female is dead, the male frog will continue to cling to her body.

Although Terry Egan found many examples of mistaken identity, enough successful pairings took place to allow him to remove 16 full buckets of fertile frog spawn from his ponds and supply a local wildlife reserve. An excellent example of practical amphibian conservation!

POISON-ARROW BOOK

Blandford Press, part of the Cassell publishing group, has established a good reputation for producing informative, reasonably priced books on many different aspects of herpetology. Past publications include books about snakes and lizards by Chris Mattison, and turtles and crocodiles by David Alderton.

The latest book to be published in the Blandford series is entitled *Poison-Arrow Frogs — Their Natural History and Care in Captivity* by Ralph Heselhaus (ISBN 0-7137-2257-6). Originally published in Stuttgart, Germany, in 1988, the English language version has only become available this year.

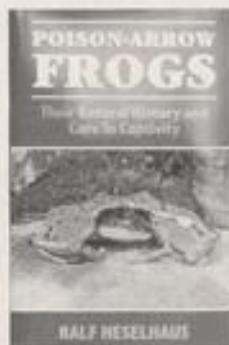
This 112-page edition contains a Preface, followed by a brief note about the classification of amphibians in general, and Poison-arrow Frogs, in particular. These introductory pages precede twelve chapters of varying length, a three-page Bibliography of mainly German publications and an Index.

The first three chapters describe the geographical regions and habitats colonised by Poison-arrow Frogs. The author recalls many first-hand observations made on his expeditions to Panama and French Guiana.

Chapter 4 entitled 'Fear-somely Poisonous', cites examples of how Indians from different parts of South America have used the skin secretions produced by this

group of amphibians. Owing to the strength of the batrachotoxins secreted by *Phylllobates aurotaenia*, *P. bicolor* and, especially, *P. terribilis*, Ralf Heselhaus suggests that these three species should not be maintained in captivity. These batrachotoxins irreversibly block nerve pathways. If sufficient toxin enters the bloodstream of mammals, death results through muscular and respiratory paralysis.

Chapter 5 gives examples of the territorial behaviour of different Poison-arrow Frogs, while Chapters 6 and 7 describe some of the survival strategies used by these amphibians. Strategies include the bright coloration of some species which warn potential predators of their toxicity. Survival also depends on successful reproduction. For example, males of some species guard the eggs until the tadpoles emerge. These larval frogs are then transported to a body of water where they complete their development.



Chapter 8 is devoted to the care of Poison-arrow Frogs in the terrarium and includes helpful information on the selection of suitable species of plants to create a favourable environment, breeding insects for food and the prevention of infection and disease.

Chapters 9, 10 and 11 carefully describe individual species of the three genera *Dendrobates*, *Phylllobates* and *Colo-*

athus. Details given for each species listed include a description of body size and coloration, geographical distribution and care in the terrarium (temperature, food, etc). When additional information is available, notes on behaviour and breeding are also given.

The text is beautifully supported by 62 colour photographs — mainly of adult Poison-arrow Frogs. These photographs are particularly helpful in the positive identification of different species.

Once again, Blandford have published a useful guide to a specific and very interesting area of herpetology. However, at £18.99 for 112 pages, this latest book does not represent quite such good value as some of the other, longer publications in this series.

HERPETOLOGY IN THE CHILTERN

Herpetologists living to the north and west of London might be particularly interested in the activities of the Thames & Chiltern Herpetological Group, this Group, which was formed in 1979, holds regular meetings on the first Friday of every month in the Barn Hall Community Centre, Amersham. Meetings commence at 8 pm and include illustrated talks by guest speakers, followed by the opportunity for discussion and further exchange of information.

In addition to the regular monthly meetings, the Thames & Chiltern organises field trips and an annual herpetological exhibition. This year's exhibition will take place on Saturday, 11 July, 10.30 am to 5 pm, at West Herts College, Watford. Members and non-members are all most welcome to attend.

The Thames & Chiltern also publish a regular (magazine-style) monthly newsletter. Further information about this Group, including membership details (adult, family and junior) can be obtained from:

Ken Whalley,
T & C Herpetological
Group,
c/o 11 Watling Street,
St Albans,
Herts, AL1 2PY.

Central American Guardians

Nathan Blackwell examines some examples of unexpected, and most unusual, protective behaviour in cichlids

Photographs — unless otherwise indicated — by Max Gibbs, the Goldfish Bowl, Oxford



Convict Cichlid. In my 'break-up' example, my male had his aggression curbed by a protective Jack Dempsey.

The human species is noted for its gregarious nature — which means that we enjoy (tolerate?) the company of others of our species. By no means are we the only species that show this trait, however. You only have to look at the great plains of Africa, or a coral reef, to realise this. But why do some animals show this trait when it can be proven that it is sometimes an advantage to be alone?

The pros and cons of gregariousness obviously depends on the type in question, whether it be the tolerance of members of your species, or of members of a different species. The former can be symbolised by any symbiotic relationship in nature (e.g. Clownfish and anemone — to use an appropriate example). However, it appears that some animals haven't quite figured out what individual status would be best for themselves.

This article concentrates on my observations of a group of animals whose behaviour has gone against the grain. The animals in question are those that I specialise in — Central American cichlids.

Two of the reasons that I had for starting to keep them are that they are aggressive, and that they have unusual behaviour. I found the high level of intelligence that they possess appealing, and my fish never cease to amaze me with regards to actions and habits. Virtually every piece of literature that I read before I started tagged them as large, aggressive monsters (or words to that effect),

but, hopefully, this piece of literature will show a new side to their character.

C.A. COMMUNITIES

It would be fair to say that the word gregariousness has no place in the C.A. (Central American) cichlid dictionary. They only generally tolerate each other's company at breeding time, and even that can lead to violence if things don't go right. Yet people still keep them, despite the fact that it is somewhat expensive to house them in separate tanks. Very large tanks are needed for communities, and there are very few combinations of species that will live together anyway. But there is one way to solve this using small tanks: keep juveniles.

On several occasions I have kept communities of C.A. cichlids in tanks. While the fish are juveniles, they have little need for territories, so they tolerate the company of others with a small amount of fighting (which you would expect anyway). As long as you provide enough hiding spaces for those who end up down the pecking order, the community will exist for as long as the fish tolerate each other. As soon as a fish gets too big (or too dominant), it is time either to transfer it to another tank, or sell it. The only problem with this is that you have to be prepared in advance for these events.

The first community of cichlids that I kept housed some of the most aggressive C.A. cichlids in existence — Convicts (*Cichlasoma nigrofasciatum*) and Jack Demp-

seys (*C. octofasciatum*). Both are noted for their habit of taking on fish larger than themselves, but the anti-social nature of their adulthood can be ignored when juvenile by the fact that they are both attractive fish. They are not the most attractive — that position is held by the Nicaragua Cichlid (*C. nicaraguense*) — but Convicts, Dempseys and Nicaraguas in the same tank provide a visually aesthetic community.

BREAK-UP

My community consisted of one male Jack Dempsey, one breeding pair of Convicts, one male Convict and two Nicaragua Cichlids. They all lived in a 30 x 15 x 12in (45 x 38 x 30cm) aquarium with undergravel filters and appropriate lighting and temperature. There was very little fighting, and I took pride in the fact that my theory had worked. Still, the day came when it became obvious that it was a bit crowded (the addition of another Nicaragua had probably helped this), so I decided to remove some of the fish.

First to go was the breeding pair of Convicts. They were transferred to another tank (in which they quickly settled down and continued to breed), and the two original Nicaragua Cichlids were moved to a larger tank. This left the Jack Dempsey, the spare male Convict, and a small female Nicaragua Cichlid together. Things went fine for a few months — until the Convict started to be aggressive towards the Nicaragua Cichlid. It wasn't actually aggression but continual harassment. The Convict would chase the Nicaragua around the tank, sometimes taking small bites from her fins.

At this point, I was setting up another tank so that I could remove the Convict, but the Jack Dempsey saved me the trouble. J.D. (as I called him — not too hot on originality, am I?) would regularly chase the Convict away from the Nicaragua, but would never show any aggression towards the Nicaragua herself. This continued until I had the chance to remove both the Nicaragua Cichlid and the Convict from the tank. J.D. put on a growth spurt, and ended up as the 10in (25cm) monster he was destined to be.

This protective nature from a species that would sooner eat another than defend it came as a surprise to me, but it was by no means the only strange piece of behaviour that I have observed from my fish.



A J.D. (Jack Dempsey) . . . protector of my Nicaraguan Cichlid female.

UNUSUAL GUARDING BEHAVIOUR

My breeding pair of Nicaragua Cichlids had been transferred to a 36 x 15 x 12in (90 x 38 x 30cm) tank, and they were joined by my other Nicaragua when the problems arose that I have just outlined. Nicaragua Cichlids are, by nature, peaceful fish and my trio, lived together with no problems at all. The largest was a mature male, and the other two were females. They all had their adult markings, and I was delighted when I observed the small female digging various pits at the rocky end of the tank. As every good fishkeeper should, I had read about the fish before I bought them, and when I noticed the female trying to keep the male up her end of the tank I, obviously, had my hopes set on them breeding.

The next day, I looked in the tank and saw the male in his territory, standing guard over some 300 eggs that were littered over the gravel. The females were both in hiding, and from the look of their fins, it was obvious that there had been some fighting during the night.

What I had learned from the books bore no resemblance to what I had in front of me. Here was the male taking sole charge of the eggs that were laid on a pile of gravel in the back of a plant-pot. My books had told me that the eggs are laid in a pit (dug in the gravel) and are defended by both parents. I just dismissed it as lack of experience on the Nicaraguans' behalf, and thought nothing of it.

Some of the eggs were infertile (white) — it was expected, as first spawns very rarely turn out a 100% hatching rate. However, the next morning I turned the tank lights on and the eggs were nowhere to be seen. The male was in his flower pot, and the females were still hiding. Then the male turned around in his pot and spat out the remaining eggs into the gravel pile. It started me thinking about what I had read on the possibility of Nicaraguans becoming (or used to being) mouth-brooders. Unfortunately, I didn't get a chance to make further observations, as, by that afternoon, all of the eggs had disappeared.

Of the two females, the smaller one had suffered the most damage — and after the eggs had disappeared, the male started turning aggressive towards her. Therefore I had to move her to one of my other tanks. This tank just happened to be the one that my spare male Convict had been transferred to. Fortunately, the Convict left the Nicaragua

alone, and she recovered quickly to her former glory.

PROTECTIVE NICARAGUAN

Cichlids are well-known for their toughness, but even they are prone to the occasional attack of White Spot. After the Nicaragua had recovered, the Convict soon went down with the infection. It didn't worry me, as White Spot is so common that there are many effective treatments for it. However, nothing seemed to work and the Convict went from bad to worse. Surprisingly, the more sensitive Nicaragua remained unaffected.

The Convict spent the rest of his life at the back of the tank — not even coming out for food. He later contracted a cloudy eye and took on an emaciated look. He survived like this for several months because the Nicaragua literally nurtured him.

She stood guard, and could often be seen carrying food from the water surface down to the Convict. She would also display aggression at anyone who went past, and would viciously attack any hands that were put into the water. During this time, I was dosing the tank with treatments (abiding by the outlines on the bottles, of course), but eventually the Convict gave up and died.

What surprised me (other than the protective nature of the Nicaragua) was that she remained completely healthy during this episode, and that the Convict didn't respond to any treatment. One explanation that I have come up with is that it was genetic. The Convict could have been the result of in-breeding, and the natural immunity of the

fish had been bred out over the generations. The Nicaragua was an offspring from a wild pair, so it probably still had all of its immune system intact.

GENETIC(?) PROBLEMS

Because of my views on the way that some fish are brought into the country, I don't buy wild fish — I only buy fish that have been bred in the UK. However, that does make me susceptible to buying in-breeds. At this present moment I have two juvenile Blue Texas Cichlids (*Cichlasoma [Herichthys] carpio*). They were both from the same batch of offspring, and when I bought them, they were both perfectly healthy. Because of their nature, I housed them in separate tanks, where they both proceeded to feed and grow.

Now the male has completely changed — it refuses to eat, has an emaciated look, and its fins are all twisted and deformed at the joining at the body. Within a very short space of time, the other fish has gone the same way. They both still have all of their normal coloration, but I'm wondering if the body deformations are the result of in-breeding. Water conditions, temperature and lighting have remained constant in the tank since I have had them, so genetics is the only feasible reason that I have come up.

PROTECTIVE FIREMOUTH

Not all of my Texas Cichlids have gone his way, though. My first Tex (*C. cyanoguttatum*) — a female — was housed in a tank with a pair of Firemouths (*Cichlasoma meeki*). All three were about 2in (5cm) long, and there was very little serious fighting. Virtually all fighting was done by the two Firemouths — fights which were always won by the male.

The Tex sensibly kept her distance, until the day when she decided that she would turn dominant. The male bore the brunt of her aggressive attacks, and after several onslaughts, took to hiding behind anything he could. This didn't stop the Tex, who would routinely search the tank for him.

This time, it was the female Firemouth that showed a strange protective nature. She would stand guard over the male and would



Nicaragua Cichlid — emergent mouth brooder?

try her best to keep the Tex from the male. Unfortunately, the female Firemouth once let her guard slip, and the male was killed.

CONCLUSIONS

So here we have four examples of strange behaviour from a group of fish that would sooner kill another than defend it. It is interesting to note that the Nicaragua Cichlids have monopolised in these examples, as they appear in three of the four listed.

Territorially

First, we have J.D.'s protective nature over the female Nicaragua. He was protecting her against the male Convict, therefore the explanation that I came up with was that of territoriality.

J.D. was getting to the age where he needed a territory, and, in his tank, there was one male and one female of different species. Obviously, from J.D.'s point of view, the male offered the only threat, as females have no need for territories. Therefore, it made sense to J.D. that if either of the other fish were going to survive, it had to be the female.

Emergent Mouthbrooding?

The second example of strange behaviour was about the 'mouthbrooding' Nicaragua Cichlid. It has long been thought that *C. nicaraguensis* was (or will become) a mouthbrooding species, simply because the eggs are non-adhesive. When cichlids lay eggs, the part of the egg that will become the head of the fry has a sticky patch that adheres to the immediate substrate. This stops the egg (and resultant fry) from being washed away by water currents. This, in turn, helps the parents, as it removes the problem of having to fetch eggs and fry and returning them to the nest.

With mouthbrooders (and *C. nicaraguensis*) the eggs aren't sticky, and so the obvious place to store them is in the mouth pouch. However, the Nicaraguan Cichlid is rarely (if never) seen holding eggs in the buccal cavity for reasons other than cleaning, or releasing fry.

Although I obviously didn't watch my Nicaraguas all night, I can remember that the male didn't show the characteristic 'gobbling' motion that is associated with cleaning and releasing. There were other fish in the tank, and one of them was an *Ancistrus* catfish, so it is possible that the storing of eggs in the mouth was for protective reasons. As catfish (which enjoy eating eggs) are active at night, the eggs needed protection by something, because cichlids are very rarely active all throughout the night.

Unfortunately, I didn't get to make further observations (which I was obviously very keen on doing) as the eggs had disappeared before any further developments had taken place.

Companionship?

The third example leaves me slightly perplexed, apart from one thought which seems to get less and less feasible the more I think about it. The only thing that I came up with was that the Nicaragua Cichlid needed companionship. The reason why I say that it isn't really feasible is that both of these fish come from the same river systems in the wild, and so they would likely to be competitors for space and food.

The Nicaragua Cichlid was of first-generation descendance from wild stock, and so the natural instincts of the parents would have been passed on to it. Instincts of self preservation should have precluded any fraternisation, and there is no way that this partnership could have been symbiotic, as the Nicaragua didn't really gain anything from its labours.

Common Enemy

The final example can almost be compared to the 'fight the common enemy' situation that sometimes has to be employed for a breeding pair that insist on showing each other aggression. I say 'almost', as the Texas Cichlid wasn't exactly comparable to an unfortunate target fish. Nevertheless, the ex-fighters put their differences behind them and tried their best against the common enemy. Admittedly, the male Fire-



Firemouths — my female became very protective with regard to her mate.

mouth didn't do much to stop the Texas Cichlid, but then he wasn't really in a good (physical) condition to do so.

The female Firemouth could quite easily have let the Texas get on with attacking the male, but maybe she 'thought' of what could have happened to herself if the Texas had disposed of the male, and then found that she was also a threat to the Texas' dominance. If the Texas had won over the male, she would have easily defeated the less aggressive female. [However, fish are not known to 'think' like this. Ed]

Central American Cichlids are well-known for their aggressive nature, and, indeed, it is probably one of the main reasons why people keep them. Yet here we have examples which go against the grain of cichlid behaviour — the grain which states that all other cichlids are a 'threat', and are therefore not worth helping in any way.

All of these examples have been observed in captivity, but it may be possible that similar situations occur in the wild. One such situation that has been observed in the wild involved a symbiotic relationship, and it is interesting to note that this example, yet again, involves the Nicaragua Cichlid. *C. nicaraguensis* inhabits the same waterways that *C. doei* (Wolf Cichlid) and *Neotrophus nematopus* (Pygmy Green-eyed Cichlid) use for feeding and breeding.

The density of *Neotrophus* prevents the *nicaraguensis* population from finding spawning sites. This may lead to frustrated males teaming up with *C. doei* pairs and helping with the defences of their fry. This ensures that more Wolf Cichlids survive, which later go on to feed on *Neotrophus*. Therefore, the *Neotrophus* population is kept low, and the *C. nicaraguensis* gain by being able to find spawning sites.

Such behaviour, to me, shows a great intelligence, and the behaviour displayed in the four previous examples show that we might have to adjust our impressions on this family of fish. They never cease to surprise or amaze, and it might just be that they never cease to adapt to situations that concern them too.



My Texas Cichlid female decided to turn dominant . . . at the expense of my Firemouth male.

Seaview

By Gordon Kay

You will recall that the last Seaview saw me begin on the rather involved subject of stocking the marine aquarium. This month sees a continuation of that very topic, with my apologies to all those who have read it all until they are blue in the face. I have to assume that you read last month's issue, otherwise the whole of this page will be wasted. If you didn't — why not?!!

COMPATIBILITY

The aquarist has — all things we covered last time being taken into account — just one major factor to consider when choosing fishes for an aquarium: their behavioural idiosyncrasies. For example, are they compatible with everything already in, or planned for, the tank?

Dinners v Diners

Firstly, is the fish likely to eat anything else? For example, Groupers, Snappers, Lionfishes and other predators will have no compunction in gobbling up anything small enough for them to swallow. Housing predators with things like Damselfishes or Gobies (or, for that matter, even smaller Butterflies and Angels) is as stupid as keeping Guppies with Oscars.

Lots of invertebrates are also efficient fish eaters. Anemones, Mantis Shrimps and many species of crab — and there are others (!) — should not be kept with tiny fish species.

Foraging on sessile invertebrates such as corals, sponges and tubeworms may not be such a spectacular example of predation as gulping down a fish, but it is still predation nonetheless. Butterfly species, Angelfishes, most Wrasses and Triggerfishes all rely to some degree on this type of food in the wild, so we cannot expect them to act any differently just because we transfer them to a glass box!

Many invertebrates — especially gastropods and echinoderms — also pose a serious health hazard to many of the other invertebrates which are commonly sold to aquarists. Confused? The only answer is to do your homework on every

animal you buy and then keep dinners and diners apart.

Territoriality

A phenomenon which also plays a significant part in limiting the compatibility of coral fishes is territoriality.

There are two basic types of territory which will manifest themselves in the aquarium. First a species with any specialised (even sometimes remotely so) dietary requirement, will violently repel from its patch of reef any species which it perceives as a threat to its supply of food. All algae-grazing damselfishes, most invertebrate eaters and even Cleaner Wrasses defend such territories in nature.

These territories can be huge in comparison to the size of their defenders and, as I said, the aquarium will do nothing to curb these tendencies. Therefore, no more than a single individual (or, now and again, a single pair) of any species which is prone to such behaviour should be kept in the aquarium. One could, of course, get away with it if one could afford a 'humongous' aquarium! (This is 'Gordonspeak' for 'gigantic' Ed).

There are also many species which, in the wild, shoal in huge numbers but which will just not tolerate another member of the same species in the aquarium. For instance, *Acanthurus leucosternon*, the Powder Blue Surgeon, congregates in wonderful, massive schools on the reef, yet will kill another Powder Blue in captivity. I don't even begin to understand why, so just read and learn which species fall into this category.

Defence

Another form of aggressive behaviour stems from the defence of nest sites. Many species are pelagic spawners which, as such, release eggs and sperm into the water column, to take their chances in the plankton. However, for every one of these species, there is another which clears a nest site and lays eggs upon it, which are then guarded and cared for with great enthusiasm.

These species are known as

benitic spawners and include the Clownfishes and Damselfishes, among others. These benitic spawners will protect the nest site, the eggs and finally, the resultant fry; very aggressively. Of course, such species are only a problem during their breeding times and do not normally pose a threat to anything else.

All of this may seem to set extremely harsh conditions upon the selection of a compatible community of coral fishes. Yet, you should still be able to fill your aquarium several times over with compatible species, to provide an interesting and aesthetically pleasing community.

'Shelterers'

We should also consider those species which defend a small core territory that contains a shelter into which they can retreat at night, or when danger threatens.

These species will range over relatively large areas away from this shelter, in order to feed, but chase away potential usurpers from immediately around it. They will, however, ignore them when away from the vicinity of the shelter. Such species include Grammas, Dottybacks, many Wrasses and virtually all Gobies and Blennies. These species are much more easily managed in the aquarium, because increasing the number of shelters available usually goes a long way towards minimising aggression.

'Non-territorials'

It must also be noted that many coral fishes are not at all territorial in nature. For instance, Lionfishes of the genus *Pterois* are totally indifferent to the proximity of fishes of the same species. Others, like the Cardinalfishes and plankton-feeding Damselfishes, are very social and do best in the company of their own kind.

Odds and Evens

One tip here: I don't understand why, but it is my experience that a small group of, say, *Chromis* (although it could be any species, for the same applies to freshwater as well as seawater

species) of an even number, will fight and generally pick on the smallest, weakest number until it is dead. They then go on to do the same to the next member and so on, until there is only one, or maybe to, left.

However, a group of an odd number — say, five, for instance — always seems to do well.

Please don't ask me why this should be so. People of far greater experience than I have never been able to give me a satisfactory answer. I just know that I have kept many fishes of all types over my 32 years (good God!) in the hobby and it always happens this way.

Exceptions

I daresay that you could pick out any one — or all! — of the points I have made here and say that you have seen such and such species housed with this or that, many times at your dealer's shop. I suppose that there are those of you who would write and tell me that you have gone against what I have said here and it has worked.

Well, firstly, the animals in your dealer's tanks have, very recently, been through a heck of a lot. Some great monster has taken them from the relative security of their home, they have been bagged and sent on an aeroplane halfway across the world, they have been held at a wholesaler's for a couple of weeks (and possibly had chemicals administered to cure some type of malaise) and then dumped into yet another strange environment which is devoid of the type of rock formations and hiding places to which they are accustomed!

How would you feel? Their fins haven't touched the ground! They may therefore be completely disorientated and have never had the opportunity to establish territories and lead a normal life.

As for the second point, what I say in articles such as this only represents a probability guide to a species' behaviour, based on my own and others' experiences over the years. All individual fishes are as different as individual humans. Oh, and they tend not to read articles like this...!

See you next time.

Focus on: *Plants* Growing Tips

By Barry R James



ARRIVALS

As I write this, the weather outside is splendid and all aquatic plants are springing into growth. The Koi in my big pool are spawning furiously on the Blanketweed on the edges.



Rumex hydrolapathum variety *sanguineus* must be this season's top arrival — introduced by Anglo Aquarium Plant Co. Ltd.

The water is almost opaque with milt. However, in spite of the tremendous forces unleashed, the water lilies remain secure in their baskets, thanks to the large rocks piled around their base.

There is the normal tremendous demand for water plants. I always save my own *Mimulus* seed every year. The resultant random crosses emerge in a riot of colour, many specimens being superior to the original mixtures in the packets. I am forced to do this as the hybrids seldom survive in the Cotswolds, where I live, over winter.

We are now waiting with impatience the appearance of *Hydrocharis*, the Frogbit (which will be out by the time we go to press). These overwinter as

turions — tiny buds — which pop up from the muddy depths about May time and start to grow vigorously.

Pygmy water lilies are also late in developing, which leads to some impatience among our customers.

A really exciting plant introduced by Anglo Aquarium Plant Company Ltd this year is *Rumex hydrolapathum* variety *sanguineus*. This plant does not reach the staggering proportions of the type, but still gets to around 3ft 6in (c 105cm). The spear-shaped leaves are tough and leathery in texture and arise from a tuberous rootstock. The dark-green base colour of the lamina (leaf blade) is heightened by the blood-red veins from which the plant gets its name. This plant forms a spectacular addition for the larger pool, although supplies may be limited for a time as demand is outstripping supply.

Another plant which is causing quite a stir is the Marsh Mallow (*Malva moschata*), the roots of which are the source of the confectionery. A native plant, it is equally at home in the water or in a border. The woody stems reach a height of around 2ft (c 60 cm). The rounded leaves have a grey-felted covering on the upper surface. The rather large pink or white flowers are produced in profusion in early summer. *Malva* is a native species, but is confined to the marshes of eastern England.

The new louvre baskets are making life so much easier for customers. The ones from Trident even have little carrying handles.

SOIL v BASKETS

BBC Gardener's World are advising pondkeepers to place a layer of soil in the base of the pool before planting. They claim this ensures a quicker balance being achieved and, consequently, clear water. This may be true, but in a couple of years, when the plants have choked up the pool, water gardeners who take this advice are going to be faced with a mammoth task when giving their

pool a clean-up.

I would still maintain that all aquatics should be confined to baskets, even in 'conservation' pools.

The other thing I object to is the practice of holding down the edges of the liner with turf. In my experience, every time you mow the edges, a fair number of grass clippings end up in the water. This quickly becomes infested with thread algae and looks very unsightly. Whatever the pool, a hard edging is preferable if maintenance is to be kept to a minimum.

UPSTANDING FEATURES

I notice an upsurge of interest in small free-standing water features this year. These can take the form of water trickling over pebbles back into a central reservoir, or troughs with water circulating via an electric pump and emerging from the old traditional manually-operated well pump. These form very nice features for the patio or smaller garden.

LAYDEKERI WATER LILIES

The Layderkeri are a group of hybrid water lilies of medium growth which are very suitable for small ponds. Bred by Marliac, he probably used *Nymphaea tetragona* as one of the parents.

These lilies are very free-flowering and as many as 50 blooms can be out at the same time with a well established group of *L. layderkeri* 'Purpurata'. The leaves are not normally larger than 3in in diameter, and are a uniform shade of green.

Four varieties are commonly available in this country:

L. layderkeri 'Fulgens' has flowers of brilliant crimson, with fiery-red stamens.

L. layderkeri 'Lilacea' has very fragrant blossoms of soft-rose. These deepen with age to a bright carmine. The stamens are yellow.

L. layderkeri 'Purpurata' is the most free-flowering of the group. It is of a rosy-crimson



JOHN DAINES

N. laydekeri 'Fulgens' is a striking medium-sized lily.

shade, slightly flecked with white.

L. laydekeri 'Rosea' is perhaps the most beautiful of all the Laydekeris but is seldom available. The fragrant deep-rose blooms are perfectly cup-shaped.

NEW PLANT PRODUCTS

One of the new offerings at the Nürnberg show held recently was a new suspended lamp system from Dennerle. This incorporates a new HQI lamp from Sylvania, which contains its own integral choke/starter, making the whole unit very light in weight. They are also much cheaper than the old heavier units.

Deep tanks pose a lot of problems for plant growers; not least of these is the absorption of light. I have found a new lamp which has great penetrative properties. It gives out a pure white light from a tubular bulb and is offered in 75 and 100 watt power ratings. They should be mounted horizontally in bayonet mount batten fittings over the aquarium. I have found that around 75 watts per two square feet works well.

The only drawback to these new Halogen lamps is the heat output, so adequate ventilation must be provided.

I have also found a mains voltage undergravel heating cable which offers considerable

savings on the equivalent low-voltage models. They are available in 15, 25, 50 and 100 watts.

THE UTRICULARIAS

Commonly known as the bladderworts, the name refers to the bladders or 'utricles' with which these plants augment their food supply by trapping small aquatic organisms. There

are four genera and over 300 species. They are, however, seldom seen in aquaria, although they are not difficult to obtain by the persistent plant fanatic.

Utricularias are widely distributed from the tropics to temperate latitudes, and inhabit a wide variety of water biotopes; some are even terrestrial. Two tropical species from the Malay peninsula are sometimes imported. *Utricularia jakorensis* is

a large robust species which, at first glance, might be mistaken for a *Myriophyllum*. However, the grey-green foliage is covered in bladders. The flowers are yellow.

As the Bladderworts are rootless, they should be floated just below the surface. The plants need good light and often take on a reddish colour if this is strong enough. Generous feeding is necessary and a temperature of 75-82°F (24-28°C) is the optimum. Increase by cuttings of the side shoots.

Utricularia gibba also hails from Malaysia but is found in Africa, Australia and throughout SE Asia as well. It forms a dense mat of pale-green threads and is often imported attached to other plants. The flowers in this species are also yellow. In all other respects, it is treated in the same way as the other species mentioned.

Utricularia vulgaris (the Common Bladderwort), is a native species which is very common in the waterways and ditches in SE England. Clusters of yellow flowers are produced in spring and stand several inches out of the water. It is often used in biology classes where the actions of the bladders entrapping small crustaceans is quite fascinating. Life expectancy under aquarium conditions is limited to around six months. This plant hibernates in the mud on the bottom.



Bladderworts (e.g. *Utricularia*) are 'unusual' feeders.

IAN HEY

Focus on: *Plants* My favourite: *Plant*

A & P editor John Dawes thought his favourite aquatic plant was the Water Lettuce . . . until he came across a very special *Cryptocoryne* in the heart of a Malaysian rubber plantation.

Photographs — unless otherwise indicated — by the author.



My first encounter with *Cryptocoryne schulzei*. The expression says: For goodness sake, Simon, take the picture . . . these mosquitoes are eating me alive!



The original *C. schulzei* habitat — the thicket in the background, just beyond the rubber trees.

June 1986 was a hot, humid month, even by Singaporean/Malaysian standards. At least, that's what I keep telling myself. But then again, perhaps it was just 'typically' warm. After all, when you are not used to intense tropical heat on a daily basis, your senses play funny tricks on you. Why else would the mosquitoes that found me so appetising as I peered down at the delightful plant below me in the middle of the Malaysian rubber plantation, look, sound and feel like vultures?!!

That's what happened during my very first encounter with the exceptional plant that has become my strong and unrivalled favourite. It's not spectacular, and it's not popular. It's not even prettier than any other *Cryptocoryne* . . . but it is extremely rare, and very special indeed. Its name: *Cryptocoryne schulzei*.

ENDANGERED SURPRISE

I had visited Singapore that June to go round the fish farms, take a look at the fish and plant industry and generally spend a thoroughly enjoyable and educational fortnight in this ornamental aquatic 'metropolis'.

I had been in touch with my friend, Lim Kim Kiat of South Island Aquarium, well in advance of my trip, so he had quite a few things lined up for me. Among these was a visit to one of his plant farms situated about an hour's drive from Johore Bahru, the southernmost city in Malaysia, accessible across the causeway that links Singapore to the Malaysian peninsula.

The day had started well, and kept getting better and better, with several stops to look at and photograph *Nepenthes* Pitcher Plants, followed by lunch at Kota Tinggi and a visit to the nearby waterfalls and pools, one of which contained large shoals of Halfbeaks (*Hemirhamphodon pogonognathus*). And this was just the 'warm-up' to what lay ahead . . . even though I didn't know it at the time.

We eventually arrived at the farm and did our 'grand tour'. As we neared the furthest corner which merged into the large neighbouring rubber plantation, Kiat told me that he had a surprise in store. He knew just how much I love plants. He also knew that I'm deeply concerned about the continued survival of all endangered species . . . so he had saved the best till last.

The small stream that fed this part of the farm emerged from a thicket of rubber trees and other assorted tropical vegetation. We followed the trickle of water up-current until it spread out into what was little more than a rust-coloured, 'oozy', mosquito-laden bog among the dense undergrowth and there, with attractively veined leaves splayed out



A solitary *C. schulzei* spathe ('flower').



The nicely-streaked underwater leaves.

on the wet mud and delicate tube-like 'flowers' (spathe) pointing upwards, was a patch of some twenty small *Cryptocoryne schulzei* plants.

Endangered species, obviously, don't 'look endangered' — they look just like any other species. Yet, the thrill that one gets in their presence is pretty unique. I remember being a little surprised — though I can't think why this should have been the case — to find that the plants looked so 'normal'. They were healthy and they were flowering. So why should they be endangered? I still don't know the answer, though I do know from a letter subsequently received from Dr Josef Bogner (who had also seen this 'patch' of the Botanic Gardens in Munich, that *C. schulzei* is recorded from only two locations, both in the State of Johore.

COMMENDABLE ATTITUDE

In total, there must have been under 100 plants, in 'our' thicket, about one in ten bearing flowers — not a lot, but enough to maintain a small supply of seeds for future generations.

I asked Kiat what, if anything, he was doing with these plants. Was he, for example, collecting and selling a limited number?

His responses to my many questions were most gratifying indeed, the plants were being left undisturbed. All that Kiat and his family and staff were doing was acting as 'guardians' to ensure the continued survival of the species. No commercial collection was either being undertaken or being considered.



Simon holds up one of the plants grown underwater after the salvage operation. Note the smaller plants which have grown from the main specimen.

In these days of hard-nosed commercialism, it gladdens one's heart to come across such a commendable approach. But then, Lim Kim Kiat is not just one of Singapore's most successful and dynamic 'aquatic' businessmen; he is also a committed, enthusiastic plant lover.

NIGGLING DOUBTS

So why did I feel uneasy when the surviving plants were in such caring hands? The answer was all around me . . . literally.

Rubber plantations have a nasty habit of ceasing to be rubber plantations now that the world demand for natural latex is minimal. None of this would have mattered, of course, in the case of *C. schulzei* . . . were it not for one vital factor: the rubber thicket/bog in question did not belong to Lim Kim Kiat. He therefore had no control over it so, if its owner wanted to demolish it, there wasn't a great deal anybody could do about it.

Then, of course, there was the worrying fact that there were so very few plants of this endangered species. What if someone poured something noxious into the water somewhere upstream? A plant that was on the very edge of its continued existence could then disappear forever in less than a few minutes. We didn't know at the time — nor do we know now — if there are even any plants at the other location, whose whereabouts we are still unaware of. The thought didn't bear thinking about.

And then it happened . . .!

DISASTER! . . . OR SO IT SEEMED

On my next visit to the farm two years later, I received the shattering news that the owner of the '*C. schulzei* thicket' had destroyed it.



The diminutive size of the bloom of this plant (photographed in June 1989) in the marshy area set aside after the rescue attempt can be fully appreciated in this shot.

What about the plants? What had happened to them? They couldn't survive if exposed to full sunlight, even if they hadn't been physically or chemically destroyed.

I had, as it turned out, jumped to all my wild conclusions without taking account of the Lims' determination to protect the species.

Having got wind of the impending disaster, Kiat's nephew, Lim Eng Huat (Simon) had mounted a salvage operation and, with some members of his farm staff, had dug up all the plants they could find.

These were then divided into two batches. The first was planted underwater to see if they would grow and reproduce vegetatively, and the second was planted in a sheltered marshy spot. Both populations, to my huge relief (and that of the Lims) were growing well, although the plants in the marshy area were not quite as healthy-looking as the original ones in the rubber plantation bog. Still . . . they were alive, and that was the most important thing of all.

THE PRESENT

To my mind, the plants seemed safer than ever before because they were now under Simon's direct control (this has now moved to Lau King Seh [David]), with Simon taking over another farm several miles away.

Even so, the threat of something going wrong remained. Had we been dealing with an 'easy', fast-growing plant, things might have been different, but — as with most other *Cryptocoryne* species — *C. schulzei* is a relatively slow grower and not a particularly profuse 'flowerer'.

Patience, and an eye for an appropriate opportunity, would therefore have to play key roles in ensuring the long-term survival of the species.

About two years ago, an unexpected break-



Dr Patrick Loh in his tissue culture 'farm' where the first *C. schulzei* specimen was successfully cultivated.



Survival in a bottle! The first-ever plantlet of *C. schulzei* produced by Drs Patrick Loh and Joseph Kueh after a great deal of brain-searching, time, effort, patience . . . and money.

through presented an exciting possibility. Lim Kim Kiat had set up a collaborative venture with two Singaporean plant tissue culture specialists, Drs Patrick Loh and Joseph Kueh, proprietors of L K Bio-Research Singapore Pte Ltd. Within a few months, they were producing large quantities of various *Echinodorus* (Swordplant) and, significantly, *Cryptocoryne* species.

When I talked to Kiat suggesting that *C. schulzei* was an ideal candidate for tissue culture, I was not in the least bit surprised to learn that he was way ahead of me. Trials were, in fact, already underway, but progress was proving both expensive and elusive.

Last June, I visited Patrick Loh and Joseph Kueh while filming a documentary for Finnish Television and, to my huge delight, was proudly shown a single tissue-cultured *C. schulzei* plantlet. It had taken many months, but persistence had paid off. The complex problems encountered had been overcome and a successful formula had finally been developed.

That was just over a year ago, since when further progress has been made.

THE FUTURE

So what of the future? Is my favourite plant now safe for all time? I'd love to be able to say that it has, indeed, been irrevocably saved.

The immediate future seems assured enough. Both the submerged and bog-growing populations on South Island Aquarium's Malaysian farm are still doing pretty well, and the supply of tissue culture specimens is coming on.

Yet, what if some totally unforeseen disaster strikes? Are the current stocks sufficiently large to give Kiat, Patrick and Joseph a fighting chance of bringing the plant back from the brink?

We can only hope that, should such an unwelcome and unfortunate eventuality ever arise, sufficient plants will have been produced to keep the species going and, perhaps, even increase its numbers in the wild.

The one major ray of hope, though, undoubtedly lies in the fact that *C. schulzei* is being protected and nurtured by Lim Kim Kiat. As long as he, his family and staff are watching over this precious, irreplaceable, highly endangered species, it will always stand a chance.

ACKNOWLEDGEMENTS

I would like to extend my most sincere thanks to Lim Kim Kiat, Lim Yong Kwee (Yong), Lim Eng Huat (Simon) and Lau King Seh (David) — all of South Island Aquarium — for their unrivalled hospitality, assistance . . . and patience over the years.

I would also like to thank Drs Patrick Loh and Joseph Kueh of LK Bio-Research Singapore Pte Ltd for allowing me to visit their laboratories, for their willingness to discuss the '*schulzei*' problem at such length, and for allowing me to photograph the first-ever tissue-cultured specimen to arise from their concerted and complex research programme.

Paper Round

By Dr Ian Winfield



NON-FASTING MOUTHBROODERS

Although most fishes fast while mouthbrooding, a few cichlids have been seen to feed in aquaria and in their natural habitats. Yasunobu Yanagisawa of Ehime University and Haruki Ochi of Hiroshima University, Japan, have recently studied the mouthbrooding behaviour of *Cyphotilapia frontosa*, a fish of the deep waters of Lake Tanganyika.

This species produces the largest eggs of all the mouthbrooders so far examined, and, in addition, has a long mouthbrooding period of around 54 days during which time the young develop into miniature adults. Just how the female and young acquire sufficient sustenance to meet their needs during this period is of particular interest to fish biologists.

Detailed observations of behaviour in the wild revealed that brooding females actively fed in mid-water, usually in a loose shoal composed of brooding and non-brooding conspecifics. Food consumed included detritus, small crustaceans (probably shrimps), insect larvae, algae and small fish. The young of such females also had food in their guts, which could have been consumed during brief excursions, although such behaviour was never observed.

Yanagisawa and Ochi concluded that feeding while within the buccal cavity is the main way in which young *Cyphotilapia* obtain their food. The observation that females in the natural habitat take food for both themselves and their



young refutes earlier, aquarium-based observations. (Source: *Environmental Biology of Fishes* 30, 353-358.)

A RUFFE PASSAGE

The Ruffe, *Gymnocephalus cernuus*, is widely distributed in Europe and Asia, although owing to its bottom-dwelling habits and dull coloration, it is little known outside angling circles. This little percid also has no commercial importance in food fisheries and is, in fact, usually considered to be a serious pest as either a competitor for food with other more desirable species, or as a direct predator of their eggs. It is with some alarm then that this fish has recently been found to have colonised parts of North America, probably by hitching a ride in the ballast tanks of trans-Atlantic cargo ships.

Evidence of successful reproduction of Ruffe in North America has now been reported by Thomas P. Simon of the Large Rivers Larval Research Station and Joe T. Vondruska of E A Science and Technology, USA, who found large numbers of Ruffe larvae in the St Louis River in Minnesota in 1986 and

1987. In addition, numbers of juveniles were found in the same areas in 1987, indicating that the fish are also surviving through the early stages of the life cycle.

Given that a female Ruffe can produce up to 200,000 eggs, this species seems very likely to become a major feature of the local fish communities over the next few years. Study of the morphology of larval Ruffe by Simon and Vondruska has enabled them to identify such specimens among the larvae of native North American percid, so they will, at least, be able to map the spread of the new arrival.

(Source: *Canadian Journal of Zoology* 69, 436-442.)

PUMPKINSEEDS, PLANTS AND PREY CAPTURE

In recent years, fish ecologists have begun to study in detail the effects of the environment on the feeding behaviour of a range of fish. In addition to their fundamental value, such investigations also have applied use in the area of habitat restoration.

Michelle Dionne and Carol

Unlike many other mouthbrooders, 'frontosa' females can feed during the period of egg incubation.

L. Folt of Dartmouth College, USA, have been studying the effects of different plant types on the efficiency with which Pumpkinseed Sunfish, *Lepomis gibbosus*, feed on the microcrustacean *Sida crystallina* and a damselfly larva of the family Coenagrionidae.

Laboratory experiments revealed that prey capture rates were greater when the Pumpkinseeds were feeding among the cylindrical stems of *Scirpus validus* than they were when among the leafy stems of *Potamogeton amplifolius*, even though the Pumpkinseed is a very manoeuvrable fish. The nature of the plant growth form was even found to be more important than its density.

Analysis of the feeding behaviour of the Pumpkinseeds showed that the main effect of the vegetation was to reduce prey location rates, rather than to interfere with the efficiency of attacks once the prey had been found.

The differences in the feeding efficiencies of the Pumpkinseeds in the different plant 'habitats' were such that Dionne and Folt concluded that foraging rates of this centrarchid could vary signifi-

cantly within and between lakes, depending on the composition of the littoral (shore) vegetation. Plant growth form, in addition to density, therefore needs to be taken into account in lake management and restoration plans.

(Source: *Canadian Journal of Fisheries and Aquatic Sciences* 48, 123-131.)

FISH ON THE MENU AT LAKE NAKURU

Birds feeding on fish are a common sight on many lakes, but **Eero Antikainen** of the University of East Africa, Eldoret, recently observed a rather extreme example of such predation. In Lake Nakuru National Park, massive numbers of *Sarotherodon alcalicus grahami* (= *Tilapia grahami*) were seen to swim up a small brook only 0.5 to 1.5m (c 20-60in) wide where the water was 10 to 30cm (4-12in) deep.

This concentration of fish attracted the attentions of approximately 350 White and Pink-backed Pelicans (*Pelecanus onocrotalus* and *P. rufescens*), 70 Marabou Storks (*Leptoptilos crumeniferus*), 30 Yellow-billed Storks (*Ibis ibis*) and 25 Cattle Egrets (*Egretta garzetta*), which together packed the brook for a length of 150m.

This species of *Sarotherodon*, which was introduced from Lake Magadi in the early 1960s, flourishes in the clear margins of Lake Nakuru. Antikainen suggests that recent high water in the lake enticed the fish to go up the brook where they were exposed to the hordes of predators.

(Source: *Bulletin of the East African Natural History Society* 20, 55-56.)

LONG DISTANCE SOUTH AMERICAN CATFISH MIGRATIONS

Interest in the breeding of some of the larger South American catfishes is high at the moment, and a recent paper by **Ronaldo B Barthem** of the Museu Paraense Emilio Goeldi, and **Mauro C L de Brito Ribeiro** and **Miguel Petreire** of the Reserva Ecologica do IBGE in Brazil contains some information of potential relevance.

Long distance migrations of South American characins are now well known, but these researchers have produced evidence that similar movements are carried out by the catfishes *Brachyplatystoma filamentosum*, *B. flavescens*, *B. caillanti*, *Goniistius platynema* and *Lithodora dorsalis*.

Extensive sampling and interviews with fishermen along the length of the Amazon point to the conclusion that these catfishes spawn in the headstreams of the river, after which their eggs and larvae begin a long passive journey down the Amazon to its estuary, which forms their main nursery area when they are about 20mm (c 0.8in) in length. The strong flow of the Amazon during the high-water season, around 11 km/hr (6.8 mph), could carry the young catfish on their epic journey in just 13 days.

(Source: *Biological Conservation* 55, 339-345.)

FLORIDA BASS NETS REVEALED BY RADIO

The Largemouth Bass, *Micropterus salmoides*, is an important sportfish in North

America, where considerable effort is spent developing appropriate management strategies. This widespread centrarchid constructs nests in a variety of areas, typically in 0.3 to 1.3m (c 12-50in) of water on firm substrates such as sand, gravel or clay, although plants are also sometimes used.

Nicholas A Bruno, **Richard W Gregory** and **Harold L Schramm** of the University of Florida have investigated the nest sites used by the Florida Largemouth Bass, *M. salmoides floridanus*, in lakes typical of Florida which have soft, organic bottoms composed of decaying plant material. Despite the scarcity of firm substrate, the native bass populations manage to reproduce successfully.

To find out the kinds of sites used in such lakes, male bass were radio-tracked to their nests over two spawning seasons, during which time 20 nests were found and examined. Spatterdock, *Nuphar luteum*, was the substrate for 13 nests, while the emergent grasses *Paspalum geminatum* and *Panicum hemitomon* housed five nests, and the remaining two nests were found in Smartweed, *Polygonum hydropiperoides*. No nests were found in the open water, even though it made up 64% of the available habitat.

The results of this study are clearly of great use in the design of plans for lake management of bass fisheries. They also reveal the vulnerability of Florida Bass populations to the application of herbicides during the spawning season. One bass was actually seen to abandon a nest of Spatterdock following herbicide application for Water Hyacinth control.

(Source: *North American Journal of Fisheries Management* 10, 80-84.)

FISH PREDATION BY INVERTEBRATES

Many pondkeepers are concerned about losses of fish eggs to invertebrate predators. A study by **Mark Diamond** of the University of Liverpool has demonstrated just how significant such predation can be in natural fish populations such as those of Roach, *Rutilus rutilus*. Such studies are very difficult because the invertebrate predators usually destroy each egg as it is consumed, making visual examination of their gut contents very uninformative.

However, by using a serological technique, Diamond was able to determine which species of invertebrates were significant predators of eggs on a Roach spawning ground in the Leeds and Liverpool Canal. Invertebrates were calculated to consume between 15 and 43% of the Roach eggs, with most of this predation coming from a caddisfly larva, *Achripodes aterimus*, and the Pond Slater, *Asellus aquaticus*.

Further studies on the Roach population of The Lake, Wynn-stay Park, Rusbon, showed that even newly-hatched Roach were consumed in significant numbers by the Backswimmer, *Notonecta glauca*, and a damselfly larva (Zygoptera). Up to 99% of the initial population was eaten by invertebrates during the first month of the lives of the young fish.

(Source: *Proceedings of the 4th British Freshwater Fisheries Conference, University of Liverpool*, pp 135-144.)

Diary dates

Sunday 5 July

North West Cichlid Group: The second annual Open Show of this BCA-affiliated Group will be held at Skelmersdale Labour Club. Judging to FNAS Standards. Details from the Show Secretary, **Ronnie Lewis**, 178 Carfield, Claybrow, Skelmersdale. Tel: 0695 28971.

Blyth Aquarium Society: 8th Open Show. Schedules and

full details from **G P Hunt**, Show Secretary, 12 Tyne Street, Ashington, Northumberland NE63 9HX. Tel: 0670 817158.

Sunday 12 July

T.V. Cats: 4th Open Show to be held at Amersham Community Centre, Amersham, Bucks. Contact **Chris Ralph**, 610 Abbey Road, Popley 4, Basingstoke, Hants RG24 9ET.

Sunday 19 July

Sandgrounders Aquatic Society: The 22nd Annual Open Show of S.A.S. (affiliated to the FNAS) will be held at Meols Cop School, Meols Cop Road, Southport. Further information from **R K Williams**, Show Secretary, 88 Cobden Road, Southport, Merseyside PR9 7TJ. Tel: 0704 505601.

Sunday 9 August

Deal and District A.S.: Open Show to be held at the T.A. Centre, Middle Deal Road, Deal. Details from **Avis Hayward**, Secretary, 53 West Lea, Deal, Kent. Tel: 0304 381721.

FOR DETAILS OF KOI SHOWS AND EVENTS SEE: KOI CALENDAR

Books

The Atlas of Garden Ponds

By: Dr Herbert R Axelrod, Albert Spalding Benoist and Dennis Kelsey-Wood

Published by: T.F.H. Publications, Inc
ISBN: 0 86622 343 6
Price: £35

Big, beautiful, and with a cover price of £35, *The Atlas of Garden Ponds* is destined to fill a niche which has probably not yet been fully catered for in the pond/water gardening sections of the hobby.

Some of the pictures are absolutely superb, many not having been seen before in English-language publications dealing with this still-expanding branch of aquatics. It also seems that virtually any subject you care to think about is given at least some coverage. The following are only the main chapter headings so, by the time you add all the sub-sections, you'll have a pretty good idea of what I mean.

Introduction, Initial Considerations, Pond Materials, Pond Budgeting, Installing a Pond Liner, Installing a Concrete Pond, Installing a Pre-formed Pond, Water Quality, Aeration, Filtration, Waterfalls and Fountains, Pond Decoration, Indoor and Novelty Ponds, Seasonal Pond Care, Pond Plants, Pond Animals, Fish Anatomy and Physiology, Purchasing Pond Fishes, Fish Nutrition, Pond Fish Species, Diseases of Koi and Other Cold Water Fishes (written by Dr K Murakami of the Hiroshima Fisheries Experimental Station in Japan), Recommended Reading, Photography and Art Acknowledgements, Conversion Chart, Metric/English Equivalent and, finally, Index.

Some topics, such as diseases, pond fish species, pond plants, pond decoration and a few others, receive pretty extensive coverage (in numbers of pages), while some others, e.g. fish nutrition receive at least as much attention as one would expect to find elsewhere.

I liked *The Atlas* for several reasons, not least because it includes some breathtaking photographs of large ponds which I have never seen before and because, in the fish section, it illustrates a few species that other books have never even mentioned as possible pond subjects. It's also a great book to sit down with in the evenings and allow yourself to be carried away by day-dreaming (or evening-dreaming?) of what you'd give to have a garden to accommodate some of the water schemes that grace the pages of this large colourful book.

On the debit side, I feel that the artwork (I have mentioned this before in connection with some other recent T.F.H. books) leaves quite a bit to be desired. In addition, many of the pond construction drawings have numerals instead of labels, readers being

directed to page 279 for 'conversion' of these numerals into explanatory captions. To me, this is totally uncalled for and unnecessarily complicated; far better, I would have thought, to have kept things as simple as possible and fully labelled the drawings 'in situ'.

The disease chapter, while being very competently written by Dr Murakami, is not as 'international' as it might have been. By this I mean that, for example, no mention is made of the fact that, in some countries (including the UK), antibiotics require a vet's prescription. One thing that struck a particularly negative chord in my mind was the recommendation (under the section dealing with Myxobolus Disease) that the only way to kill the spores is "to destroy the entire fish by sprinkling them with lime, burning them with a flame thrower, or boiling them". We are told to "cover the fish with lime and bury it in the ground or burn the fish [sic] as soon as you find it affected by this disease...". I think many fishkeepers would not only find it impossible to take this course of action, but they would also find it quite unacceptable.



This chapter also appears to over-emphasise Koi at the expense of other pond species, an emphasis which, I feel, also permeates other sections of the book. This tends to create the impression that these sections have perhaps been 'lifted' from elsewhere and adapted to fit *The Atlas*, rather than being specifically written for it.

On the fish front (as I've mentioned earlier), it's great to see pictures of 'new' fish... but how do I look after a *Vimba vimba*, or a *Chilogobio czerskii*... or an *Acanthorhodeus aswami*? Unfortunately, no details are provided. Also within this section, the fish depicted as a Ryukin in the top left picture on page 218 is not a Ryukin at all — it is more

of a long-finned Pearlscale, or Hamanishiki minus the two cephalic 'bubbles'. Either way, it is obviously not a "marginally acceptable" fish "for some ponds".

Overall, I think that *The Atlas of Garden Ponds* is a different-looking, very desirable book which could give many hours of pleasure to pondkeepers of every level of experience and commitment. I think it achieves a great deal... I also think it could have achieved a great deal more.

John Dawes

Pacific Coast Nudibranchs (Second Edition)

By: David W Behrens
Published by: Sea Challengers
Available from: Dr W Backhuys,*

Seashell Treasures Books,
Warmonderweg 80,
2311 k2 Oegstgeest,
The Netherlands

ISBN: 0 930118 17 0

Price: Approx 60 Dutch Guilders,
plus p & p

Like so many other right-handed people I tend to do when picking up a magazine or book for first time, I held *Pacific Coast Nudibranchs* in my right hand, and started flicking through the pages with my left hand, i.e. from the back of the book, towards the front.

The first feeling I got was one of sheer, unadulterated admiration for the photographers, since the vast majority of the 217 full-colour illustrations of these amazing molluscs (there are others of egg ribbons as well) appear to have been taken in the wild. To be able to take such outstanding pictures without the advantage of stage managing the whole event... floating and swaying in underwater currents... is no mean achievement, I can assure you.

Having got over my first positive reaction, I came across what I sensed would be the main drawback if I were to look at this book through the eyes of an aquarist, rather than of a scientist. 'Rhinophores', 'rachidian', 'aeolid', 'bulloid' and 'caryophyllidia' are only a few of the words that jumped out of the pages at me, causing me some concern. I needn't have worried. By the time I'd flicked through to the front, there they were — every one of them defined in a six-page Pictorial Glossary. What a relief!

It was now time for my second, and subsequent, more leisurely look at this profusely illustrated volume. My conclusion is that it is, in a word: magnificent.

It doesn't, of course, deal with 'aquarium' nudibranchs, though a few species might well be familiar to marinists, particularly some members of the suborder Doridacea. There are also two species of *Elysia* which may occasionally find their way into home aquaria. Other than these, the rest are very

much 'non-aquarium' types.

This, of course, is not a criticism — merely a statement of fact. There is a great deal to delight and inform, not just every serious marine aquarist, in *Pacific Coast Nudibranchs*, but also (dare I say it?) every other type of aquarist (yes, even the coldwater specialist) who may share a common affinity for all aquatic creatures.

For me, the highlight of the book is undoubtedly the pictures of *Berthelinia chlois*, having first come across its fossil ancestors during my undergraduate days in the late 1960s. What appeals to me about this unbelievable creature is that 'it doesn't know

the rules!' It has a two-valved shell — just like a clam or a cockle... but then it has the body of a snail. Wonderful!

For those who, like me, love 'exceptions' to rules, this is not the only gem either. There are also the various members of the families Acteonidae, Cylichnidae, Retusidae, Diaphanidae, Bullidae, Haminoecidae and others forming the order Cephalaspidea.

So, if you are looking for a really well illustrated book, packed with essential information (even including the etymology [origin] of many of the scientific names), then look no further: *Pacific Coast Nudibranchs* is the book for you.

* Other **Sea Challenger** books are distributed in the UK by **Steven Simpson Natural History Books**. Tel: 0273 727328; Fax: 0273 203754. Titles include:

Pacific Coast Inshore Fishes (3rd edition)
Pacific Coast Subtidal Marine Invertebrates
Caribbean Reef Invertebrates
Marine Animals of Baja California (2nd edition)
Dangerous Marine Animals of the Pacific Coast
Sea of Cortez Marine Invertebrates
Reef Sharks and Rays of the World (in preparation)

John Dawes

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Focus on: *Plants*



Despite what some people may say, it is quite possible to combine luxuriant plant growth and undergravel filtration . . . but you need to know how to go about it.

PLANTS AND UNDERGRAVEL FILTERS

As Mary Bailey shows, it is perfectly possible to grow healthy plants using undergravel filtration — as long as a few important rules are observed.

Photographs — unless otherwise indicated — by the author

There is a myth, of many years standing, that it is impossible to grow plants when undergravel filters are in use. I have never really subscribed to this theory, and three years ago decided to put my ideas on the subject into practice. This article is the distillation of my experiences at that time and since.

'NON-EXCLUSIVE' FILTRATION

It has to be said at the outset that if you are one of the all-too-many aquarists who believe that a tank cannot function unless the filtration is a reasonable analogue of Niagara Falls, then the type of set-up I am going to describe is not for you. Thus, there is little point in trying to grow plants where such conditions are a necessity for the well-being of the fishes — e.g. with Malawi Cichlids. If, however, you are setting up a well-planted community, or wish to specialise in Discus or Dwarf Cichlids from slow-moving or still waters, then there is no reason why you should not combine UG and sub-aqua horticulture — the two are by no means mutually exclusive.

In fact, you could probably run such a tank without any filtration at all — I know this is heresy in our hi-tech era, but when I started fishkeeping 20 years ago, it was the norm, and if you did have a filter, it was one of those little corner box jobs that we now use just for conditioning treatments. Those of us who pioneered Rift Lake Cichlids had all sorts of problems until we realised that these fishes



Harlequins and plants are highly compatible.

HAD to have artificial aeration to simulate their natural habitat. But I digress . . . (as usual!).

ADVANTAGES

The advantage of using UG where it is not strictly necessary is that it optimises bacterial action in reducing wastes to relatively harmless nitrates, and thus gives us a margin for error — i.e. the occasional undetected demise of a fish (decomposing corpse behind the Amazon Swords), or overdose of food is unlikely to result in an unmitigated ecological disaster.

It can also be a way, where tank space is limited, of keeping rather more fishes in such a set-up than would be possible without filtration. Of course, it is possible to do this by using other types of filter; but against that, we must remember the advantages of UG — minimal effect on the aesthetics of the tank, total bottom coverage (no pockets of untreated wastes) and all-round water circulation, no risk of leaks, no risk of fishes getting into the filter, etc.

And, in addition to all these advantages, by having plants as well, we use up a lot of those relatively harmless nitrates — which can, however, have a long-term ill-effect on health if the level gets too high — and make our tank highly efficient.

It may still be necessary to change water periodically — if only to top up the content of minerals and trace elements taken out by the fishes and plants — but not so much or so often. This is an important consideration if you are keeping species which don't like disturbance, or if you are having to spend lots of time and money converting hard alkaline water to something suitable for Discus and other Amazonian fishes, not to mention the fact that, these days, you may have to treat your tapwater to reduce its nitrate content before you dare use it for your fishes!

SECRETS OF SUCCESS

The secret of combining plants with undergravel filtration is — as in so many areas of fishkeeping — largely a matter of patience. The plants must be allowed to get well-rooted and be showing signs of vigorous new growth **BEFORE** the UG is brought into action.

Setting Up

Tank size does not matter; I have now combined plants and UG in tanks ranging from 15 x 10 x 10in (38 x 25 x 25cm) to 48 x 15 x 15in (120 x 38 x 38cm). UG plates should be fitted to cover as much of the bottom as possible, using a single uplift per plate. I find that, at low turnovers, if there are multiple uplifts, it is difficult to balance airflow to avoid water taking the course of least resistance and going down the 'weaker' uplift,

instead of through the gravel.

The plates should be covered with 2.5-3.5in (6.4-9cm) of fine to medium-grained gravel and the tank aquascaped as required. As usual, add water and the heating equipment, and once the tank has reached its working temperature, then plant it out as desired.

Organics

At this point I should mention that if you wish to incorporate some form of organic material into the substrate (e.g. peat, or laterite) there is no reason why you should not do so. The usual argument against this is that it will be sucked through the filterbed, come up the uplifts, and make a glorious mess of the tank — and this is quite true.

The solution is to set the UG going for a day or two at a fairly fast rate, and, during this time, the filter will trap the offending bits. After all, the inert sludge resulting from the bacterial action on detritus does not come up the uplifts (unless you are going for the Niagara effect in a long-established tank!). Turn the UG off again as soon as the water has cleared.

Rooted Plants

If you possibly can, use plants that have been kept rooted in a tropical aquarium, rather than those often seen lying around in trays of rather cooler water in many shops. You only have to compare the root structure on a newly-uprooted growing plant with that of a 'trayed' specimen to see why.

It is much harder to plant the former because of the sheer quantity of roots curling all over the place. Plants with a healthy root structure will establish much more quickly and with minimal die-off of existing leaves.

I am inclined to think tropical plants are just as delicate as tropical fishes, and none of us would consider leaving fishes sitting around for days (or weeks) on end in water with a temperature 15 or more degrees F below what they require as normal. In my experience, by far the best plants are those scrounged from friends and replanted after only an hour or so out of their normal habitat.

Fertilisers

As the tank is going to be fish-less for a while, you must remember that plants need food to thrive, and so the tank should be fertilised with an appropriate amount of aquarium fertiliser, especially if you have decided not to use organic material in the substrate.

Lighting

Obviously, lighting is important; I use two 36in (90cm) fluorescents (cheap and cheerful ones, nothing fancy) over my 48in (120cm) tank, which is 15in (38cm) deep. It helps, in addition, to have some sort of reflector inside the hood, especially if you are using cover-glasses, which reduce the intensity of the light actually reaching the

plants. As long as cover glasses are in use to protect against 'fall-out' from corrosion, a lining of kitchen foil, shiny side exposed, makes an excellent reflector (there are also some very good models available commercially).



Even if species like *Apistogramma nijsseni* (this is a female) disappear from view for long periods in a heavily planted tank, the glimpses that one gets from time to time are well worth the patience.

Deeper tanks will require a greater light intensity, and I think many failures with plants these days are attributable to the greater depths of tank that have become the norm since all-glass tanks came along.

The lighting period should be at least 12 hours a day, and longer will do no harm while the plants are establishing and there are no fishes present. Remember, however, that once the tank is inhabited, its occupants need their rest just as we do, and a 12-hour period of illumination probably best equates with what they would experience in nature.

Maturation

So now we have the tank set up and planted, with the undergravel filter in place but not running. This is where the patience aspect comes in, as the next step is to leave the entire set-up alone for at least a month.



A definite 'no-no' for a planted tank: the 'giant' Red-tail Catfish.

The only permissible 'fiddling' is any necessary adjustments to hardness and pH required to provide the optimum conditions for the intended occupants.

The actual length of the patience period

may vary according to the type and initial condition of the plants. Once the plants have rooted properly, they should start to put forth new young green leaves, and this will be a sign that they are utilising the fertiliser you put in, and are thus in a fit condition to utilise fish wastes.

The plant-establishing period will also allow the bacterial maturation of the tank, i.e. the formation of colonies of the bacteria that process wastes. These develop in any tank, with or without UG; what UG does is to increase the surface area (of gravel) available for colonisation by aerobic (oxygen-utilising) bacteria by drawing oxygenated water through the gravel. It is these bacteria that are instrumental in the initial processing of toxic wastes, converting them to relatively harmless nitrates.

At this stage, it is probably best not to remove any old leaves that die off and start to decompose, even if these are unsightly — they are giving those vital bacterial colonies something to work on (food!) in the absence of fish waste products.

Resisting Temptation

When you see vigorous new plant life, test the water for ammonia and nitrite, and if the levels of these are minimal, then it is safe to add some fishes. Don't add the entire intended population, but gradually build up the numbers over a 4-6 week period, allowing the ecosystem to take up the strain gradually. Resist the temptation to set the UG going!

When the tank has been planted for three months or so then, provided plant growth is rampant (and it should be — if not, then you are doing something wrong!) you can start up the UG. It should be driven by air (NOT powerheads), and initially the water flow should be very slow, a mere trickle of bubbles such that there is virtually no surface agitation.

Over the next few weeks, you can increase the air flow gradually to what is eventually required, but do remember that this should not be a mega-current, even when in full flow. It is not necessary; if your plants show any sign of check at this stage, then you have gone too far, or too far too fast.

Signs of Success

My 48in (120cm) tank has now been running with the undergravel action for nearly three years. The growth of the higher plants is so rampant that algae have long since practically disappeared, and if I have any problem, it is an excessive resemblance to a jungle, making it sometimes difficult to establish if I still have any *Apistogrammas*, and if so, what they are up to.

Obviously, this could be remedied by judicious thinning (perhaps 'weeding' is a better word!). But then again, it is a rewarding experience to see a female *Apistogramma macramor* leading a brood out from under a decaying leaf (*Apistos* often hide in leaf litter in the wild, so I don't 'garden') or to find that you have more tetras than you started with!

Koi Calendar



By David Twigg

This month, water temperature will be nearing its maximum for the year and you may find yourself spending evenings sitting on the lawn or patio, watching your Koi meander around the pool. Maybe a glass of wine in hand to refresh you after your days work; what could be better?

Alternatively, you may find yourself collecting excess Blanketweed from the pool or, maybe, even digging another one.

TIPS FOR THE MONTH

Whatever your situation, this is the time when the effort put in throughout the winter months is well rewarded. Seeing your Koi eagerly feeding is a pleasure and, even if you are still teaching your Koi to take food from your hand, I am sure you will find mental, as well as physical, relaxation.

For those of you who have not tried hand-feeding, I offer the following tips. Have patience, sit quietly at the pool-side and do not move the hand once it is in the water, i.e. let the fish come to the hand not vice-versa. Hold the food (we were advised to start with cockles and found them to be very acceptable to our fish) between forefinger and thumb with the other fingers curled up into the palm. Your Koi may approach and turn away at the last moment, causing disappointment, but persevere. If at any time you want to take your hand from the water, please lift it straight out very slowly to avoid frightening the fish and thus having them bumping into each

other, or worse, into the pond walls.

This procedure may take several attempts to be successful, and you should not hold onto the food for too long. In these early stages, it may be wiser to let the food go when a fish is within an inch or so of your fingers as a reward for coming to the hand.

Do not be frightened yourself. Even the smallest of Koi have a strong sucking ability and will often suck your fingers or the back of your hand, rather than take the food. Do not take the hand away quickly when this happens, as you will only frighten the fish and set the process back a day or two. You should come to no harm because Koi do not have teeth at the front of the mouth. They do, however, have three rows of pharyngeal teeth at the rear for crushing food.

Have patience and I wish you "happy hand-feeding".

Hand-feeding aside, this month is one where I am particularly careful about the regularity of feeding. It is essential that a fairly constant load is placed upon the biological filter in order to keep water quality at its highest during this time of high water temperature.

NEW KOI SOCIETY

I have been notified of the formation of another Koi Society. This one is the **Potteries & District Koi Keepers Society**. Although not affiliated to the BKKS at this time, it is hoped to do so when they have got off the ground. See below for meeting details.

JULY SHOWS

- Six shows this month:
- 4/5 — **Central Section BKKS**. Open Show at Walsall Arboretum. Dealers and Craft Fayre. Contact **Mike Higginbottom** on 0922 37682.
 - 5 — **Lower Thames-side Section, BKKS**. English-style Open Show. Eastwood Junior School, Rayleigh Road, Eastwood. This is an under-cover show and 16 Koi dealers will be present. Bonzai stalls, bouncy castle and swing boat are being provided for other

JULY						
S	M	T	W	T	F	S
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30		

members of the family. Additional attraction here is the display of classic, veteran and vintage cars (Rolls-Royce, Daimler and Jaguar). Bags of free car parking. Entry £1.50 adults, accompanied children free, children and senior citizens 50p. Contact **Albert Radley** on 0702 529675.

- 5 — **South Wales Section, BKKS**. English-style Closed Show at St Mellons Garden Centre, Cardiff. Sponsored by **Pet 'n' Aquatics** and **John Woodall**. Contact **Fred Blight** on 0222 618860.
- 5 — **Yorkshire Koi Society** Open Show. Harewood House, Leeds. This day out offers trade stands, Koi raffle, information and advice, birds of prey exhibition and a classic car display. Show is open 10 am - 5 pm. Contact **Steve Lamb** on 0904 626655 or **Mike Naylor** on 0274 662848 for entry forms.
- 11/12 — **Northern Section, BKKS**. Open Show. Tatton Park. This large two-day show is one of the biggest in the calendar. Twenty Koi dealers and 40 craft stalls will be there to whet your appetite. Beer tent and Bonzai, bouncy castle and other kiddies' entertainment should make for a great day out. Enter your Koi and stand the chance of winning a superb engraved crystal trophy. Contact **Tony McCann** on 061 794 1958.
- 12 — **Suffolk & North Essex Section, BKKS**. English-style Closed Show. Free Roberts Koi, Great Sampford, near Saffron Walden. There should be plenty of interest at this show, with a large selection of craft stalls, a licensed bar, side stalls, dealers' stall, Bar-B-Q, snacks and other amusements to keep your interest. Contact **Dennis Preou** on 0371 856450.

26 — **Essex Section, BKKS**. English-style Open Show. After lengthy consultations with representatives of the **Essex Water Company**, the Essex Section reluctantly have decided to **CANCEL** this show due to the shortage of water in the area.

SHOW CALENDAR

- 15/16 August — **BKKS National Open Show**. "Koi '92". Billing Aquadrome, near Northampton.
- 23 August — **Avon Section BKKS** Closed Show. Park Garden Centre, Over Lane, Almondsbury, Bristol. Contact **Mr Lerway** on 0454 898207.
- 30/31 August — **South East of England Section BKKS**. English-style Open Show. Ravens Wood Boys' School, Oakley Road, Bromley, Kent. Contact **Mick Wright** on 0634 718943.
- 5/6 Sept — **Mid-Somerset Section BKKS**. Closed Show. Royal Bath & West Showground, Shepton Mallet. Contact **Alan Purnell** on 0458 72132.
- 5/6 Sept — **Crouch Valley Section BKKS**. Open Show at Prince Avenue Primary School, Southend-on-Sea.

WHAT'S ON IN JULY

- 1 — **Suffolk & North Essex Section BKKS**. Show talk and video evening. 7.45 pm at the Prince of Wales PH, London Road, Marks Tey, Colchester, Essex. Contact **Dennis Preou** on 0371 856450.
- 2 — **The Potteries and District Koi Keepers Society**. 8 pm, The Bid-dulph Arms, Biddulph, Stoke-on-Trent. Contact **Graham Platt** on 0782 396670.
- 2 — **North Wales Koi Club**.

- Guest speakers are Liz & Mike Donlan. 7.45 pm, David Bryant Bowling Centre, Frith Beach, Prestatyn. Contact Eileen Price on 0745 591730.
- 5 - Essex Section BKKS. Visit by Worthing Section. Contact Bobbie Barton on 0702 611750 or Margaret Bishop on 0702 522388.
- 12 - Mid-Somerset Section BKKS. Coach trip to Kennet Valley Section ponds. Contact Alan Purcell on 0458 72132.
- 19 - Northern Section BKKS. Coach trip to Yorkshire Section ponds. Contact Tony McCann on 061 794 1958.
- 19 - London Section BKKS. Pond visit to South Hants Section BKKS. Contact Keith Nind on 081 673 3574.
- 19 - Suffolk & North Essex Section BKKS. Visit Northampton Section ponds. Contact Dennis Preou on 0371 856450.
- 19 - Kennet Valley Section BKKS. Pond visit to Lower Thames-side Section ponds. Contact Bob Thompson on 0734 713640.
- 19 - Japanese Water Gardens. KOI Auction. Contact JWG on 0602 397926.
- 22 - London Section BKKS. Ruskin House, Coombe Road, Croydon, starting 8 pm. Gary Pritchard (a Koi judge) leads discuss-

ion on members' fish and the requirements of Showing Koi. Contact Keith Nind on 081 673 3574.

- 26 - Lea Valley & Harlow Section BKKS. Visit Chiltern Section ponds. Contact Barry Ford on 0279 419101.
- 26 - Worthing & District Section BKKS. Visit by Middlesex Section. Contact Steve Willard on 0243 267893.

AN INVITATION

I hope my monthly column of events, reports and topical items is proving useful in helping you to arrange your calendar. Although I do my best to contact as many people as possible, it may be that you don't see your society or section meeting or shows, etc, mentioned here. If so, please contact me, or your club secretary, as soon as possible. This request also applies to dealers with special events, auctions, etc. My thanks to those who have already responded.

All Koi keepers are welcomed to the events mentioned in this calendar (an entry fee may be payable). Further details can be obtained from the contact telephone number quoted alongside the diary entry. Please write to me at your earliest convenience via the Editor at 9 Tufton Street, Ashford, Kent TN23 1QN.

Derek



"Off colour, my foot! They were talking because they didn't have perms like their favourite football players!!"

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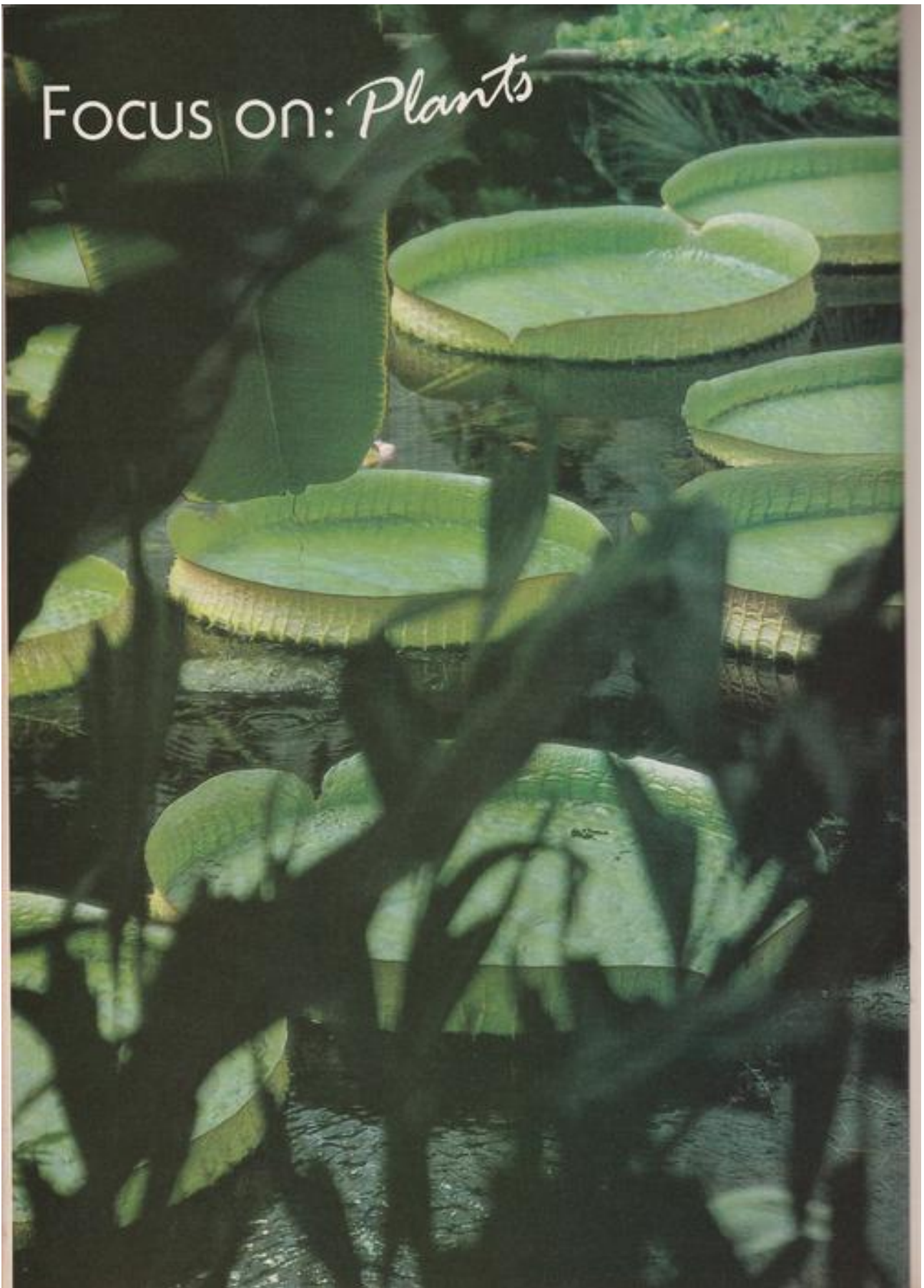
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Focus on: *Plants*



Spotlight



JOHN DAWES

Above, *Victoria amazonica* photographed in the wild in a calm inlet off the Rio Solimoes in Brazil. Note the virtual absence of leaf 'lips'.



Top right, a youngish leaf of *V. cruziana*, almost completely unfurled.

Centre right, the branching network of supporting tissues on the underside of these *V. cruziana* leaves can be clearly seen on the deep upturned 'lips' characteristic of this species. Two flower buds (already on the surface), plus one just below, are also visible.

Right, a one-day-old *V. cruziana* bloom beginning to close up during early evening. This particular specimen was being grown in an open-air decorative pond in the Botanic Gardens, Singapore.



JOHN DAWES

The Amazing Amazon Lily

Author and photographer Brian Beckett turns his lens on one of the most remarkable aquatic plants in the world.

Main photograph, plus others — unless indicated — taken by the author at Stapeley Water Gardens.

Imagine growing water lilies with leaves 6ft (2m) and more across and which can support the weight of a baby. An impossible dream? Yes, unless you have an enormous indoor pool heated to 80°F (26.6°C) and illuminated with sunlight and powerful lights for up to 18 hours a day.

If this is a little beyond your means, an alternative is to visit 'The Palms Tropical Oasis' at Stapeley Water Gardens near Nantwich, Cheshire, where Giant Amazonian Water Lilies, *Victoria cruziana*, are on show all the year round. (See also the **Out & About** feature by John Dawes in the March '92 issue of *A & P*).

AMAZON LILY SPECIES

Despite its name, this particular species of the water lily family does not come from the Amazon basin, but is native to tributaries of the River Plate in Argentina and Paraguay.

The almost identical *Victoria amazonica* (= *V. regia*) is from the Amazon region of Brazil and is equally popular for cultivation. It is different from *V. cruziana* in having folded leaf margins which are 10cm (4in) rather than 15cm (6in) high, and the sepals of its flowers are prickly and not smooth.

These monster plants, often called the 'Queen of Water Lilies', are found in quiet bays and old beds of these large tropical rivers.

V. cruziana was first discovered in 1801. Its seeds were subsequently brought to England in 1837 and grown by the head gardener at Chatsworth House. They were named after Queen Victoria, who was "pleased to receive" a preserved leaf and flowers in 1849.

CULTIVATION

Both species are cultivated in tropical houses or, in warmer regions, in heated open-air ponds. In the wild, they are perennials but, unless given powerful artificial light, as are the plants at Stapeley, it is usual to cultivate them like annuals because, even if heated, they are unlikely to survive the poor light of a winter season.

The seeds are put into flower pots in early spring. They are similar to peas and are germinated in sandy compost covered with an inch (2.5cm) of water. The first leaves are small, submerged, and arrow-shaped, but simple floating leaves follow shortly afterwards.

The seedlings are transferred to soil rich in nutrients and planted into deeper water when their floating leaves are about 6in (15cm) across.

Then, under ideal conditions, they can grow at a staggering rate to become 5ft (150cm) across in only three weeks!

The huge leaves of older plants are supported by a branching network of strong veins which protrude from the undersides and are covered with sharp prickles, presumably thus putting off herbivorous fish and other plant-eating aquatic animals. The strength of these leaves can be judged by the fact that, if the load is evenly distributed, they can carry a weight of up to 50kg (110lb). Several books contain pictures of contented babies sitting on these leaves, blissfully

unaware of the watery depths beneath them (see afore-mentioned article for one such photograph).

Rain and other water that collects on the upper surface of the leaves drains away through small pores leading into channels to the lower surface.

FLOWERING AND POLLINATION

Flower buds 8in (20cm) across appear in May or June on healthy, fully-grown plants. The buds open in July into flowers up to 14in (35.6cm) across with 80 petals.

Victoria species bloom at night — in fact, they open their flowers twice. On the first night, they open their shiny, creamy-white blossoms just after dark. The flowers are still warm from the fierce heat of day and give off a strong sweet fragrance of tropical fruit which attracts beetles related to our June Bugs (*Cyclocephala* sp.).

Unlike many flowering plants, these water lilies do not feed their hungry visitors with nectar. When the insects arrive, loaded with pollen from visits to other flowers of the same species, they are 'rewarded' with solid, sterile food packages which grow on the female parts of the flower. Remarkably, these 'food handouts' generate heat within their tissues which continue attracting insects long after sunset.

As morning approaches, the flowers close trapping the beetles inside. The insects carry on eating during the day and may do con-

siderable damage to the flower but, in the process, fertilise enough ovaules to make their visit worthwhile.

During late afternoon, the flower, now odourless and pinkish in colour, opens for a second time. As this happens, its anthers burst, shedding pollen onto the escaping beetles so they can pollinate fragrant 'first-night' flowers which will be opening at about the same time in other plants nearby.

After its temporary captives have departed, the flower closes again and submerges so that the seeds ripen under water.

This complex natural pollinating mechanism can be by-passed during cultivation and the pollen transferred by hand.

There are seven genera and 65 species of water lily with a worldwide distribution, but none are as spectacular as the *Victoria* species. The only other which comes anywhere near them in terms of size is *Euryale ferox*, a little-known plant of tropical East Africa. Its leaves are just as large as the Victorias, but do not have upturned margins, and its flowers are small, with violet petals.

DAF

Giant water lilies are one of many exotic plant and animal exhibits to be seen at Stapeley Water Gardens, which has been named the U.K.'s number one gardening attraction by the British Tourist Authority.



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Koi Talk

By John Cuvelier



DELAYED DELIVERIES

Can you recall those far-off days when to be a customer of a company selling you anything, carried with it a certain respect? At one time you could be quite sure that, somewhere behind the scenes, your order would receive immediate attention and, if delivery was required, it would be in the next post. No, I'm not spoofing, this really used to happen!

A couple of weeks ago I phoned a particular Koi dealer and, quoting a credit card number so as to avoid any cheque clearance delay, ordered a new 15 watt UVC and an assortment of spare tubes to service my existing units. A simple enough request you might think? So why should it take eight days for my order to arrive, particularly as the Royal Mail Parcel Force managed overnight delivery?

Could it be that this is symptomatic of the malaise that seems to permeate UK business life? We'll deliver Thursday, but we don't know which Thursday! I find it all very irritating. There are two very large companies with regular multi-page adverts in this and other magazines who can regularly deliver within three days of receiving an order. So why can't they all do it?

COLUMN HAZARDS

One of the hazards associated with producing a monthly column such as this, is the fear of recommending something for others to use which turns out to be suspect for one reason or another.

Since my mention in the May issue of tapwater conditioning equipment, I have received word from a number of various sources warning of possible problems for fishkeepers in using this type of equipment. Some of the units on the market, while perfectly safe to use as drinking water purifiers, are of questionable use where fish stocks are concerned.

I've been given to understand that these units can even contain media consisting of 'fused copper and zinc', that alone must set alarm bells ringing for any fishkeeper let alone we, Koi keepers! Obviously, columnists like myself can only report the facts which are passed to us in good faith and the only advice we can pass on to anyone contemplating the purchase of this type of equipment is to insist upon a written description of the equipment, together with a full breakdown of the 'canister's' media content.

I'm sure that no reader would contemplate the purchase of a home 'water softener' in view of what is already known regarding the problems which have been familiar for many years among aquarists, so I fear we must now add 'purifiers' to our 'treat carefully' list! (Watch out for my article on **Water Quality** in the August Supplement.)

SPAWNING FRENZY

Oh happy day! Around the middle of May, our Koi completed an excellent demolition job on our pool and filter. Our previously perfectly clear water took on the appearance of something nice people would not dream of mentioning in respectable company!

I just don't know what got into them this year but suspect the spell of beautiful weather probably had something to do with it. In all my years of keeping Koi, I have never seen such an orgy of spawning which, indeed, bordered upon the indecent.

The stench was unbelievable; even my wife, Sheila, who has no sense of smell, detected it inside the house. They were at it when I rose at 6.30 am and were still going, though less enthusiastically, 12 hours later. By the

following morning it was all over bar the close-down and clean-out of my pre-filter which was clogged solid for the first time ever!

It was clearly apparent that every single Koi in our bunch had joined in the sport; I now look forward to a splendid collection of fry.

IRONED-OUT SNAGS

Speaking of which, I've hopefully ironed out the one or two snags with the hatching pool described last year. The major problem was that of Blanketweed due, in the main, to poor shading of the pool which is located in full sunlight. Having provided a hinged and lifting full cover and a sheet of blue 'visqueen', that particular problem appears to have disappeared.

The Mark 2 trickle filter has also put in an appearance, being twice as large as the old Mk 1. This now contains 14 litres of Saporax (ouch!) topped off with about the same quantity of hair rollers. The beast is constructed from a disused diatomaceous earth swimming pool filter (a sketch is provided for those who feel like bothering to pro-

duce something similar). In addition, a 15 watt UV has been installed in the feed to the filter and if that little lot does not do the trick, I give up!

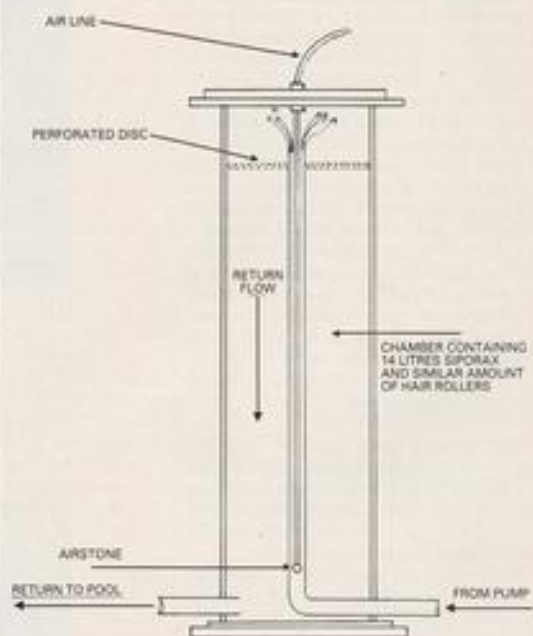
As the diagram shows, pool water is pumped up the centre and is oxygenated en route. It then gravitates down through the perforated disc and passes through the hair rollers and Saporax before returning to the pool. The hatching pool has a capacity of 485 gallons (c 2,200 litres) and the target is a turnover of twice an hour, although this is a moveable figure, depending upon performance.

Needless to say, I'm not expecting miracles but it's got to be a worthwhile experiment!

STRAW RETAINERS

I hear via my faithful grapevine that some rot-proof bags for retaining barley straw in a filter are becoming available. It's not a bad idea, as the usual method of using net bags invariably results in most of the straw escaping and finding its own way home, usually to the detriment of pumps, etc.

For more information, contact **Ray Vidler** on 0304 215711.



In these days of depleted ozone layers and global warming, the British pond in the summertime can be expected to be slightly tropical! This will bring benefits, as well as problems. The fish, for example, should feed well and grow rapidly, and their owners will be able to sit around the pool (suitably screened from the ultraviolet rays). The main problem will be oxygen content.

OXYGEN AND HEAT

As water warms, its oxygen content falls, with obvious stress to fish, who will be seen mouthing the surface as they 'gasp for air'. There are cases of large Koi dying during thunderstorms, where warm water combines with high carbon dioxide layers over the water, depriving the fish of oxygen.

The solution to this problem is water movement to bring the upper layers of oxygen-rich waters down to the bottom layers. Cascading the water is most effective, so if you do not have a waterfall, create one via a pump and ornament. A fountain is useful, but often so light and delicate that it may not create much water movement. Removing the rose so it cascades will help.

Fish farmers know the problem well and there are powerful airblowers and underwater porous pipes available to salmon, trout and carp growers. The equivalent for the pond owner can be a simple aquarium airpump, sited in the garage or out-house, etc, for electrical safety, with long aquarium airline tubing running out to the pond (it can be buried under the soil) attached to an airstone (6in - 15cm - or more so that it sinks).

SUMMER WASTES

Another summer problem is that a healthy appetite will give more excreta, especially ammonia which pollutes the water and poisons the fish. A good filter system should cope with this because the higher temperatures mean greater bacterial activity within the filter, but do make sure the medium is clean to allow water to flow through.

If the pond is simply a 'water hole', the summer can turn it into a stagnant pool and the fish will rapidly die. If it is impossible to fit a filter and aeration system in such a set-up, the water must be partly replaced as often as possible. A good method is to lash the outlet of a garden hose into a sweeping brush propped upright so that the water cascades into the pond. This reduces chlorine levels and adds oxygen.

WATER SUPPLIES

Never change more than 50% with tap-water because the chlorine content will harm the fish. Remember, too, that a hosepipe ban may be in operation... but some authorities allow the use of a hosepipe for livestock; check with your local water board.

It's useful if you can divert rainwater into the pond. The drainpipes from the roof can be adjusted to pour directly into ponds, rather than the sewers, providing you live in



The Summer

Dr David Ford of the 'Aquarian' Advisory Service offers his tips for trouble-free, warm-weather pondkeeping

Photographs by the author





Pond



Top left, plant well around a garden pond, especially with summer-flowering plants because these will bring with them a myriad insects that can feed the fish valuable but safe live food.

Top right, a simple ornament, such as this frog, can be connected to a cheap aquarium pump to give a cascade that aerates the water in hot weather.

Left, the best aeration system is a waterfall, which can be something novel, such as the Lion's head in my own double pond system.

Above, a fountain helps aerate the water; and it also looks decorative. The system shown here includes a submerged floodlight for evenings.

a reasonably clean air area. If industrial pollution is present, the water can be collected in butts, where the first 10 minutes or so can be discarded and subsequent rain can be collected. Acid rain only occurs initially in rainstorms.

A simple but effective trickle system for ponds (where allowed) is to fit an aquarium airline tube to a garden tap via a drilled cork. Run the tubing under the soil to the pond and adjust the tap to give a drip supply.

This compensates for evaporation losses that can be quite high in the summer heat. It should not replace water changes, of course.

ALGAL BLOOMS

The main summer problem, especially if the sun is shining, is algae. There are many species and you take pot luck which type settles on your water. It may be *Polytrix* which gives a vegetable soup, or *Synroga* which gives mats, *Cladophora* with its wispy threads, or the dreaded Blue Green with its bad odour.

The only answer to all these blooms is, in my view and that of many others, the ultraviolet light system that kills such free-floating algae. There are many units on the market which can be plumbed into the filter system (remember to add the unit before the filter so the dead algae are removed).

The traditional filter will not remove algal blooms, especially species such as *Euglena* which can move and just swim through filters. Special filter systems that claim to cope with algae are on the market; these often include magnets that coagulate the algae to make them easier to filter out, e.g. the Siporax filter from A1 Garden Aquaria.

A particularly troublesome type of algae, is Blanketweed which can grow as quickly as you can haul it out. In fact, it is a very useful plant in that it removes nitrates from the water, can be eaten by the fish, harbours lots of

aquatic livefoods and when gathered (use a rough stick to collect it like candy floss) is a good fertiliser for the roses, etc. Treatments for Blanketweed are available if necessary, such as Interpet's Pond Balance.

FEEDING

Unlike at other seasons, there is no restriction on what fish can digest in summer. Therefore, you can feed daily or twice, even thrice a day. At 80°F (27°C) or more, the fish tend to become lethargic and so less enthusiastic about feeding... since these are tropical temperatures, feed tropical diets, such as 'Aquarian' Tropical 'Flake Food which can be given to even the largest of Koi, who will 'hoover' it up from the surface. It is also easily digested, with low excreta problems.

At around 70°F (21°C) the fish will take any amount of food, such as chicken, lean beef, fish fillet, shellfish, boiled peas, spinach, scalded lettuce, brown bread, etc. The rule is, if you can eat it, the fish can (generally) eat it, but do avoid anything with animal fats (that is both you and your fish).

Include some commercial diets, such as pellets, sticks, granules and flakes, as well as fresh foods, to ensure feeding adequate vitamins and minerals which the best manufacturers include in their recipes.

One excellent natural food is in short supply in summer: the red garden earthworm. However, many insects will be around and some will fall into the water. These are a safe live diet for any pond fish because they carry no parasites. Never feed live aquatic live foods (*Daphnia*, *Tubifex*, larvae, etc. unless cultured) because these will carry parasites.

PLANTS

Growth of aquatic plants, especially marginals, will be strong, although some will be

checked as they flower and seed. Keep a gardener's eye on such plants because seed can be gathered and potted for future planting to help cut costs and add yet another dimension to the hobby. A hot summer



A 15-watt Ultraviolet Steriliser attached to the inlet of my pond filter. Note that the outlet of the tube is a larger pipe than the inlet, something all pond pipe systems must have for proper water flow.

means even the so-called tropical plants will bloom in shallow water, such as *Cabomba*, *Myriophyllum*, *Vallisneria*, *Sagittaria* and *Anacharis*. All are available from the aquarium shops.

Summer is the time to enjoy water lilies, especially the 'Tropical Day Bloomers' which can grow in Britain if the tubers are overwintered indoors.

DISEASE

Summer should see any Carp Pox fading away. Fungus is not prevalent in warmer weather either. Bacterial problems can occur, but antibiotic treatments are easy to supply via the fish food during summer. Contact your local vet if body ulcers or Fin Rot are seen on the fish.

White Spot is rare in summer, but larger parasites may appear, such as Fish Lice, Anchor Worm and leeches. The fish, if affected, show distress or irritation, so some should be netted into a glass tank for examination. If parasites are seen (tiny worms or blobs on the fish) they are best removed physically using cotton buds soaked in paraffin to make the parasite 'let go'. Though less effective, pond treatments for ectoparasites are available if individual attention is impossible. Check the magazine advertising.

Snails may proliferate and these may carry parasites, so it's best, in my view, to eradicate them. Use a lump of raw liver in a jam jar to protect it from the fish. Lower the jar via a line at dusk and haul it out as soon as possible next day. The nocturnal feeding of

snails means the jars will collect all of them eventually.

OTHER WORK

Mostly do nothing . . . because summer is the time to lie back and just enjoy the garden pond.



A tip for plugging pond equipment to the mains, or for housing transformers: use two sizes of plastic 'tidy' boxes (usually on offer at DIY stores); place the larger box upside down over the lower to give protection from weather and insects, etc. allowing domestic plugs and sockets to be used. This is protected by a mains circuit breaker, of course. If in doubt, consult a qualified electrician.

PONDSIDE ASSISTANCE

① Reading List

A Fishkeeper's (Interpet) Guide to Garden Ponds by David Papworth, Salamander Books, 1984, ISBN 0 86101 129 5, must be top of the list. It is only a pocket-sized book and therefore not expensive, but is full-colour with 80 photographs, 50 illustrations and 20,000 words of wisdom. As the publisher states: planning a garden pond raises many questions. How big? Where to put it? What fish and plants to stock it with? This colourful guide answers all these questions and more with a clear practical approach that will encourage everyone with a garden, or even just a patio, to embark on their first pond with absolute confidence.

If you want to build a Koi pond, then another book in the same series must be read, *An Interpet Guide to Koi* by Barry James, Salamander Books, 1986, ISBN 0 86101 279 8. 120 pages, 20,000 words and 100 colour photographs packed into a pocket-sized book, with valuable information on filtration systems for the clear water pond.

Also in the same series is Dick Mills' excellent book *A Fishkeeper's (Interpet) Guide to Coldwater Fishes*, Salamander Books, 1984, ISBN 0 86101 134 1, with more data on the choice of fish to add to the pond (and aquaria).

A very similar publication is the TFH series *A Complete Introduction to . . . and a*

useful read is their *A Complete Introduction to Garden Ponds* by Al David, TFH No CO-017, 1987, ISBN 0 86622 266 9. TFH state "authoritative advice is given about making the pond, how to protect it against enemies, which fish and plants to put into it — and how to keep it beautiful".

The cheap small handbooks by Foyles includes one by Arthur Boarder, *Garden Ponds* with sensible advice therein, and another Foyles handbook, *The Water Garden* by H G Witham Fogg is also interesting.

For more information on ponds as a water garden, the best choices are John Dawes' *Book of Water Gardens* by our magazine's editor, published by TFH in 1989, ISBN 0 86622 662 1. Others include *The Stapeley Book of Water Gardens* by Stanley Russell, 1985, ISBN 0 7153 8649 2, published by David and Charles for Stapeley Water Gardens and *The Lotus Book of Water Gardening* by Bill Heritage, 1982, ISBN 0 600 37026 7, published by The Hamlyn Group for Lotus Water Garden Products.

In fact, the *Stapeley Water Gardens Catalogue*, published annually, is always worth getting (send £1 to Stapeley, Nantwich, Cheshire CW5 7LH) because it contains useful advice on pond building.

If you want data on moving water, your choice is a book written by Frank Orme and published by Nimrod Press in 1986,

ISBN 1 85259 006 5 called *The Landscaped Rock and Water Gardens*.

② Equipment

Specialised equipment will be needed for the clear-water pond, so catalogues are useful. *Stapeley Water Gardens* are listed above; others include Cyprio Ltd, 133 East Gate, Deeping St James, Peterborough, and In-filtration Ltd, Units 12 and 13, Millingford Industrial Estate, Bridge Street, Golborne WA3 3QE.

③ Advice

To obtain first-hand information from experts, why not join a fish club? Those specialising in ponds are the Koi keepers' and the Goldfish Societies. The *British Koi Keepers' Society* publishes a monthly magazine packed with information from the members and it includes useful advertising addresses. The secretary is P Perrin, 'Treeland', 8 Eastcombe Road, Weston-super-Mare, Avon BS23 2TQ.

The *Goldfish Society of Great Britain* is a long-established fish club that meets at the YWCA, Great Russell Street, London, so if you live in that area contact GSGB, 38 Herent Drive, Clay Hall, Ilford, Essex IG5 0HE. For northerners, try *The Northern Goldfish & Pondkeeper Society*. For information write to WH Ramsden, 18 Ainsdale Road, Great Lever, Bolton, Lancs.

GROWING GIANT VALLISNERIA



As this photograph shows, the Giant Vallis which I am holding is almost as long as I am tall!

A giant *Vallisneria* (*Vallisneria gigantea* Gräbner, 1912) is one of the most rewarding water plants which one can have growing in one's aquarium. It is, really, a large plant for a large aquarium. The light green leaves can measure up to 2 metres (c 6.6ft) in length and they can be 2-3.5cm (0.8-1.4in) broad and will lie as a thick layer on the surface. It is not often one sees a really dense plantation of the Giant *Vallisneria*, because there are such a lot of other plants which the aquarist also wants, and needs, space for.

MAGNIFICENT COMBINATION

I have had quite a bit of success in growing the Giant *Vallisneria*, together with *Cryptocoryne trillium* (synonym: *C. neollii*) and *Cryptocoryne pontederifolia*. The long leaves of the Giant *Vallisneria* will moderate the light

Danish aquarist and author **Jørgen Wimo** offers some useful guidelines for the successful cultivation of this attractive, but substantial, plant.

Photographs by the author

so much that green algae, and especially thread algae, will not be able to grow on the leaves of the *Cryptocorynes*, but there will still be enough light for the *Cryptocorynes* so they grow at a reasonable rate.

A very beautiful interior can be created by allowing a long and strong *Vallisneria gigantea* to grow together with the low and decorative *Cryptocoryne trillium*, which, if left undisturbed, can cover the whole bottom of the aquarium as a green carpet. This is a magnificent sight which is, unfortunately, not seen very often.

AQUARIUM REQUIREMENTS

A plant as large and fast-growing as *Vallisneria gigantea* needs a lot of light and nourishment, but the light must not be that intensive that the top leaves turn yellowish. They must be light green and without layers of lime.

The nourishment in the aquarium might very well come from the mulm produced by the fish. In the aquariums where I grow plants I only clean the bottom layer every five years! Dirt is removed every week or so, but the bottom layer is only disturbed when I



This close-up of a Giant Vallis leaf tip shows the parallel inter-connecting veins beautifully.



Before opening, the male flowers are 'encased' inside pointed leaf-like bracts.

move the biggest plants every third month.

For a Giant Vallis to show reasonable growth, there must be iron (Fe) in the water, the pH value must be low (acidic) and the contents of oxygen around the roots of the plant must also be low. That is why such plants grow very well when the bottom layer is old, 'dirty' and not disturbed by a bottom (undergravel) filter.

NATURAL DISTRIBUTION

In nature, *Vallisneria gigantea* is found on the islands of Luzón and Mindanao, in the Philippines and in New Guinea.

They are found in rivers, small streams and lakes, and in water holes in swampy areas, where they often grow in a water depth of only 20cm (8in), with leaves measuring 2 metres (c 6.6ft).

CHARACTERISTICS AND PROPAGATION

From an onion-shaped rhizome arise short roots and up to 15 long leaves. The leaves are light green with approximately 15 longitudinal veins which are connected with each other.

The plant is single-sexed, so there are separate male and female individuals. The female plants should be the more common, but all my plants are males.

Propagation is most commonly effected by means of runners. The easiest way to get a lot of plants is as follows: Two to three weeks after planting a *Vallisneria gigantea*, you will see two or three runners coming out from the

rhizome, with a baby plant spreading every 5 to 15cm (2-6in). Each runner can carry from one to seven new plants.

When roots have developed on all the new plants, you can carefully take them all up, separate them and re-plant each plantlet where you want it to grow. You can repeat this every few months and, before six months have passed, you won't know what to do with all your plants!




As the male flowers open, their delicate nature can be fully appreciated.



Once fully opened, the male flowers float up to the surface, leaving behind an empty, almost transparent, 'cup' with a central 'cone'.

Male and female flowers look like those of *Vallisneria spiralis* but are larger (2 to 3 cm — 0.8 to 1.2in long). The male flowers are positioned on a short stalk, united in a close inflorescence and surrounded by two green leaf-like bracts. When these come apart, the male flowers will surface and float around as small light green cones measuring 1mm (0.04in) in diameter.

The female flowers are green and sit on long stalks surrounded by a 2-3cm (0.8-1.2in) long and 4mm (0.2in) thick twisted

leaf. They will also float around on the surface where fertilisation takes place when a female flower meets a male flower. 

SCIENTIFIC DETAILS

Order: Hydrocharitales.

Family: Hydrocharitaceae.

Genus: *Vallisneria*. Linné, 1753.

Named after Antonia Vallisneri de Vallisnera, professor of botany in Padua, 1661-1730.

Species: *gigantea*. Gräbner, 1912; the name *gigantea* means gigantic.

A variety (subspecies) of *Vallisneria gigantea*, known as *Vallisneria gigantea rubra*, hort., has red brown leaves and dark veins. I do not know where it comes from, but it is said to grow in the same place in nature as *Vallisneria gigantea*. This variety has been known since 1977.

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Alex Stephenson

LETTING IT SHOW



Alex Stephenson takes a 'sideways' look at fish shows and the truly impossible job facing Judges.

Illustration by the author

Those of you who regularly go to fish shows will already be familiar with most of what is to follow. To those who don't attend, perhaps these words may provide some encouragement to do so.

A fish show is a congregation of fish owners, together with friends, relatives, and hangers on, who assemble at a given place in order to have their respective fishes assessed by other experienced fishpersons known as Judges. The whole thing is stage managed by members of a club or organisation who swear they will never get talked into it again.

The opening scene is often one of controlled chaos, with exhibitors arriving at a church hall or similar venue to find the car park already full. Having resolved this problem, each in his or her own way, they form a disorderly line for the 'Booking In' ceremony.

This completed, assorted fish in assorted containers are brought forth and tastefully arranged according to species, etc. During, and for a short while after, this activity — known as benching — exhibitors may be seen taking the opportunity to assess the merits or otherwise of the competition. Whispered discussions take place in small groups. Phrases such as: "Is it supposed to be that colour?" and "Must have had it at least a week!" may be overheard.

These sporting comments are brought abruptly to an end when one of the official stewards indicates the desire to have the hall vacated to allow judging to commence. It is not normally put quite like that, but we know what is meant.

There now follows a long period when fishfolk are supposed to amuse themselves. Many shows have trade stands; most have raffles or some other diversions; one or two even have an auction.

Having spent more than you intended, due to unrepeatable bargains at the trade stands, gambled a small fortune on the raffle, and got stuck with something you didn't want in the auction, you seek sanctuary in the nearest Pub — the same Pub it seems which found favour with most of the other exhibitors and friends. And so the conversa-

tion takes up where it left off: "You know the Judge I mean, Myopic Mac", and so on.

A word here about Judges. These are men and women who bravely do what no sane person would attempt. They score each of the fishes exhibited and place them in order of preference. As everyone knows, if there are ten fish with ten different owners in a class, the Judge is going to make nine enemies! Judges, on the whole, are knowledgeable and dedicated people who give up their time to provide a service for us. They therefore deserve expenses paid, free lunches, and police protection!



He's certainly taken it hard! That fish has never been beaten before!

There is not a Judge in the world who fully appreciates a fish's merits in the same way as the owner. None of us who exhibit fish ever agree with the result. Even if we win, we would have put the minor placings in a different order. All this is, of course, quite irrelevant, and, mercifully, quite unknown to the Judges. At least, it should be. . .

Although most exhibitors enjoy fish shows (why else would they do it?). It seems

fairly certain that most fish do not share this enthusiasm. For them, spending the day in a bare glass box, being stared at by strange people, has little to offer. It is a rare fish indeed that can maintain a sense of occasion throughout the proceedings. The best one can hope for is for one's fish to be hurling streams of abuse at the Judge when he or she is allotting the points. At least, while doing this, the fish will show itself, instead of impersonating a sunken galleon.

Whatever kind of fish you show, presenting it properly is a must. How this is done, and the work involved, can depend on the type, or, more accurately, the size of the fish. This always reminds me of musicians: the flute player strolling in, all smiles, producing the instrument from an inside pocket, while the percussionist struggles with half a ton of equipment. Likewise, the exhibitor of Mosquito Fish and suchlike can produce them from a briefcase, whereas the Goldfish exhibitor needs a lorry and a team of Sherpas just to cart the water.

Apart from club-type shows, which have classes for just about every sort of freshwater fish, there are a number of specialist shows throughout the year. Organisations whose interests are Livebearers, Catfish, Goldfish, etc, all hold shows covering their particular branch of the hobby. These shows usually incorporate many Breeders Classes and are ideal functions for contacting amateur breeders who can help further your interests. Many people, in fact, use them as hunting grounds when in search of information or stock.

Speaking of hunting grounds, the Pub has gradually emptied, many of the occupants having gone to visit a local fish emporium in search of additions to their collections. These people may be observed later secreting mysterious items in plain brown wrappers into motor cars.

By now, the judging is almost over and many of the results are known. The returning owners crowd around the score sheets. Disappointed fishkeepers are not famous for their dignity in defeat. The moods range from philosophic acceptance to suicide! Just to rub it in, the winners are, naturally, elated. If you thought earlier conversations were a little spiteful, you will now be appalled at some of the outbursts.

It doesn't last long, though. Composure restored, it's time for prize giving, debenching and the journey home, to reflect and compete another day. While we are reflecting, it is worth remembering that the people who organised the affair still have several hours of work ahead, clearing up the mess we have made.

Finally, just in case any fish Judges have actually read all of this, I would like to add that fishkeepers really do appreciate their efforts. This is borne out by the fact that, despite all the disagreements, no Judge has ever been assassinated. **ASP**

DIARY DATES

Note to Society secretaries: Please send us details of your Society activities in good time (8 weeks prior to publication of relevant issue of A & P) and we'll be pleased to publish them in our 'Diary Dates' section.

QUARANTINE — HAVE YOU ISOLATED THE PROBLEM?

Peter Skinner of Koi Kraft continues his wide-ranging series on Koi keeping with a look at essential 'early' care.

Photographs by the author.

Probably the most exciting part of Koi keeping is purchasing new fish. It may take hours of scouring the tanks of the local (or not-so-local) Koi dealers until you find that special fish which has eluded you until now.

Before you make your purchase, you check to see that there are no blemishes on the fish and that it is swimming and behaving as it should. On arrival home you float the bag in the pond for the prescribed time so as to avoid temperature shocking the fish when it is released. The other fish venture close to the bag to check out their new companion. Eventually, you release the fish and it swims away and joins the pack and cruises around the pond as if it has been there all its life.

The above sequence of events is exactly how the purchase of new Koi should be but, occasionally, this enjoyment is tempered by health problems with new arrivals which can sometimes be passed on to the original occupants of the pond.

INQUEST

Why? What did I do wrong? What is wrong with my pond? Was the journey home too long for the fish? Did I buy infected fish? These are some of the questions that the panic-stricken Koi keeper will be asking in an attempt to establish the cause of the problem.

In fact, as long as the fish are properly bagged using oxygen, and you arrive home within a few hours and, provided the fish are not temperature-shocked and your existing fish have been thriving, it is more than likely that the problem can be traced back to the way the fish have been treated since arrival in the country.

STRESS Immune System

The standard of health of any fish is in direct relation to the quality of the water in which it is kept and the amount of stress to which it is subjected.

Carp in the wild would normally enjoy good water quality and would rarely be exposed to stressful situations. As a result,



This is a sample of mucus taken from the skin of a Koi showing one *Gyrodactylus* (Skin Fluke). These parasites are not clearly visible with the naked eye, so a microscope is required to detect their presence. This shot is taken at x40 magnification.



A microscope will be required to determine the presence of all but the very largest of parasites.

the immune system of the fish would usually be successful in resisting the various disease organisms.

Effects of Stress

A fish that is subjected to stressful situations will not always appear to us to be any

the worse for wear but, in fact, stress causes an insidious weakening of the immune system which will open the way for opportunistic pathogenic (disease-causing) organisms. It could take weeks or even months for the immune system to recover once the source of stress has been removed. Unfortunately, it would be very rare indeed that, throughout this period, the fish would not come into contact with a life-threatening bug of some kind.

In practice, it is a race against time between the immune system regenerating sufficiently to displace the disease, and the disease developing to such a degree that it, in itself, causes stress in the fish, thus preventing the immune system from functioning as it should.

This is a vicious circle which can be broken only if you identify the cause of the stress so that it may be removed, also maintaining a therapeutic concentration of the appropriate medication at the time when the fish is most likely to contract a disease.

Fish in Transit

Obviously, the transport of fish from place to place will cause a certain amount of stress. In fact, some very long journeys can be so traumatic that the fish do not survive. This is rare, providing that the fish are carefully handled and properly bagged.

Fish imported from the Far East will have a journey of about 10-15 hours and fish may be in the bags for a few hours more while waiting for the flight. On arrival, they are likely to have to wait a few more hours in their bags while they clear customs and are transported to their new holding facility.

It is normal practice for several fish to be transported in each bag; consequently, the water quality will deteriorate and the oxygen levels will be depleted. The longer the fish stay in the bags, the more they will be stressed and, of course, the longer they will need to recover from their journey.

If all goes well during the trip from oriental pond to UK holding facility, there will be no casualties on arrival and the fish will recover quite quickly. Unfortunately, there are so many stages in the journey that, often, there will be problems along the way which will inevitably cause extra stress. A delayed flight, a bottleneck at customs, or even substandard holding facilities at source, would make an enormous difference to the health of the fish.

Before fish are transported over long distances, they are usually kept without food

for a few days which, consequently, will reduce the amount of pollution in the water while they travel. This practice is good in the short term because the fish will arrive in better condition but, sometimes, it can mean that the fish will lose weight, particularly if they do not resume feeding soon after arrival. I have known cases where large fish have not taken food for some weeks after arrival because of the stress caused in transit.

Settling In

On arrival in this country, the fish should be kept in well filtered and aerated water and in slightly subdued light and should not be disturbed for a minimum of two days. This period will, at least, allow them to settle down and they should then swim normally and be ready to accept some food.

Most of the fish should come to the surface quite quickly to take some floating food, but there will usually be some which will ignore both floating and sinking pellets. These fish can be encouraged to feed by putting some flake food in the tank and then agitating the water gently to make the food sink slowly. Even the most stubborn fish finds it difficult to resist a little flake moving past its nose!

PARASITE THREAT

During the following few days, the fish are most susceptible to disease invasion and so they should be treated appropriately. The first and most serious risk is that posed by parasite infestation.

Most parasites are opportunistic, which means that they will usually cause a problem only when the fish are weak and less able to resist attack. For this reason, it is vital that all new stocks are checked for parasites. This involves carefully taking a mucus scraping from the skin of the fish and placing it on a slide so that it can be examined under a microscope.

There are some parasites which can be seen clearly with the naked eye such as *Lernaeus* (Anchor Worm) and *Argulus* (Fish Louse), but, although new arrivals may be host to some of these, they do not present an immediate threat to the life of the fish. It is the microscopic parasites which are highly dangerous if not kept in check, especially as some of them have very fast procreation rates.

For example, a fish with ten parasites on it when examined could have many thousands a few hours later.

DIAGNOSIS AND TREATMENT

If there is someone available who has the specialist knowledge to diagnose disease problems at an early stage, then the correct treatment can be administered without delay, but if such a person is not available, then the fish should be given prophylactic (preventive) treatment.

Salt should be added to the water at 0.8oz per gallon (5g per litre). This should be pure salt, and must be dissolved properly. As a back-up to this, malachite green and formalin should be added to the water at the



This Koi has a large ulcer which, if not treated quickly, will lead to septicaemia and/or dropsy and death.



Treatment with antibiotics is sometimes the only effective means of therapy. Injection is the most precise means of administration of these drugs, but the fish will need to be anaesthetised to allow safe handling.

recommended dose rate (follow instructions on the pack very carefully!). Choose a formulation of this product which is intended to be used on a multiple-dose basis, because maintaining a constant therapeutic concentration for several days is much better than treating just once.

If the fish respond well to the treatment and are feeding and moving normally after about ten days, then the risk of severe parasite problems will slowly decline as time goes on and the salt content can be reduced slowly.

Some people prefer to keep their Koi in salt on a permanent basis. There are advantages and disadvantages to this but, personally, I feel uneasy about keeping fish in salt permanently because carp were designed to live in fresh not salt water.

BACTERIAL INVASION

The next biggest threat to the health of the fish is that from bacteria. Many of the bacteria which cause problems among Koi



This Koi has advanced septicaemia. Notice how the reddening is spread all along its underside and the vent is particularly red. If an infection is allowed to progress to this stage, the fish has only a slim chance of survival.

are opportunistic in much the same way as the parasites. Bacteria, however, can cause harm to a fish from the outside and inside.

If the mucus layer on the fish has been breached and the skin has been damaged, this can allow the entry of bacteria under the scales or into the subcutaneous layer (as in the case of semi-scaled or scaleless fish) and you have the makings of an ulcer.

Bacteria can also cause problems within the fish; they can attack the gills (bacterial gill disease) and cause severe damage. In its early stages, this condition is hard to spot and can lead to the destruction of the gill filaments and, subsequently, the death of the fish.

Sometimes a bacterial infection on any part of the fish can lead to septicaemia (the presence of pathogenic bacteria in the blood). This is a very dangerous situation because the blood can then communicate the disease to vital organs.

Antibiotics

Generally speaking, if the fish are kept in good conditions when they arrive, there shouldn't be too many problems caused by bacterial infection. Any wounds should be cleaned up and the application of the correct antiseptic preparation should be sufficient but, sometimes, the administration of antibiotics will be necessary. This may be by bath, injections or medicated food.

Antibiotics should be used under supervision of an experienced person and, even then, only as a last resort. The misuse of antibiotics can sometimes cause problems, rather than solve them.

If the fish are being treated for bacterial infections, they should be kept in warm water; this will accelerate their recovery. They should be monitored carefully so that if any fish should suffer a relapse, it can be treated early.

REMAINING PARASITES

The last main consideration with new stock is that of any remaining parasites such as Anchor Worm, leeches, Fish Lice and intestinal worms. These parasites can be killed without too much trouble by the use of proprietary medications (with the exception of intestinal worms).

Care must be taken with any fish which has been infected by Anchor Worm because, even after the death of the parasite, the anchors will be left embedded in the skin of the fish. If the anchors are not removed, it is likely that the area will become infected at a later date.

Fortunately, intestinal worms are not as common as the other parasites mentioned above, but they can be killed with the appropriate medication available from your vet.

PURCHASING FISH

When you next purchase fish, if you want to find out whether or not the stock have been fully quarantined, you only need look at the state of health of the fish. If some are



A group of healthy Koi. Notice how they are evenly spread. Unhealthy Koi usually hold in their pectoral fins and remain almost still at the bottom of the tank/pond, or hang just below the surface of the water.

gasping at the surface, holding their fins clamped or have ulcers then, obviously, the treatment regime at that establishment is not sufficient.

Try to find out when the fish arrived in the country. If they have been here for less than two weeks, this will confirm that they have not been fully quarantined because, for most treatments to be effective, they must be administered as a course which may take several days. This, together with the settling in period and the observation period after treatment, means that two weeks must be regarded as the minimum quarantine period.

The space available in this article does not really do justice to the magnitude of this subject. For this reason, I have outlined only the basic principles and practices in an attempt to unravel the mysteries surrounding unexplained mortalities soon after purchase. I hope to cover more aspects of disease prevention and treatment in a later issue.

POSTSCRIPT

I was recently approached by a man who was having problems with his fish. He was mystified as to why they were dying one after

another. I suggested that had they been properly quarantined, he wouldn't be experiencing these problems.

He told me that he had purchased the fish six days previously and that they had arrived two days before that but were fully quarantined. Responding to the puzzled look on my face, he said that the dealer had told him that the fish had been fully quarantined in Japan before dispatch. Oh dear!

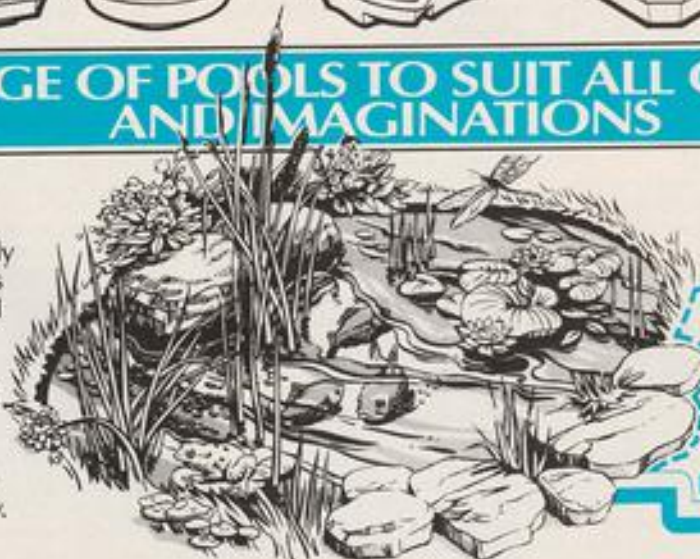
MAIN CAUSES OF STRESS

- Rapid changes in water temperature (temperature shock)
- Overcrowding
- Lack of food
- Disease
- Rough handling
- Netting too frequently
- Predators
- Tanks/ponds too small (a fish always needs to have the opportunity for a quick getaway when frightened)
- Sudden shocks (such as banging on a tank)
- Medications (some more than others)
- Poor water quality:
 - Deterioration in water conditions as a result of inadequate filtration
 - Toxicity as a result of treatment overdosing or the presence of other pesticides, heavy metals, chlorine, etc
 - Inadequate oxygen content



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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:

Your Questions Answered, The Aquarist & Pondkeeper, 9 Tufton Street, Ashford, Kent TN23 1QN.

Herpetology, Julian Sims. Koi, John Cuvelier. Tropical, Dr. David Ford. Coldwater, Pauline Hodgkinson. Plants, Barry James. Discuss, Eberhard Schulze. Marine, Graham Cox.

MARINE

GORDON KAY TAKES OVER Y.Q.A. FROM GRAHAM COX

After almost 30 years as our resident marine expert, Graham Cox is 'retiring' from Your Questions Answered. We would like to offer Graham a heartfelt vote of thanks, both on our own behalf, and that of our readers,

for the sterling service he has so unselfishly and enthusiastically provided over the years. We also wish Graham continued success with Waterlife Research Industries Ltd.

Gordon Kay, who takes over

from Graham as from this month, is already well-known to A & P readers as our regular 'Seaviewer' and contributor of frequent eminently readable and informative features (his latest article: **Different Look-**

alikes appears elsewhere in this issue of A & P). Please address all future queries. **For the attention of Gordon Kay, Your Questions Answered, and post, enclosing an S.A.E. to the A & P office (address above).**



FAR-REACHING QUESTIONS

I would like to set up a 6ft

(180cm) marine aquarium and would welcome your advice on equipment, materials, best rock salt to use, filtration system, setting up, etc.

P.S. — I have had a Ribbon Eel in my first tank for three years now. It measures 3ft (90cm) in length.

Your letter contained so many different, far-reaching points and questions (the main ones being mentioned above) that I find it impossible to answer constructively. You are, really, asking something akin to "How long is a piece of string?". There are so many considerations to account for; things like:

How much money can you devote to the project?

What type of animals do you wish to keep (invertebrates need far different care and equipment from Coral-fishes)?

... and many others.

Given answers to these basic types of question, I could give far more concrete, positive advice. In the absence of these, I can only suggest that you go back to the very beginning and read.

Read everything you can lay hands on (there are several excellent books about) until you become well acquainted with all of the many different filter systems and techniques around in the 90s. When you fully under-

stand all that you have read, you will then be able to make informed choices.

Also, visit shops, have a good look at their live and dry stocks ... and ask for details of anything you find interesting.

I'm sorry that I haven't told you what you wanted to read, but perhaps you would like to write again when you know which way you want to go. I would then be delighted to be able to offer you more detailed advice.

P.S. — Congratulations on your Ribbon Eel. At 36in (90cm) long, it is now adult size. Just don't be tempted to add anything else to the aquarium ... please!

COLDWATER

ANTI-CAT PROTECTION

My pond was completely cleared out of fish some time ago and I haven't re-stocked it since. Before I do, I would like to know what devices there are on the market to protect fish from cat attacks.

I can well understand your worry about the cat visitors to your pond and the need to protect your fish. In fact, I have had enough experience with clever angling felines to last me a lifetime! The uncanny thing is that it is always the most valuable, or the most beautiful, or

best-loved, fish which are caught.

Unfortunately, at the time of writing, there is nothing I know

of on the market which might be termed as a cat deterrent. Actually, there would probably be a public outcry if there were;



Unfortunate cat-attack victim.

after all, there are many cat lovers among us, and such a gadget might be seen to be cruel, even if it only operated as a thing which scared off the animal.

The only sure way to protect your fish is to net the pond. Yes, I know it spoils the whole concept but, in the end, it does the job well. I, personally, like the dark green netting which you can buy from the garden centres, as many of the pale green net sold in aquatic outlets has a rather fine mesh and therefore really does restrict the view of the fish.

HERPETOLOGY

AXOLOTL SUPPLIES

I am very keen to take up Axolotl keeping. However, I don't know where I can obtain captive-bred specimens from. Can you help?

With regard to the acquisition of captive-bred Axolotls, *Aquarist & Pondkeeper* reader, Mr T Byrne of Southampton, has recently written to me asking about possible outlets for some Axolotls which he has bred. I would suggest that you contact him first at the following address:

Mr T Byrne,
69 Nelson Road,
Freemantle,
Southampton.
Tel: 0703 780609.

If this potential source fails, then I would be inclined to place a request in the advertisements section of the regular



A dark wild-type Axolotl. This and other types of this interesting amphibian can be obtained from various sources.

monthly newsletters of the leading herpetological societies and the quarterly *Bulletin* of the British Herpetological Society. The relevant addresses to contact the editors are as follows:

Association For The Study Of Reptilia And Amphibia (ASRA)

ASRA's monthly newsletter is called *The Rephiberary*. To place a 'wanted' advertisement for Axolotls, details including colour and number required should be sent to:

Trevor Rose,
the Rephiberary Editor,
19 Longmead,
Abingdon,
Oxon OX14 1JQ.
Tel: 0234 520665.

If so happens that Trevor Rose has bred Axolotls in the past and may still have some surplus animals available.

South Western Herpetological Society (SWHS)

The monthly newsletter of the SWHS is produced by the Society's Secretary:

Frank Gibbons,
"Acanthus",
59 St Marychurch Road,
Torquay,
Devon TQ1 3HG.

International Herpetological Society (IHS)

To place a 'wanted' advertisement in this society's

monthly newsletter, relevant details should be sent to:

Tony Mobbs,
65 Broadstone Avenue,
Walsall,
West Midlands WS3 1JA.

British Herpetological Society (BHS)

The *Bulletin* of the BHS is edited and produced by John Pickett and Simon Townson. Relevant details of your request for Axolotls should be sent to:

John Pickett,
84 Pyrlles Lane,
Loughton,
Essex IG10 2NW.

With regard to the commercial supply of amphibians in general, and Axolotls in particular, you might try:

Blades Biological,
Scarletts Oast,
Furnace Lane,
Cowden,
Edenbridge,
Kent TN8 7EG.
Tel: 0342 850242.

If this specialist biological supplier cannot help you, then several other suppliers of amphibians and reptiles now regularly advertise in *Aquarist & Pondkeeper*.

Another source of suppliers of amphibians (and reptiles) can be found in the Animals & Pets section of *Exchange and Mart* — published weekly. For example, there is a supplier of

herpetiles in the West Midlands who frequently advertises in *Exchange and Mart*:

Midland Pet Aquarium &
The Serpentarium Ltd,
8 Freer Street,
Walsall,
West Midlands WS1 1QD.
Tel: 0922 34657.

Rep-Tech in Buckinghamshire are very large suppliers of wild-caught and captive-bred amphibians and reptiles to the pet trade. Contact them at the following address:

Rep-Tech,
P.O. Box 303,
Wooburn Green,
High Wycombe,
Bucks HP10 0LY.
Tel: 0494 680022.

However, as you are not a trade outlet, Rep-Tech might not directly supply you with livestock. As an alternative, they should give you the name of the pet shop in the Glamorgan area with whom they do trade.

The Pet Shops section of the *Yellow Pages* will also give the names and addresses of most of the local suppliers of animals (specialist and general) in your area. You could try these potential sources.

Finally, you could place an advertisement for Axolotls Wanted in *A&P* and/or *Exchange and Mart*.

DISCUS

MIXED BAG

I am setting up a tank measuring 48 x 18 x 18in (120 x 45 x 45cm) for Discus and will be using either Tetra foam filters, or a gravel bed.

My question is, by using two Tetra Super Brilliant or two Super Brilliant Pro, will this be enough?

Can you also tell me the difference between the Peruvian Green Discus and the Tefe Green Discus? Finally, how can I tell the difference between wild-caught and tank-raised Discus?

Regarding the filtration of your aquarium, you give me very little to go on. As such, two air-operated Super Brilliant or Super Brilliant Pro should cope with the volume of water of your aquarium. However, this will

also very much depend on the number of fish you intend to keep, the frequency and amount of water changes, and also (to a lesser extent) the type of food you are using.

Sponge filters have a very large surface area and are also much easier to maintain than other types, but you should remember never to clean both of them at the same time.

The difference between a Peruvian Green and a Tefe Green Discus are basically the body colours. The Peruvian Green Discus was collected in an area around Leticia in Colombia in the 60s and 70s by R Wandurruga. It seems that when Mr Wandurruga died in the late 70s, he took the exact

location with him and, as far as I am aware, they have not since been seen in Europe. What made these fish different from any of the other recognised varieties, was the overall speck-



No wild-caught Discus is ever this colour. There are other differences too.

led effect of their body colour, showing red, blue and green.

The Tefe Green Discus will have a golden-brown body base colour, blue and red markings above the head and going into the body. The centre of the body will have a number of red spots. In a superb specimen, these spots will cover the entire body and will often form horizontal lines. These fish are generally known as Royal Green Discus.

Wild-caught Discus will almost always show a beautiful golden to golden-brown body base colour, whereas in tank-bred Discus fish the body base colour is usually grey, or silvery-grey, sometimes with a slight tint of golden-brown.

TROPICAL

FLICKING/YAWNING KRIB

I have a tropical freshwater tank containing a mixture of community fish, including Kribi which have spatoned several times.

However, the male rubs himself against the rocks and 'yawns' quite frequently. I've tried a few remedies but the behaviour still continues. Can you help?

Flicking, scratching and yawning are certainly characteristics of irritation and may indicate body and/or gill flukes. However, since you have treated your tank for parasites, these should not be present. Sometimes, the eggs of parasites survive the treatment, but a re-dose after a 50% water change is effective.

Assuming the flicking, etc. continues, then the cause is not parasitic. Often, it is something toxic in the water, from ammonia excreted by the fish, to nicotine from smokers in the home.

Remember that the solution

to pollution is dilution! Do some regular partial water changes and see if the trouble stops. Also, get a nitrite kit and test the water ... any nitrite means ammonia is present too. Keep both contaminants at zero via a good filtration system.

MOONLIGHT MADNESS

I have had what I think is a pair of Moonlight Gouramis for three years now. They measure 4 1/2 in (11.4cm) and 5 1/2 in (14 cm) but I can't see any great difference between them.

I have been told that the dorsal fins of male and female Moonlights are much more similar to each other than they are in, say, blue Gouramis. Is this true?

My fish are in a 3ft (90cm) tank maintained at 86°F (30°C). I have partitioned the fish off to see if this will help in my attempts at spawning them. The 'male' seems really mad to get to the 'female' but 'she' doesn't seem to be very interested!

The Moonlight Gourami



Moonlight Gourami — the most easily detectable difference between the sexes (other than in older specimens) lies in the colour of the pelvic fins.

(*Trichogaster microlepis*) is found in still waters in places like Thailand and Cambodia where they are taken as a food fish. Most trade species are farmed in the Far East and do not grow to the size (6in — 15cm) of the wild fish. At (11.4in — 14cm) you have good adults that could possibly be wild fish.

The problem with the species is that they are timid, so the male must be very contented to build a bubble nest. Yes, the dorsals are similar; the most easily detectable sex difference

is in the pelvic fins which are orange to red in males, yellow in females. Perhaps you do not have a true pair?

You are correct to separate the pair temporarily (if they are a pair) with a tank divider. The water level must be low to give moist, still air over the surface. Water should be of medium hardness and neutral to slightly acid, temperature up to 86°F (30°C), so that is OK.

If the eggs are laid, remove the parents as soon as possible and have Infusoria standing by.

PLANTS

SHADE/FENCING PLANTS

We are planning a pond for our garden, and although the majority of the pond area will be in the sun, there is one edge along by a fence, which will be mainly in the shade of the fencing.

Can you please advise on any



The Giant Reedmace (*Typha latifolia*) is a tall, elegant, but invasive, marginal.

attractive marginals which thrive quite happily in shady conditions? It does not matter how tall they grow, as we would not mind part of the fence hidden anyway. Are there any suitable species in the reed family?

Secondly, can you tell me the best time to dig out and plant a new pond?

The taller Reedmaces (Bullrushes) will grow 6-8ft (1.8-2.4m), so there would be no problem for them to reach the sunlight. *Typha latifolia* is the more robust, but *T. angustifolia* reaches the same height but has more graceful foliage.

Caltha polypetal, *Carex* species, *Lynchnum americanum*, *Iris pseudacorus* and *Iris pseudacorus variegata* will also thrive in this situation.

Anytime, weather permitting, is fine for constructing modern ponds, but concrete is best used in the warmer months (but not too dry).

Plants are nowadays all offered in containers, so anytime is suitable for planting. Fish are best added around April.

KOI

PREVENTIVE POOL TREATMENT

We would like to start treating our pond to prevent outbreaks of disease and would therefore welcome your advice on what treatments to use and at what dosage levels.

We would also welcome details of a good book dealing with fish health.

I'm sorry to advise you that I'm one of those characters who do not believe in preventive treatment for Koi pools.

I have always felt that, provided no obvious problems occur with specific fish, more harm than good will come from indiscriminate dosing with chemical additives.

As long as good husbandry is practised, with new fish being strictly quarantined, the chances of random infections with parasites, etc. are pretty remote.

However, the *Interpet Manual of Fish Health* should always, in my opinion, have pride of place on your bookshelf. It will prove indispensable in the event of any calamity.



A good book to have within reach at all times.

What's your opinion?

By Billy Whiteside,
BA, ACP



MARINE TANK SIZES

Marine aquarist **Dave Kershaw**, who is secretary of the West Yorkshire Marine Aquarist Group and lives at 12 Miller Avenue, Sandal, Wakefield, West Yorkshire, writes: "You ask, 'What is the smallest size of marine tank recommended and what would it cost to set up?' The standard answer should be 36 x 15 x 15in (90 x 38 x 38cm) at about £200, but this is misleading. More correctly, the size of tank must depend on many factors:

- "(a) what you wish to keep;
 - "(b) compatibility;
 - "(c) time available to service your tank;
 - "(d) your experience with marines; and
 - "(e) how keen you are.
- "Let's try to deal with these one at a time.

"First, what you wish to keep. This should apply to all branches of fishkeeping, not just marines. I have bred Guppies in the fruit bowl on the sideboard to prove a point; I keep and rear Dwarf Sea Horses in five-gallon (22.5-litre) tanks; but would need a 100-gallon (450-litre) tank even to start thinking about a Red-Tailed Catfish or a Nurse Shark. You have to match the tank size to the fish you wish to keep. Remember: a minimum of two gallons per inch (9 litres/2.5cm) of marine fish — and they grow!

"Compatibility can also be a problem. Two Angels living happily in 60 or 70 gallons (c 270-320 litres) would fight to the death in 30. All is really trial and error; but think about the species first. Do they shoal? Do they live in pairs? Do they stay

in one location on the reef or range over a wide area? What or who do they eat? [See also *Seaview June and July*, Ed.]

"Available time is probably the most important factor. If you can't find a couple of hours every week to service the tank, don't keep marines. Large-system tanks can be very stable — marine fishkeeping is really all about keeping water — needing servicing only once a week; while a two-foot (60cm) tank requires daily attention.

"Experience is a pearl beyond price: it can't be taught, it can't be bought, and technology can only try to replace it. With the more expensive modern systems much of the water quality is monitored; but still things go wrong. After a year or two, you go past a tank and know when something is amiss. Start with the easy species that will let you make a mistake. The experience factor also applies to tank size: a small tank can be very unforgiving.

"Enthusiasm is the vital factor. This overcomes all obstacles, finds answers, solves problems and achieves the nearly impossible. As a 15-year-old I started keeping native marines in an 18 x 12 x 12in (45 x 30 x 30cm) angle-iron tank; this was 31 years ago. I had no money, no artificial salt, no equipment and very little available knowledge; but I was enthusiastic. Every trip to the coast ended with bottles of collected seawater and a grumbling father, but the rockpool fishes lived.

"Finally I will try to answer your question. With experience and enthusiasm you can keep Dwarf Seahorses or some of the smaller Gobies in less than five gallons (22.5 litres) of water, with only an air-driven sponge filter. The cost is less than £20. Ideally, you should start off with not less than 50 gallons (225 litres) and as many technical aids as you can afford: cost £500. Realistically, a three-foot tank with an undergravel filter and a power head, plus a little enthusiasm, should prove more than adequate. What about invertebrates? Well, that's a totally different matter!

"May I pose a question? Has anyone ever frozen marine fish to death? I run each of my

60-gallon (270-litre) tanks on a 50-watt heater. I had a heater fail in February and lost no fish; but I know several people who have boiled their tanks. My heaters are on most of the time so the contacts tend not to 'carbon up'. The brighter marine lights slowly bring the temperature up in the day time, and 60 gallons takes a long time to cool down. What do you think?"

ALAN'S MIXED BAG

Alan O'Brien's home is at 86 Blumfield Crescent, Slough, Middlesex, and he is a regular contributor to this column. He writes: "Regarding my last letter and my problems with a marine cure, I wrote to the manufacturers asking for some sort of explanation. They did not bother to reply. I would expect better from an organisation with a named person as its head. Eventually, I sorted the problem out and am glad to say all is back to normal.

"Sorry to hear that you continue to lose your Angels, but I agree with your conclusion that the algicide probably caused irreparable internal damage. I look forward to the day when manufacturers are forced by legislation to print the contents of their 'cures' on the bottles so that we can see for ourselves what we are giving our pets.

"Now to the topics you raised recently. The query about the cleaning of existing UG filters is a good one which will affect me in the future — especially as my filters are of the modular kind. I confess that I have no idea other than stripping the system how best to clean UG filters. I look forward to comments from others. Fortunately, it should not be necessary to clean them very often, provided a reasonable level of maintenance has been employed. I do not expect to remove mine for cleaning before five years at least.

"Plant suppliers are becoming more numerous these days and I have tried many. Of these, I can wholeheartedly recommend Ocean Aquatics. I have used them on several occasions and have always received plants in excellent condition. Their catalogue is also quite colourful and

interesting to read. I have no connection with this organisation.

"Marine system minimum size is very important. I believe that a 36 x 12 x 15in (90 x 30 x 38cm) tank should be the absolute minimum. This will hold about 22 gallons (100 litres) of water before coral gravel and decorations etc are added. Even then, only 5½in (c 14cm) of fish could be added over the first six months, with this doubling to 11in (c 28cm) maximum over a year.

"This is an absolute maximum stocking level. Incidentally, I would not stock my marine system in excess of 75% of the maximum system capacity. The main problem with marines from the aquarist's point of view is that they come from an extremely stable environment and are therefore not equipped to adapt to the variable water quality they experience in captivity — even in the best system. Thus, as big a system as possible will ensure that water quality is more stable and easier to maintain. I can tell you from experience that keeping anything other than very hardy marines in a tank of the size stated is not easy. I read somewhere that the most popular system size for marines in Europe was approximately 100 gallons (450 litres). As most people look on a 36in (90cm) tank as 'big', what would they think of a 100-gallon system? Mine is about 75 gallons (c 338 litres) and I find this about right. It is easy to maintain and holds about six 2-3in (5-7.5cm) long fish.

"Conversely, my tropical freshwater system of the same size holds about 20. No surprise then that some people stay with tropical freshwater systems for the increased quantity of fish that can be maintained in the same sized system."

Like Alan I, too, have bought plants by post from Ocean Aquatics and have been equally impressed by the quality.

SUCCESS WITH PLANTS

Plants also feature in the next letter. Sreedhar Mudaliar wrote to me from 316 Convent Way, Southall, Middlesex, say-

ing: "I was very interested to read about your untouched Kribensis tank in the Silver Jubilee edition of W.Y.O.? I was so happy to read that at least someone is having success with a thriving tankful of plants.

"I set up my 30 x 12 x 15in (75 x 30 x 38cm) tank many times; but the plants in it just died eventually; even though they lived for a long time, they didn't grow big. They produced smaller and smaller leaves and I had to throw them away. I had an undergravel filter in the tank on those occasions. The last time I set up my tank I did not use a UG filter; I used a small, outside power filter instead, with some success. The plants I used were two species of *Vallisneria spiralis* [sic], Amazon Swordplant, Hairgrass and *Eloëda crispata* [sic]. Of these plants, only one species, *Vallisneria spiralis*, was successful. The other plants did fairly well, but not with the success you had with your tank.

"I would like to set up my tank again and would be grateful if you could give any more advice on what other plants I could use. I also notice in your article that you have not mentioned anything about a heater. I could recognise some of the species of plants from your photograph, but I should be grateful if you could let me know all the types of plants in your tank and any other information which would be useful to me. Do you have any snails in your tank? S.A.E. enclosed."

I'm looking at my Kribensis tank as I type this and see a vast shoal of fish flashing their rosy-purple bellies at each other; however, there is no suggestion of fighting. Two large Amazon Swordplants, like cabbages, now dominate the tank, with several clumps of Java fern and some Pennywort (*Hydrocotyle* sp) growing in the shade beneath. If I were to remove the Swordplants, other species of plants would thrive in the brighter bottom light.

The tank is lit by two 40-watt bulbs that cost about 35p each. An outside power filter and an airstone are switched on for the hours of darkness, i.e. about six hours in my home. I add fish food once or twice daily and top up the water level when it sinks by evaporation. I very rarely do any water changing. There is a heater in the tank and it's set about 78-80°F (25.5-26.6°C). I

certainly do not check the water temperature, or the pH, hardness, etc. If the plants thrive, the fish also thrive.

The plants thrive if they are planted, left alone, given a reasonable amount of light and left with some waste on the aquarium gravel to provide food for them. If the tank is kept spotlessly clean using a UG or any type of filter, the plants will slowly starve to death. Other plants that can thrive in the Kribensis tank are Indian Fern, Hairgrass, Java Moss and *Heteranthera zosterifolia*.

This last plant does not have a common name but it can grow very quickly and seems to remove lots of mineral salts from aquarium water. The stems can grow very long and are quite brittle. They can be trimmed regularly and the top cuttings planted in the gravel. The plant seems to absorb most of its mineral salts from the water directly rather than through roots. It's quite cheap to buy, if you can find it, and well worth trying. Uncut, the strands will twine around and across the water surface and prevent light from reaching lower plants.

If you wish to grow plants in an aquarium I'd say: don't keep it too clean, don't over-feed the fish, and use a couple of tungsten bulbs, from a supermarket, at a cost of around 75p. Keep the temperature around 76-82°F (c 24-28°C). If one or two species thrive, buy more of them; if others slowly fade or die, ignore them. I have five tanks of thriving plants and fishes, and a sixth that I keep too clean with a



power filter and which contains only weak, fading plants. Algae tend to flourish in that tank; and the use of some algicides can sometimes damage fish if used on a long-term basis.

Having lost all my adult Angels, I recently went to a Belfast dealer's shop with my mind set on about five young 'ordinary' Angels. I love the old-type, Silver Angel with the black stripes and dislike all the fancy-finned, pale-coloured variations invented by some breeders abroad. I was delighted to find a tank sporting a shoal of beautiful young Angels of the type I wanted — and bred locally by a Belfast aquarist to boot. There are numbers of home breeders around the Belfast area and, when my dealer foresees a need for a particular species or variety in the future, he asks someone local to breed and raise the fish for him. I usually prefer such fish to imported ones, as I am sure that they are well adapted to local water conditions.

I visited Dr Neville Carrington at Interpet at Easter, as reported last time, exactly 20 years since my original visit. Things have gone from

strength to strength since my last visit and I had a lovely day at Dorking, with Neville touring me around his factory, his home and a number of fine shops in or near Dorking. I'll report my updated findings in an *Out and About* article in the near future.

I include a photograph of one of my planted tanks as it used to be in the past. I hope you like it. I feel that every dealer's shop should have one well-planted decorative tank on display. Does yours?

FUTURE TOPICS

For next time, drop me a few lines about anything mentioned above; and on: (a) breeding cichlids; (b) feeding pond fish; (c) plants by post; (d) marine invertebrates; and (e) fancy coldwater fishes in a decorative tank in the home.

I have not kept a coldwater tank for years, but I left Dorking thinking that I might set up again as many fancy coldwater fish are, at least, as pretty and interesting as tropicals and marines — and they are easier and cheaper to keep in many cases. I exclude £286 Koi!



Garry the Goldfish hated the reality his owner wanted.

Letters

Turtle Imports and Bans

Julian Sims (*Herpetology Matters*, April) commented on the trade in Mediterranean Tortoises, Box Turtles, and Red-eared Terrapins, concerning the existing import closure, diversion of trade and suitability as pets, and proposed import ban respectively.

A number of points in Mr Sims' article warrant criticism, not least the impression that Box Turtles "thrive in captivity". This statement not only seems to pre-empt the survey that the Tortoise Trust is doing, but also, like many opinions held by reptile keepers, lacks supporting ethological evidence.

I, and many others, feel that loss of a single animal to the unnatural attrition of the exotic pet trade is wholly unjustified. However, if one chooses to talk 'numbers', volume of animals involved reveals a current Box Turtle trade of approximately 5,000 to 10,000 individuals per year, in comparison with Mediterranean Tortoise imports that were running at typically 50,000 to 300,000 per year. Therefore, the re-directed 'substituted' species market is then a fraction of the pre-tortoise ban level. Numerically, this represents a far less bad situation.

Regarding Red-eared Terrapins, Mr Sims' opinions here are, I believe, over-reactive and misplaced. To begin with, Mr Sims has previously stated that he would support a ban on hatchlings, but would accept trade in Red-ears 4in and over in shell length.

As pointed out to Mr Sims before, his idea that only larger Red-ears be permitted in trade effectively amounts to a ban anyway. The USA and Canada banned their Red-ear trades (of 13 million animals per year) in 1975, and despite the fact that terrapins of 4+ in can still be legally traded, the domestic market has not taken up these size Red-ears, and ranching practices have not adjusted to sell larger turtles because the systems are geared to produce only hatchlings.

Further, the suggestion that a



The Red-eared Slider. Should there be an total ban on the importation of this hardy species?

diversion of trade may result in "less hardy", and environmentally more threatened, species being imported "probably from south-east Asia" overlooks at least two important points:

- ① That Red-ears are not hardy; between 78-99% are dead within their first year of captivity; and
- ② Red-ears are threatened in the environmental context, with potentially around 300,000 (ecologically highly important adults) turtles being taken from the wild annually.

Also, Mr Sims returns once more to the "trade substitutes" issue. A replacement for the Red-ear trade would require hatchlings. Currently these are ranching; wild-caught hatchlings, for various reasons, are not practicably supplemented. The Red-eared Terrapin gap, therefore, could not be filled.

In addition, if a potential and undesirable trade/species diversion is regarded by animal keepers and traders as a likely or an inevitable consequence of measures to control heavily exploited species, such as the Red-ear, then this has other implications. In particular, this approach effectively accepts that those who support exotic animals trade are not only determined to act unscrupulously, but are also directly (traders) and indirectly (purchasers) incapable of applying even moderately responsible restraint.

Another consequence that supporters of animal trade should consider here is that, in the absence of trade integrity,

animal and environment protection organisations will be required more rapidly to broaden campaigns to ensure that blanket, rather than single-species, bans are always sought.

Clifford Warwick,
C.Biol., M.I. Biol., F.R.G.S.,
Chairman,
Reptile Protection Trust,
Worcester.

Julian Sims Replies

As I stated in the April edition of *Herpetology Matters*, North American Box Turtles thrive in captivity, as many previously published factual accounts testify. However, as I also reported, not all Box Turtles do as well as expected — hence the importance of the welfare survey being conducted by the Tortoise Trust.

With regard to the proposals totally to ban the importation of all Red-eared Sliders (*Trachemys scripta elegans*), my comments were topical and certainly not misplaced. For example, the current conservation appeal of the British Chelonia Group (BCG) is promoting just such a total ban.

In both the February and April 1992 editions of *Herpetology Matters*, I have referred to these proposals and requested that the facts and implications be carefully considered.

I have suggested that, instead of a total ban, a limit should be placed on the total NUMBERS and the minimum SIZE of Red-eared Sliders imported. Restrictions must include a minimum carapace length for importation, for example, 4 inches

(over 10cm) for females and 2½+ inches (6.5cm) for males. Such legislation would necessitate improved conditions and better care in the USA in order to raise these aquatic reptiles to this size. Larger Red-eared Sliders would be more expensive to buy in Britain due to the increased rearing costs incurred in North America. The extra expense would reduce the number of 'impulse purchases' and make them less 'disposable'.

Larger Sliders would also give a better indication of the size to which these reptiles can grow. Their greater size dictates the space which must be provided in an aquatic vivarium. Contrary to Mr Warrick's comments, large Red-eared Sliders are hardy reptiles which do well in captivity. This is not always the case with hatchlings, hence there is a bias in the mortality figure which he quotes.

A total ban on the importation of Sliders will not secure the conservation of these freshwater reptiles in the wild — wetland habitats are particularly vulnerable and are being destroyed by a number of human activities, including pollution by chemicals and water extraction. However, if a captive breeding programme was established in the United States, this could actually benefit the survival of the Red-eared Slider.

A precedent has already been established with the captive breeding of the North American Diamondback Terrapin (*Malaclemys terrapin*) on a commercial basis. The venture was so successful that more than 241,000 individuals were liberated into the wild to help conserve the species.

This example is one of many which illustrates how dedicated herpetologists are committed to conserving reptiles and amphibians through captive breeding projects. Enthusiastic herpetologists thoroughly research the biological and environmental facts about the animals they maintain and are involved in the practical conservation of species. They are not the unscrupulous, irresponsible supporters of the animal trade as described by Mr Warrick in his letter.

Ironically, due to EEC regulations which are likely to take effect from 1 January 1993, importation of all Red-eared Sliders will cease. The reasons



Key
 [Solid Grey Box] Red-foot Tortoise (*Geochelone carbonaria*) the more widespread of the two species.
 [Hatched Box] Yellow-foot Tortoise (*G. denticulata*).

Map showing the overlapping distribution of Red-foot and Yellow-foot Tortoises on the mainland of South America.



A pair of Yellow-foot Tortoises (*Geochelone denticulata*). Note the lack of contrast in the brown coloration of the carapace (the upper part of the shell) and the 'parallel' sides to the carapace.

South American 'Foot' Tortoises

Julian Sims introduces two attractive species of land tortoise that, with a little forethought and care, can prove to be excellent, long-lived pets.

Photographs by the author



A Yellow-foot Tortoise from above showing the 'parallel' sides to its shell.

given common names which relate to the coloration of their front legs: the Red-foot Tortoise (*Geochelone carbonaria*) and the Yellow-foot Tortoise (*G. denticulata*).

Red-foot Tortoise

The Red-foot is the more colourful of the two species. In addition to the red of the scales on the front legs, the edge of the carapace can also be tinted red. The overall coloration of the carapace (the upper half of the shell) is black (hence its Latin name which relates to carbon) but the centres of the shields (the aerolae) are conspicuously lighter in colour, usually yellow-brown.

The Red-foot is also the smaller of the two species. Adults usually grow to a carapace length of about 30.5 cm (c12 inches) although lengths up to 44.2 cm (17.5 inches) have been recorded. The carapace of adult tortoises is characterised by a constriction about half way along the body. This gives older reptiles the appearance of having been 'pinched inwards' at the sides of their shell.

Ever since sea-faring expeditions ventured beyond the equator, tortoises have been brought back to Britain from South America, but never in the large numbers imported from Europe and North Africa. Although CITES legislation ended international trade in the 'traditional' species of the genus *Testudo* from the beginning of

January 1984, tortoises of the genus *Geochelone* (sometimes referred to as *Chelonoidis*) are still being caught in the wild and imported from South America.

MOST POPULAR SPECIES

The two species most frequently imported from the mainland of South America are

Yellow-foot Tortoise

The Yellow-foot has less contrasting carapacial coloration, being almost the same shade of brown all over.

This species is one of the largest types of 'mainland' tortoise in the world. Adults can grow to a carapace length of over 61 cm (c24 inches). This large size has, in the past, led to other common names being used to describe this tortoise, for example, the Hercules Tortoise and the Brazilian Giant Tortoise.

Unlike the previous species, Yellow-foot tortoises retain a parallel-sided carapace throughout their life.

GEOGRAPHICAL DISTRIBUTION

Throughout much of their range in the north of the continent, the two species occur together. Owing to this overlapping distribution, the species are said to be *sympatric*. Neither species is found at very high altitude, for example, no higher than 800 metres (c3,600 ft) above sea level. Tropical forested lowland areas seem to be the favoured habitat.

The Yellow-foot is found in Colombia, Venezuela, the Guianas and Brazil. Its range does not extend west of the Andes and only extends south as far as Bolivia, not Paraguay.

The Red-foot is more widespread. Its distribution extends further north and south. Red-foot Tortoises are found west of the Andes, through northern Colombia, into western Panama. To the south, the range of this species extends into Paraguay.

Off the mainland, both species are found on Trinidad, and the Red-foot also occurs on a number of other West Indian Islands.

CAPTIVE CARE

Because of their countries of origin and the types of habitat colonised, South American tortoises are generally regarded as 'tropical tortoises'. The conditions under which they are maintained in captivity should reflect the environment from where they were caught.

Temperature Requirements

An indoor vivarium can be used to accommodate these reptiles all year round, especially through the autumn, winter and early spring months. Originating from tropical regions, these tortoises would not naturally hibernate in the wild and should not therefore be allowed to do so in captivity. They must be maintained at about 30°C (86°F) all year round. However, the way in which this is achieved and maintained could easily cause stress, so care needs to be taken.

A silvered spot-lamp, which has a tungsten filament, can be used to create a basking 'hot spot' in a vivarium by day. Tortoises are described as *posturing heliotherms* because they bask in a hot area to increase their body temperature and then move off to cool down. Thus, it is most important that shade areas are also provided for the tortoises to retreat into. Adequate shade will prevent these

An adult Red-foot Tortoise (*G. carbonaria*) from above showing the black ('carbon') coloured capace and the 'constriction' about halfway down the length of the shell.



A side view of a Red-foot Tortoise showing the conspicuous lighter aerolae in the centre of the dark shields of the carapace.



A pair of Red-foot Tortoises.

reptiles from overheating and allow them to regulate their body temperature.

Do not connect the spot lamp to a thermostat to control the amount of heat which is radiated. Depending on the type of thermostat used, the light would either flash on and off, or dim down, only to increase in inten-

sity later. These unnatural systems could result in the animals becoming stressed and losing their 24-hour (circadian) response to day and night.

To maintain a natural behaviour pattern dependent on the amount of light available, it is essential either to turn the spot lamp off

manually at night, or connect it to a time clock so that a regular length of day can be precisely controlled.

An additional method of maintaining a hot spot, especially at night-time, is to use a suspended ceramic infra-red source. The advantage with this type of equipment is that the temperature can be controlled by a thermostat. A temperature of 30°C (86°F) refers to the hottest part of the vivarium underneath the infra-red source. Other parts of the vivarium should be cooler so that the tortoises can retreat from the hot spot and cool down.

It is most important that the thermostat senses and controls the true maximum temperature at the basking hot spot. The glass or wood used to construct the vivarium can act as an insulator and prevent some of the heat from reaching an external thermostat which does not have a remote sensor. Thus, traditional types of thermostat with a bimetallic strip would not detect a true reading if they are fixed outside the vivarium.

Vivarium Base

The floor of the vivarium should be covered with a medium which can easily be kept clean; for example, sheets of newspaper. These sheets can be changed regularly to keep the vivarium hygienic.



A juvenile Yellow-foot Tortoise hatched at the Cotswold Wildlife Park.

For any species of tortoise which is kept in an indoor vivarium, it is a good idea if part of the floor is covered with sheets of sand paper as used for cage birds, for example, Caperns Tydisan. Again, these sheets are very easy to change when they become dirty, but they will also help to wear down the claws of tortoises. Sheets of sand-paper also look slightly more pleasing than sheets of newspaper.

If the floor of the vivarium is made of wood, then it is well worth varnishing its upper surface. This will make thorough cleaning easier and prevent any moisture from being absorbed.

Moisture

Provide a shallow water dish in the vivarium. The dish should be large enough for the tortoises to climb into for a good soak.

South American tortoises like to take long drinks, extending their head and neck out as far as possible and swallowing the water in a rhythmic action. The skin of the neck and at the top of the front limbs of these tortoises usually has a 'moist' appearance.

Because of the frequent bathing enjoyed by these reptiles, the contents of their water dish should be changed regularly.

Sunlight

There is no substitute for natural dappled sunlight for captive reptiles. Even if this reaches your animals through the glass of a greenhouse, it will still have an important psychological effect. Therefore, in the summer months, South American tortoises do well in a greenhouse (if one is available).

Remember to provide a water dish and an area of shade into which the tortoises can retreat.

Free-range

Originating from the tropics, South American tortoises cannot be allowed total freedom to roam at will in a British garden. Such a free range existence would result in these reptiles succumbing to health problems caused by low temperatures, particularly digestive and respiratory disorders.

However, on very hot, sunny days, the

tortoises respond well to the opportunity of being given controlled freedom outside. In the past, I have kept a *G. carbonaria* which loved to bask in a sun-drenched flower bed which was sheltered from cooling winds by a brick wall.

Diet

A variety of foods should be offered, different types of fruit being a particular favourite. Slices of sweet apple, pear, banana, orange and pineapple (fresh or from a tin) are all eaten with relish, as are lettuce leaves and slices of tomato.

South American tortoises are omnivorous in their choice of food, ie they eat both vegetation and meat. Therefore, the food offered to these reptiles does not have to be exclusively plant-based, but should also contain items of meat.

Lean beef, slugs and snails are all eaten. However, these examples of foods must be chosen with care:

① **Lean Beef** must be selected to avoid feeding excessive fat. Fat is difficult to digest and can accumulate in the liver.

② **Slugs** Do not feed slugs which may have come in contact with slug pellets. These poisonous products used by gardeners to control slug pests will also prove toxic to reptiles.

Feed South American tortoises on a daily basis; they do not have to have a fast day in their feeding programme.

In addition to fresh fruit and vegetables which provide vitamins, the diet of tortoises should also contain an adequate supply of calcium. Calcium is necessary for the healthy formation of the carapace and plastron of tortoises (and freshwater turtles).

Unfortunately, the symptoms of calcium deficiency, or a dietary imbalance of this mineral, are quite common among chelonians maintained in captivity and were recorded as long ago as 1872 by J. de C. Sowerby and E. Lear in their classic book, *Tortoises, Terrapins and Turtles*. Drawing number 5 shows the result of calcium and vitamin imbalance in the diet of *G. carbonaria*. Many of the shields of the carapace resemble pyramids, and this upper part of the shell has become very deformed.

However, although calcium is essential, it is not always easy to get reptiles to eat sufficient to remain healthy. One way in which calcium (together with other essential minerals and vitamins) can be offered, is by dusting food with a multi-mineral and vitamin powder such as Vionate.

Most forms of food which are offered to tortoises can be treated in this way. Unfortunately, the smell and taste of multi-mineral powder can put some tortoises off their food, rather than encourage healthy feeding.

Therefore, an alternative method of providing calcium for chelonians might be required. Such a method is to use cuttlefish bone. An entire cuttlefish bone should be provided for tropical tortoises to bite into in a vivarium or greenhouse. Small cubes of broken cuttlefish bone can also be mixed in with the rest of their food.

CONCLUSION

Undoubtedly, land tortoises from South America are very interesting reptiles to maintain in captivity. If some basic conditions are provided, they will thrive and prove to be rewarding animals to observe and study.

ACKNOWLEDGEMENT

All the photographs in this article are of tortoises maintained at the Cotswold Wildlife Park, Burford, Oxon. Sincere thanks are extended to the Park staff for their kind assistance, and, in particular, to Glyn Evans.

THE AQUARIUM

Part 7

Echinodermata: Sea Stars, Urchins and Cucumbers

Andy Horton moves on to one of the best-loved groups of invertebrates kept by marine aquarists.



Popularly regarded as typical inhabitants of the seashore, sea stars (starfish) are not common on all the shores of the world, although, when present in the intertidal zone, they can occur in millions. Quite rightly, books feature them as an important type of animal found in the sea, and nowhere else. All Echinoderms are found exclusively in the marine habitat, from rockpools and stranded under stones by receding tides, to the greatest depths of the oceans. A specimen of the deepwater star *Porcellanaster tansooi*, for example, was discovered in the Marianas Trench, 7584 metres (24,881 ft) below the surface!

GENERAL FEATURES

A common characteristic of Echinoderms is a spiny skin which will feel rough to the touch in most of the sea stars² (or starfish), or have the obvious hedgehog-like spikiness of the sea urchins. Echinoderms are also characterised by a radial symmetry and an internal skeletal system of calcareous plates, with a simple nervous system, but without a brain.

Sea stars, urchins, and sea cucumbers move by means of thousands of fluid-filled tube feet. This method of locomotion, pro-

duced by the so-called 'water vascular system', is unique to this phylum. The water for the system enters through an internal sieve plate (*madreporite*) on the underside. The force that such a system can exert is such that the tube feet are often capable of forming a suction cup, enabling a sea star to climb vertically, and making it difficult to remove the animal from a surface it may be adhering to.

CLASSES OF ECHINODERMATA

There are five³ distinct classes, in which all species can be grouped by means of their external appearance.

CLASS

Crinoidea Sea Lilies and Feather Stars.

Asteroidea Sea Stars.

Ophiuroidea Brittlestars.

Echinoidea Sea Urchins.

Holothuroidea Sea Cucumbers

There is rich fossil evidence recording that Echinoderms originated during the Cambrian period over 500 million years ago, and flourished during the Palaeozoic Era⁴. The Crinoidea are the most primitive class.

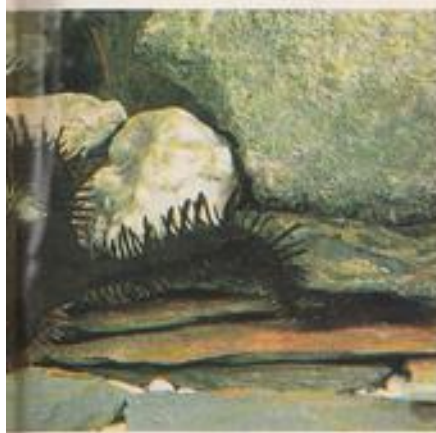


MAX GIBBS - THE COLLEGE BOOK, OXFORD

ANDY HORTON

ANDY HORTON

MARINES REVIEW



MARK GIBBS — THE OCEANIC ROOM, CHICAGO



CORAL WORLD, ELLIOTT

Far left, one of the more attractive species of Sea Cucumber — the Feather Cucumber, *Cucumaria miniata*.

Above left, Brittlestar, *Ophiomastix venosa*, one of only a few species found in aquaria.



Above, a 10-inch (25cm) Red Sea Feather Star — A Crinoid — feeding.

Centre left, Sea Urchins have been around for a long time as this fossil Shepherd's Crown found on Brighton beach testifies.

Centre right, the very attractive Edible or Common Urchin (*Echinus esculentus*).

Bottom left, three different Echinoderms: Cushion Star (*Asterina gibbosa*), larger Common Star (*Asterias rubens*) and a Shore Urchin (*Pisammachinus millaris*)

Bottom right, Common Starfish (*Asterias rubens*) in feeding position, humped over a mussel.

ASTEROIDS

The Asteroidea are the typical sea stars which are popular and usually easy to keep in marine aquaria. Sea stars commonly available include the Orange Starfish, *Fromia monilis*, a distinctive orange and red species from the Indo-Pacific, the particularly common predatory Red-knobbed Starfish, *Protoreaster lincki*, and the abundant Blue Starfish, *Linckia laevigata*, found on the Great Barrier Reef.

Sea stars most frequently possess five arms, but there are many exceptions, including the well known Crown-of-thorns Starfish, *Acanthaster planci*, that feeds on living corals, and has at least 13 spiky arms, the Common Sunstar, *Solaster crossaster*, with anything from 8 to 14 arms and which lives in British seas, and the Purple Sunstar, *Solaster endeca*, which is found on both sides of the north Atlantic. From the Antarctic ocean a multi-rayed species, *Labidiaster annulatus*, will grow over 30 thin arms.

Cushion Stars have only very short arms, and can be described as pentagonal in shape. Often, they only grow to a small size, and even when adult, fit comfortably in home

aquaria. In British waters, the bright Red Cushion Star, *Porania pulchra*, is found in deep Scottish waters, requires specially cooled aquaria and is difficult to feed. Some of the tropical species of *Calappa* feed on coral polyps.

Asteroid sea stars move slowly, although if you try and frame the animal in a camera lens, they will seem to move quite rapidly! In the sea, they will slide over rocks and mussel beds and in between stems of dead coral, but only relatively rarely spreadeagled like a star on a flag.

In normal circumstances, the arms will be of equal length. The best way of measuring the sea star is to use a ruler, or string, from the centre of the disc to the tip of one of the arms, to obtain the radius⁶, and double the reading for the diameter.

In the sea, storms can toss sea stars upside down. It is interesting to watch such an inverted star right itself, which it can manage in several ways, including the animal folding its arms in half, until the tube feet get a hold.

Sea stars are scavengers and opportunistic feeders, but most of them have a major item of prey, often bivalve molluscs. The Common British Starfish, *Asterias rubens*, is a predator found on mussel beds, where it can reach epidemic proportions. It feeds on mussels in an unusual way, humping itself over the prey, and waiting until one of the two halves of shell opens to feed, before inserting part of its stomach through the opening and pouring in digestive enzymes that enable it to consume the bivalve without actually swallowing it. Ionised ammonia (NH₃) waste is excreted through the body wall.

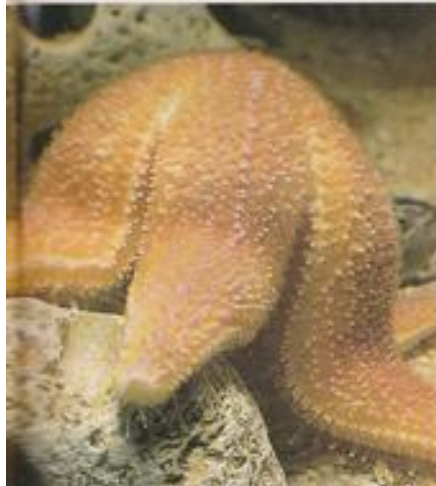
In aquarium practice, suitable sea stars will take raw whitefish and mussel, if the fish do not pinch it first. Live cockles can also be introduced as food in British coldwater aquaria. The tropical knobbed stars will eat other invertebrates in the same aquarium, while the Common Sunstar will eat other sea stars.

Sea stars can detach arms, and grow new ones to replace them. Sometimes, though, the detached arms themselves can grow into separate animals.

OPHIUROIDS

Brittlestars are abundant in numbers in all the oceans. For this reason, they should be relatively cheap in the shops. There are many different species which will tend to hide under stones.

Brittlestars obtain their common name because of their prevalence for detaching some of the five arms, which are long (as opposed to the body disc of the animal which is usually small). The limited powers of movement which these stars possess is achieved by waving the slender arms about, often quite spectacularly.



ANGY HOUGHTON

CRINOIDS

The earliest Echinoderms evolved as sedentary sea lilies anchored by a stalk in the substrate. Currents would bring the food detritus to the stationary animals, a method of feeding which has been retained by the few survivors of this class, now found only in deep water.

Feather Stars are more mobile crinoids, with a few shallow-water species being suitable for aquaria. These are arranged with a reduced stalk and a spray of arms more like a plant than an animal.

The British Featherstar, *Antedon bifida*, is known to feed on organic particles, but coral reef species have been observed actively feeding at night, and it can be surmised that the food would include zooplankton (this has been proved in some Red Sea species).

All crinoids are easily damaged and tend to hide in the invertebrate aquarium.

ECHINOIDS

Sea Urchins can be pretty animals, and because many species are small and plentiful, they are eminently suitable for aquaria. Some species will hide under rocks, but others rely on sharp spines to protect them from fish and crustacean predators.

The genus *Diadema* — the appropriately named Long-spined Sea Urchin — has long spines that are very painful (and venomous) if stepped upon. Take care! They survive well in aquaria. Sea-Potatoes or Heart-Urchins, including *Echinocardium cordatum*, with a heart-shaped test, bury in sand. Fossils are often found on British shingle beaches.

Between the spines, long tube feet (*cirri*), sometimes called feelers, are used for locomotion in all urchins. They also function as food sensors, and in Heart Urchins, are even used in respiration and disposal of wastes as well. However, it is the limy test that is the major distinction of the Echinoidea, but this will only be seen after the animal has died, as it is obscured by the spines and cirri.

An empty test will rattle when shaken with the remains of the feeding structure called 'Aristotle's Lantern'. Sea Urchins graze algae extensively, and encrusting animals can be attacked with five sharp teeth (*ossicles*). The Indo-Pacific species known as the Common Urchin, *Echinometra mathaei* is available to aquarists.

Human exploitation of urchin species like the large Edible Urchin, *Echinus esculentus*, of British shores for food and the curio trade, has had some detrimental ecological impact, while in other areas, removal of predators like lobsters have increased their numbers.

HOLOTHUROIDS

Strange, vermiform (worm-shaped), and gherkin- and cucumber-shaped animals that inhabit offshore seas, Sea Cucumbers are the province of the marine aquarist. These bizarre, interesting creatures are known only to marine enthusiasts, including divers, and are unlikely to be recognised by the layer-

son or terrestrial naturalists.

However, a species known as the Cotton-Spinner, *Holothuria forskali* found in the Mediterranean Sea and in south-west British seas, is often on display in public aquaria in Devon and Cornwall.

A species of animal known as the Sea Apple, *Pseudocolochirus axiologus*, is frequently offered for sale. The body is more rounded than is usual for this class, and is attractive, with a ring of feathery feeding tentacles that superficially resemble some of the Cnidaria⁷ (eg corals and anemones).

Holothurians are uncommon animals on the tropical reef. They are detritus feeders which fare better in dirty tanks, but this may not suit their companions. They need to hide from aggressive fish which may attack them, causing them to emit sticky tubules from their anus, at the opposite end to the tentacles.

Only some genera possess this defensive reaction, though. Others hide in rocks or in burrows, with only the tentacles protruding.

Although able to move, Sea Cucumbers are rather sluggish on their tube feet. Remarkably, they can also regenerate parts of their body!

ECHINODERM HABITATS

Echinoderms are found in all the oceans, and at all depths, inhabiting muddy, sandy,

Echinoderms have surprisingly few enemies. The principal predator of sea stars are other, larger, sea stars of different species e.g. the Sunstars. Brittlestars will be attacked, and eaten by some fish and urchins provide meals for large crabs, some of which will easily crush the test ('shell'). Small fish may then run in and eagerly feed on the flesh.

REPRODUCTION

Most Echinoderms are dioecious, which means that the sexes are on separate individuals. As many as two million eggs can be discharged into the sea by the female at the same time as the male releases sperm. Fertilisation is erratic and at the mercy of the currents; and the unreliability of sperm meeting egg is thought by some (including me) to be responsible for explosions of sea star populations, at least applicable to the Common Starfish, *Asterias rubens*.

In some Echinoderms, the early larva is shaped like a cask (or barrel), such as in the Featherstar, *Antedon bifida*, or the sea cucumber of the genus *Cucumaria*, but other larvae come in odd shapes, with long arms, and various different stages, before they settle on the bottom for their adult existence. Sea stars will live for over four years in captivity.

NOTES

For more information and references, please write to **Andy Horton**, specifying interest.

¹ Pronounced *e-hi-no-d'erm* (Chambers)

² Sea stars used in text instead of the colloquial 'starfish'. After all, they are NOT fish.

³ A further class, namely: Somasteroidea, with mostly extinct species, and only one living representative, *Platystrophia*.

⁴ Palaeozoic era; from 570 to 225 million years ago. Many crinoids died out during this era.

⁵ Sometimes included as a sub-class of Stelleroidea (Barnes 1987).

⁶ Measurements of major radii = from centre of disc to tips of arm.
Measurement of minor radii = from centre of disc to edge of disc.
Measurement of diameter of disc + minor radii x 2, used to describe size of Brittlestars, plus the length of the arm measured separately. (Clark 1968).

⁷ Cnidaria Part 1 A & P, November 1991; Part 2 A & P, February 1992.

⁸ Low-energy sites defined in *Guide to Inshore Marine Life* by D. Erwin & B. Picton (Immel 1987).

⁹ Salinity; A & P, July 1990, Water (Environmental Health series)

rocky . . . in fact, all types of terrain, with greater numbers on rich feeding grounds, but others finding a niche in low energy sites⁹.

The Sand Starfish, *Astropecten irregularis*, can dig in sand and feed on submerged bivalves. Mussel beds are often covered with millions of starfish, the species varying in different parts of the world, while sandy-bottomed seas can be the home for aggregations of millions of brittlestars.

Although, if the right food is provided, Echinoderms are easy to keep, it should be noted that they have a low tolerance of reduced salinity. They should therefore not be kept in brackish water under any circumstances, or where the salinity falls below 3.0‰ (see Specific Gravity Table⁹). Temperature tolerance is within narrow limits, with no margin of error. The British Shore Urchin, *Psammechinus miliaris*, for example, cannot be kept above 24°C (75°F).

Specific Gravity readings at different salinities

Temp	NOPE	NOFF
SG	Salinity	SG
1.022	= 3.0%	1.020
1.022	= 3.1%	1.021
1.023	= 3.2%	1.022
1.024	= 3.3%	1.022
1.025	= 3.4%	1.023
1.026	= 3.5%	1.024
1.027	= 3.6%	1.025
1.028	= 3.7%	1.025

← Salinity suitable for fish

← Desired salinity for Echinoderms