AQUARIST & POND KEEPER

AUGUST 1993

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AUGUST 1993
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COVER STORY — OSCAR

Photograph: Max Gibbs, The Goldfish Bowl, Oxford

Our cover picture shows two excellent Red Tiger Oscars belonging to the species *Astronotus ocellatus* which hails from the Amazon.

It is fair to say that virtually every aquarist is familiar with this impressive fish, which can grow to around 30cm (12in) in length.

Less well known, perhaps, is the possibility that there may be two other species of Oscar. These are pictured and described in Dr Herbert Axelrod's latest mammoth book, *The Most Complete Colored Lexicon of Cichlids* (reviewed elsewhere in this issue of *A & P* by Dick Mills).

A. crassipinis is found in the Pantanal of Brazil, is smaller than *A. ocellatus*, has a single eye-spot (ocellus) on the upper caudal peduncle, has bars on its body and is elongate in overall body shape.

A. orbiculatus is a little more dubious as a valid species, with very few reported collections having been made. This 'other' Oscar appears to lack ocelli, either in the dorsal fin or on the base of the pectorals. Photographs taken on this 'species' seem to have been retouched, so Dr Axelrod, justifiably, casts doubt on its validity.

In the end, it could well be that there are only two, or even one, species of Oscar . . . which is back where we started.

Editorial

SEX AND CHLORINE

Splash! 5 am. The heron's late this morning! I sit bolt upright in bed, mind racing as it tries to focus my thoughts while, at the same time, listening to the commotion in my pond. I should be up and chasing, as I've done before, but today, through a particularly heavy haze of sleep, I stupidly wait for the flap of wings that will tell me that another Goldfish has taken to the skies inside our silent, satisfied, neighbourhood winged terror.

I sit and wait. The flaps don't come. But the commotion is still as vigorous as ever. Slowly — ever so slowly — my brain manages the inordinately difficult task of putting two and two together.

There is no heron, at least not this time. I did, however, top up the pond and flushed it through with tapwater last night. It never fails. Every time I do this — or so it seems — my Goldfish and Koi think it's springtime all over again and launch into yet another totally uninhibited spawning orgy.

Hormone injections? What hormone injections? When it comes to sex, my Koi and Goldfish . . . and Gudgeon, for that matter, appear to be addicted to chlorine! For all I know, they could be addicted to chloramine as well.

I have, of course, no way of testing this. I'm also certain that the drop in temperature, plus the draining away of accumulated organics (these latter being an unavoidable consequence of a non-filtered — albeit intentionally understocked — pond) which accompany such a flushing, both have a part to play in stimulating spawning activity in my fish.

Catfish keepers are well familiar with this 'cold-shower-in-reverse' effect. It is the one they use when they experience difficulties in spawning some species, particularly *Corydoras* catfish. At such times they carry out a major water change in the breeding tank, with the top-up coming direct from the mains cold tap.

The standard reason given for the undoubted success of such a strategy is that the fresh, cooler, coldwater tricks the fish into thinking that the monsoons have arrived. This is almost certainly correct, but when we are talking about fish like Koi, Goldfish, Gudgeon and so on, which are 'coldwater' in every sense, monsoons don't come into the picture.

Furthermore, springtime (the main spawning season) for these fish results in *warmer* water than that experienced during the preceding months. So, how come that my fish react to colder water by going into a spawning frenzy, whether it's May, June, July . . . or even August?

Could it just possibly be that chlorine, for all its undoubted toxicity to fish, can actually act as an aphrodisiac when its concentration is low and it is supplied in conjunction with cold water and the removal of particular accumulated waste products?

I really don't know, but I'd be very grateful if someone who does were to drop me a line. In the meantime, what am I going to do with all my new lovely, mongrel Koi? . . . and do I dare top up my pond again before autumn?

John Dawes
Editor

News Desk

Aquatic Centre First for Cyprio

Aquatic filtration specialist **Cyprio** has been instrumental in the opening of an aquatic and butterfly centre on the north shore of Rutland Water in Leicestershire, western Europe's largest man-made lake.

Aquarium tanks, ponds and thematic displays explain and demonstrate the ecology of Rutland Water and illustrate the myriad aquatic and fish life within the reservoir, as well as in the streams and rivers which feed it.

Anglian Water reservoir manager **Frank Knight** remarked: "Aquatic displays of this nature can only be made possible by the installation of sophisticated filtration equipment. Cyprio designed a special system to achieve absolute clarity of water in every environment at the centre."

Rutland Water is reported to be one of the most popular day trip venues in the east of England, with approximately 750,000 visitors every year.

One of the ponds at the new aquatic centre at Rutland Water, Leicestershire.

Sparsholt Success

Over 5,500 visitors attended this year's open day at **Sparsholt College, Winchester.**

A special National Careers Forum, providing advice on fishkeeping as a career, formed part of the attractions, and help and advice was also available from **Dr David Ford,** from the 'Aquarian' Advisory Service, **Adrian Exell** (Interpet) and Tetra's aquatic consultant **Bernice Brewster.**

Varied Interests of Photo Winner

The winner of the *A & P* photographic competition (see April and June issues) was presented with her prize recently by competition sponsors,**'Aquarian'.**

Sarah Bunn, of Hill Croome in Worcestershire, won the competition with a superb photograph of her Veiltail Goldfish, and was presented with her prize — a Pentax SLR 35mm camera — by **Dr David Ford,** senior consultant to 'Aquarian'.

Sarah is a keen aquarist, photographer and horse breeder, and has a Koi pond and three tanks of Goldfish to accompany her collection of nine horses, five dogs and eight cats.

She explained that she first became involved with fish three years ago: "I saw some beautiful pedigree Koi and immediately wanted to own some," she explained. "My husband, Rob, is a keen builder, so we were able to build the perfect pond, which now accommodates 14 Koi."

Sarah subsequently wanted to see the fish indoors, too, so a display of Fancy Goldfish was installed, before the inevitable breeding tank and fry tank followed.

Solway Plea for Speakers

Solway Aquarist Society is endeavouring to invite as many speakers as possible to participate in their society meetings.

John Cowan, Hon Secretary of the society, explained: "We are looking for knowledgeable and experienced fishkeepers to add to the list of excellent speakers we have enjoyed at the club."

He continued: "The society is keen to promote the hobby and encourage existing fishkeepers, and it is only by meeting other fishkeepers from outside our region that we can learn and gain from their experiences."

Contact: **John Cowan, Hon Secretary, Solway Aquarist Society, 7 Warrenhill Road, Collin, Dumfries DG1 4PW. Tel: 0387 75 606.**

Koi '93 at Billing

The **British Koi Keepers Society** holds its National Show at Billing Aquadrome, Northampton this month (14–15 August).

"Hundreds of the best Koi ever imported into the UK will be on display", promise the organisers. Large specimens weighing up to 25lbs and up to three feet in length will also be included. As well as one of the most famous Koi, known as the "Crown Sanke" and reported to have been sold in Japan for the equivalent of £330,000.

For information, contact **Greg Peck, on 061 747 3390** or **Mrs M Fleming on 091 268 0936.**

The Supreme Champion of last year's Koi '92 was this incredibly beautiful 23in Kindia Showa.

Ilford Convention '93

Ilford and District Aquarists and Pondkeepers Society held their annual Convention recently, with over 100 aquarists attending the event.

The convention was sponsored by **'Aquarian',** who provided a display of their New Formula fish foods, together with the **FBAS,** who also had a stand selling *Fishworld* magazine.

A display of Ranchu judging took place during the event, while talks by **Dr Keith Banister** and **TA's Gina Sandford** were supplemented by a "Light and Sound" show by **Mike Sandford.**

Next year's event, Ilford's 60th anniversary, will feature talks by German aquarists from **Koln Aquarist Society (8 May 1994), at Sir James Hawkey Hall, Woodford Green, Essex.**

Photographic prizewinner Mrs Sarah Bunn treats her Koi having received first prize in A & P's photography competition, sponsored by 'Aquarian'.

TOMORROW's AQUARIST...

By Gina Sandford

TACKLING THE HEAT

Summer brings hot weather and overheated aquaria. Temperatures in our tanks rise to 27°C (81°F) plus, and there's nothing we can do about it. For my tanks this is quite a rise, as I normally run them at about 22°C (72°F), but the increase in temperature is gradual and so, hopefully, will be the decrease, so no harm is done.

The problems occur with the amount of dissolved oxygen there is available to the fish. If you take equal volumes of air and water, there is 20-30 times less oxygen in the water than in the air, so aquatic creatures are at a disadvantage from the word 'go'.

The next problem is that the amount of dissolved oxygen in the water decreases, not only with increasing temperature, but also with salinity. In freshwater, there are 12·8 mg of dissolved oxygen per litre at 5°C (41°F); at 20°C (68°F) this has reduced to 9·2 mg/litre and, at 30°C (86°), it is down to 7·5 mg/litre, which is very low. So, what can we do to improve the situation for our fishes?

Most gases are exchanged at the water surface, and the thickness of the meniscus ('skin') will determine the efficiency in this process. In nature, wind ruffles the water surface, stretching the surface tension and reducing its thickness, thus allowing a freer exchange of gases. Likewise, water movement has the same effect — highly oxygenated waters are found in rapids and fast-flowing streams, whereas lower levels occur in the slower stretches of rivers.

Useful Tips

Therefore, what we need to do is agitate the water surface of our aquarium to encourage a more efficient gaseus exchange. This can be achieved by increased aeration using a fine airstone, with a spray bar from a power filter spraying down onto the water surface to break it up, or by using an additional small internal power filter with the outflow at the surface to achieve the same effect.

But perhaps the most pertinent thing to note is the stocking levels of your aquarium because, if you have too many fishes, the problem will be greater. So, a little forethought in ensuring that you do not overstock your tank will help alleviate the problem.

SUMMER STROLLS

Next to ferreting about in rocks for fossils, one of my favourite coastal pastimes is messing about in rockpools. My trouble is that, not being very clued up on native marines, I never know exactly what I've found. I can't take the creatures home because I live too far from the sea and, anyway, I don't have the necessary set-ups to house them properly. So, I have to rely on my memory, Mike's camera skills, or a dog-eared book that I take along.

My favourite book is almost an idiot's guide to shore life — and, believe me, it's exactly what I need! Published by the **Marine Conservation Society** and entitled *Guide to Inshore Marine Life*, it sets out to group creatures by answering two questions: "What is it?" and "Where does it live?"

Each entry is illustrated by a colour photograph and that makes life easier. So far, I've found several species of crab, anemones, seaweeds, fish, etc.

But when you're out and about by the sea, don't just look in the rockpools. There are shells and animals washed up on the beach and, above the tidal zone, there is a whole host of maritime plants to be discovered.

Last time I was in Cornwall, we were visiting friends and ended up on the beach. We came across a dead gannet, several fish heads (which were brought home to remove the flesh and see the bones) and countless different shells. We also came across patches of oil, old cans, bits of glass, nylon fishing line and plastic bags. Why is the human race so thoughtless?

So, what did *you* do at the beach? Laze in the sun, or get your tan while investigating your surroundings? Write in and let me know.

SNIPPETS

1. Water beetles can fly! They often crash into greenhouses on moonlit nights when they mistake the reflection for that of a pond. Check your ponds regularly for beetle larvae, as these highly predatory creatures can quickly decimate populations of very young fish.
2. If you keep fish, a degree in insanity is a vital qualification!
3. Yarrell (1841) notes in the introduction to the second edition of his work, *British Fishes*, that in 1835, Dr John Davy observed that the Bonito had a temperature of 90°F, 10° higher than the surrounding water. It was believed an exception to the general rule that fish are universally cold-blooded.

MIKE SANDFORD

Great Diving Beetle: an underwater predator that can fly! (See Snippet 1).

MIKE SANDFORD

Rockpools harbour many exciting secrets. But always take great care.

4. If you trap your finger between the pectoral ('chest') spine and body scutes (bony plate-like scales) of the Doradid (Talking) catfish, *Megalodoras irwini*, it hurts!
5. Fishes that migrate from the sea to freshwater are known as *anadromous;* those that migrate from freshwater to marine are *catadromous*. How about that?

Confessions of a Fish Widow

Marylin Apps found the long-running search for clowns not quite as funny . . . or easy as she thought it might be.

Isn't life strange? There I was, merrily going along enjoying the fruits of my 'Fish Widowhood' (new carpets when the fish tanks crack; bribes of Eldorado when the gravel needed degrunging in the sink, etc) when a fish-life crisis hit me. I wanted to go to a 'Fish Club' meeting!

The more I fought the desire, the stronger it got. So I took the fish by the fins and demanded to be taken to the next meeting of the 'Fin Fan Club'. The look of terror on my husband's face confirmed my worst suspicions — the fish club was a secret male bonding society akin to the Freemasons!

END-OF-TERRACE EXPERIENCE

I could picture them all in Barry's end-of-terrace in Gravesend — one trouser leg rolled up to the knee — one naked hairy foot submerged to the ankles in Barry's wife's washing up bowl full of pre-washed gravel — singing the song of the Fishkeepers ('How much is that Fishy in the Fish Tank? The one with the wiggly tail.').

I wanted in — so I went.

The first Wednesday of the next month saw me sitting in Barry's end-of-terrace between Julian (shoals of Piranha and a tank of Guppies?) and Graham (just a community tank really, but I'm thinking of getting some breeding Angels).

Disappointingly, there were no secret ceremonies — and no women — apart from Barry's wife before she went off to aerobics. It was all a lot of fishkeepers — talking about fish!

"I showed at Tenterden," Mark said.

"D'you come anywhere?"

"Won through to the regional with my Uaru."

"D'you win the regional?"

"No. Fish died the week before. D'you want to see some pictures?"

Four thousand hazy photos of an indeterminate muddy brown liquid later, I was ready to throw in the towel.

One interesting item came out of the meeting, however. I overheard my husband saying he'd like some "clowns", but he thought they'd be a bit expensive. It was his birthday soon and I didn't know what to buy him. So 'clowns' it would be.

CLOWN SEARCH

Now I'm not a Fish Widow for nothing. I do know that 'clowns' to a fishkeeper are not the same as 'clowns' to normal people. 'Clowns' had to be fish — or fish-related. So I consulted *Dr Axelrod's Mini Atlas of Freshwater Aquarium Fishes (Mini Edition)* but could only find *Cleithrochromis bouleyi* (The Mae West Cichlid?) under CL.

I looked the colour photo up just to make sure that *Cleithrochromis bouleyi* didn't have a clown-like disposition and would do instead of a real 'clown' — but found only my four-thousand and first photo of an indeterminate muddy brown fish!

Back to the drawing board. I decided to go fish shopping. After all, shopping for fish might almost be as much fun as 'real' shopping.

My husband refused to come with me at first. I think this probably had more to do with an incident involving rolled up trouser legs and a washing up bowl at Barry's house after a glass or three of his home-made parsnip wine, than my actual lack of fish-shop credibility. After all, could I help it if I didn't know my Discus from my Danios?

My husband relented and came with me in the end, after I happened to mention that the fish shop was quite close to a very nice little dress shop I know and I thought there would probably be time to combine fish shopping with some 'real' shopping. I didn't mention 'clowns'. After all, when you're almost middle-aged you don't get many surprises on your birthday.

FASCINATING FISH SHOPS

Fish shops are actually quite fascinating places — if you like dark humid cupboards running at 90°F with the constant clamour of

pumps and paraphernalia and the clang of children banging on the fishtanks and the clap of parents clipping their offspring round the ear for not reading the notices about not banging on the fishtanks.

I lasted 1½ minutes in my first fish shop. In fact, I lasted 1½ minutes in my last fish shop as well — being one and the same place.

I came out into the outer sanctum — otherwise known as the payment cubicle — and found, not 'clowns' exactly — more fluorescent pink gravel alive with bubbling underwater water wheels and sunken galleons and treasure chests with bobbing skeleton's heads.

Well, they made me laugh. Surely 'clowns' would do no more than that. I bought a sunken galleon. And a 'No Fishing' sign. And a treasure chest with a bobbing skeleton's head. I considered the fluorescent pink gravel, but decided that the necessary half a ton wouldn't quite fit into my handbag, along with my other purchases.

Still there was always another time...

CUPBOARD CLOWNS

My husband emerged from the cupboard. He was holding a plastic bag with two small fish striped in orange, black and white. He smiled. I smiled. I'd spent a lot of money on his birthday. I hoped the two small fish weren't going to be too expensive.

"Clowns!" my husband said, and held the two fish aloft.

"Oh!" I said clutching my very heavy handbag. "They don't look very amusing!"

My husband and the fish shop owner gave me 'one of those looks'.

"The name 'clown' in the fish world," my husband intoned, while his two small fish, which pound for pound must have been more expensive than caviar, were wrapped, "is given to various brightly coloured species of fish."

"Not necessarily connected by genus," the fishman said, packaging the fish into their final brown paper sack.

"Yes," my husband said, "there are Clownfish, Tomato Clowns, Clown Loaches ..."

"Clown Surgeonfish." (The fish shop owner joined in on the clowning) "Clown Triggerfish, Clown Killifish, Clown Barbs, to name but a few!"

"Coco the Clownfish?" I ventured.

My husband and the fish shop owner gave me another 'one of those looks'.

"So why has Dr Axelrod only got Mae West under CL in his *Mini Atlas of Freshwater Aquarium Fishes (Mini Edition)*?" I said, noisily clanking my sunken galleon about in agitation.

My husband and the fish shop owner gave me yet another 'one of those looks' and my husband quietly took me to one side and asked if I'd been on the parsnip wine again.

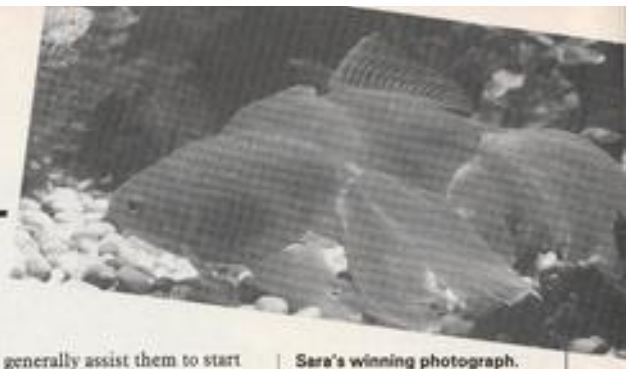
Of course, it turned out that I'd only looked up the Dr Axelrod's index of Latin names of fish. You'd think, wouldn't you, that a *Mini Atlas (Mini Edition)* wouldn't have room to run to such niceties as splitting the proper names from the Latin ones.

As for the *Amphiprion ocellaris*, they've settled down nicely to a life of clowning in a rather nice pale peach-coloured anemone. They've laid five lots of eggs in the last year. None of the fry have survived so far. Apparently, we have to sort out the 'rotifer' problem before we get a 'giggle' of baby clowns.

Of course, there's still the other problem to sort out. Does anyone know where I can find a home for a sunken galleon (slightly damaged), a 'No Fishing' sign and treasure chest with a bobbing skeleton's head?

My husband didn't find them very amusing. Isn't life strange? AHP

Letters



Sara's winning photograph.

Otley's Yorkshire Triumph

I have read the report by Gwen Kirby on the Yorkshire Aquarist Festival which you published in the June issue of *A & P*. I read with dismay that, within the article, our society is not stated as the overall winner of the tableau competition and that the honour was given to another society.

Otley Aquarist Society is a small informal society of keen fishkeepers who entered the tableau competition for the first time in 1992 and won third prize. We were highly delighted with this result and, despite unfortunate events, became dedicated to bettering ourselves this year.

Our winning tableau was planned in the autumn of last year and was constructed by a group of members throughout the winter months. The construction was finalised at Doncaster, with all members of the society helping to make our entry as good as possible.

We were soon to discover that our effort had been worth it when we received first prize. To see the name of the society on the trophy was an immense delight. I think all members smiled for weeks afterwards!

It is our intention to enter the competition again next year and we hope to repeat our success. I hope that the error in the article can be corrected and that we can be entered as prize winners in your magazine.

Sue Kenworthy,
Secretary,
Otley Aquarist Society.

[*Thank you, Sue, for putting us right on our unfortunate slip-up. We are pleased to rectify matters and offer Otley A.S., both our sincere congratulations and apologies!* — Ed]

Fish Welfare at YAF

The report on YAF by Gwen Kirby was very good, apart from a slight printing error. I think it was Otley's Fire Brigade tableau, not Darlington [*see above* — Ed].

One comment that I would make on your report is that the Festival is very well stewarded and any fish in distress is hopefully quickly seen and dealt with by stewards who are, themselves, fishkeepers.

The Festival is stewarded day and night, and there is always someone available in the hall. They wear steward's badges, so if anyone sees something that they are worried about, they can let us know.

Incidentally, there was one large goldfish on one of the tableaux that looked as if it had gone to the 'Great Goldfish Bowl in the Sky', but as a result of the prompt actions of one of the committee members, it was brought round and is now still on the show circuit . . . and winning!

J A S Jones,
Scarborough,
North Yorkshire.

FBAS Help For New Societies

As a result of your mentioning the Federation's activities in *A & P* (thank you very much!), I receive many letters from aquarists seeking details. Wherever possible, I direct them to their local society. There are, however, some areas where a society does not currently exist and so we may refer enquirers to their nearest society, which may be some distance away.

When several aquarists in a particular locality have made similar enquiries and we think there is enough interest to start a society, we compile the names into a list, introducing all parties to each other and generally assist them to start up.

Collective interest has been shown by aquarists in the Oxford, Gloucester and Hertfordshire areas, as well as Bromsgrove, Droitwich, Worcester, Tonbridge and Derby. I would therefore be grateful if you would, through your magazine, appeal for more aquarists in these localities to write in.

I have already approached Barry Allday (manager at the Goldfish Bowl, Magdalen Road, Oxford) and he has stated that they will be prepared to support the new venture by advertising in the shop for new members. Similar support has been offered by Underwater World at the Roger James Garden Centre, Bragbury Lane, Stevenage.

Adrian J Dempsey,
General Secretary, FBAS.

Happy Photo Winner

I would like to thank both *Aquarist & Pondkeeper* and Dr Ford of 'Aquarian' for running the competition which I was lucky enough to win. To be able to indulge oneself in both of one's hobbies was great fun in itself; to win, was unbelievable!

Initially, I decided to enter as I felt that getting to grips with photographing fish in an aquarium would be very challenging, and so it proved. I certainly learnt a lot, inspired, I may add, by the photographs in your magazine.

Do keep up the competitions. Win or lose, they are great fun. My sincere thanks to all concerned with the last one.

Sara Bunn,
Upton-on-Severn,
Worcs.

Thank You Cyprio

I would like to say a big 'thank you' to Richard Davies of Cyprio Ltd, for the speedy and helpful manner in which his company helped with a problem concerning my ultra-violet steriliser.

I look forward to your excellent magazine every month and would be very grateful if you could print my thanks.

Patrick Cooney,
Leeds.

"All right, son — you twin — I'll take you fishing!"

Seaview

By Gordon Kay

'HORNED' DEVELOPMENT

The peculiar egg case of the Horn Shark looks like a corkscrew. It is conical, about 6in (15cm) long and has two spiral lips — 'flanges' — which wind down around the outside.

The female shark lays an egg in a soft, light brown case. She then picks it up and carefully places it in a crack in the rocks, where the flanges prevent the egg case from being pulled out. The egg case slowly darkens and hardens, further securing it in the rock.

Female Horn Sharks lay a number of eggs at the same time and may jam them all into the same crack. The wide end of the cone is not sealed and so allows a constant supply of oxygenated water over the developing embryo.

After eight or nine months, the young shark has used up all of the food in the yolk sac and is on the point of hatching. When it wriggles out of its case it is about 8in (20cm) long and extremely vulnerable.

LEOPARD CONGREGATIONS

Almost anything will eat such a small, delicate creature, including Leopard Sharks. These sharks are very sleek and silky, covered in large, very regular bars and spots. On Catalina, there is a cove where Leopard Sharks sometimes gather in their dozens. No-one is quite sure why they do this, and a research programme has begun to discover why. So far, this research has produced nothing of note.

Leopard Sharks do congregate in shallow water to reproduce, but they congregate at the cove all through summer. It could therefore be that some populations have a split breeding season.

Another theory is that the sharks are attracted by the water temperature. Sharks are cold-blooded, so their metabolism is governed by the temperature of the sea. In a shallow, protected cove, where there are no currents, water temperature is a degree or two higher than in the open ocean. In warmer water, sharks' metabolism may increase just a little, possibly allowing pregnant females to reduce the time they have to carry their litters. Until research has been thoroughly completed, this theory remains a matter of pure conjecture.

CORAL WORLD — ELAT

In Brain Corals the characteristic surface patterns are created by the non-separation of the polyps as they multiply.

CORAL WORLD — ELAT

The Giant Clam is the fastest-growing bivalve mollusc in the world.

FRINGES AND BARRIERS

In a suitable area, colony upon colony of corals may build up into a reef over time, living corals growing on the dead ones. The reefs that develop near the shore of continents and islands are known as *fringing reefs*.

Where a shallow seabed extends for some way out from land, reefs may develop far out to sea. When such reefs develop in a line parallel to, but some distance from, the shore, they form a *barrier reef*.

Barrier reefs are not necessarily continuous, as the name implies. The Great Barrier Reef for example, is made up of countless smaller reefs strung out along the edge of the Australian continental shelf.

RECORD GROWER

The Giant Clam, *Tridacna gigas*, is the largest of several large clams found in the Pacific and is the fastest growing bivalve in the world. It increases in length at a rate of 8-12cm (3-5in) per year when young, and can ultimately reach a length of 4ft 6in (1·4 metres).

As in other bivalve molluscs — such as oysters and mussels — the giant clam's body is encased in a hinged shell. It usually lies on the seabed seeking food, with its shell agape, but it can partially close it when danger threatens. As the clams grow to adult size, they use their ability to shut their shells completely.

Because of their size, Giant Clams, like corals, are unable to move around in search of a mate and so could find themselves stuck in a sterile, single-sex community. To counteract this, clams are hermaphrodites, able to act as either male or female with any neighbouring clams.

When first born, they start life as males, only developing female parts when they are about six years old. This is possibly because sperms, being much smaller than eggs, require far less energy to produce. The young male clam can therefore put most of its energy into growing.

As it increases in size, the clam can gather more food and hence gain more energy. 'He' is also then able to start producing energy-expensive eggs. The larger it grows, the more eggs it can produce, increasing its chances of reproducing successfully.

Giant Clams spawn from early to mid-summer, on those days of the lunar cycle when tides become become smaller, just as corals do. The exact day may vary from reef to reef, but all clams spawn in late afternoon, taking their cue from the fading light.

As each clam spawns, it releases chemicals which induce neighbouring clams to do the same. At the same time, it ejects gametes (sperm and eggs) under pressure, so that they rise high in the water volume and spread quickly. Both these actions increase the chances of cross-fertilisation.

In addition, one clam will spawn a number of times in the season, but will not produce sperm and eggs in the same spawning. It usually sheds sperm first, then releases eggs later.

CORAL CLONING

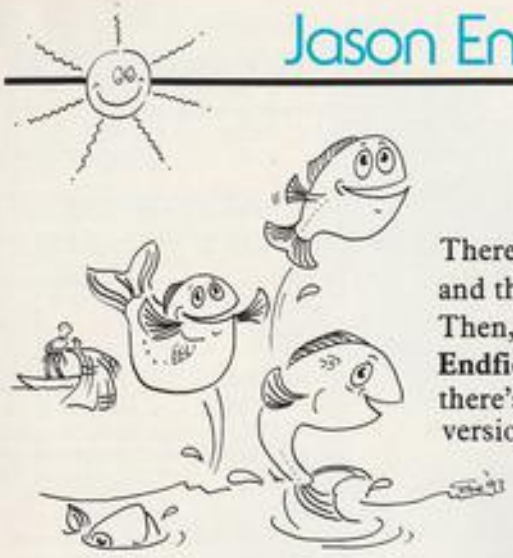
A coral polyp can reproduce by dividing and then laying down a wall of calcium carbonate between the two identical polyps, or 'clones'. Each of these grown up and out, dividing repeatedly as it goes.

Encrusting corals grow only at the edges of the colony, while plate corals lift off the reef into the water. Foliose corals expand within and around the colony, forming leaf-like sheets and undulations.

When the polyps of Brain Corals clone, they do not separate completely and only form walls along their sides, hence they grow in continuous lines reminiscent of the meandering fissures of the human brain.

Branching corals keep on dividing or splitting to form new branches and, in so doing, greatly increase the surface area of the colony exposed to water. Branches, weakened and then broken off by waves, may settle on the reef or the seabed and establish new colonies.

Jason Endfield



There are fish songs . . . and there are fish songs. Then, as **Jason Endfield** discovered, there's the Senegalese version.

Everybody's Doin' The Senegal Fish Dance

Today I've been counting up the number of songs about fish that I know, partly because I've got nothing better to do, and partly because as they say, "a busy mind is a healthy mind". I'm sure that whoever said that wasn't envisaging a mind filled with fish songs!

However, there are several such songs, and rather interesting they are, too. There is that evergreen classic 'Three Little Fishes', the 'Yodelling Goldfish' (which I've talked about in a previous feature many moons ago) and my new favourite, which I discovered just recently.

I was indulging in my other hobby of short-wave radio listening when I stumbled across a programme from a station in Senegal — the former French colony in West Africa. Despite my very rudimentary schoolboy French, the novelty of such a remote station kept me listening and, with great difficulty, I managed to translate enough key words to understand the news bulletin.

Among the headlines was a story devoted to a runaway umbrella that had left its owner's hands during a freak rainstorm, went on to knock two people unconscious (one of them the local town mayor) and crossed a nearby border post into Guinea where it is being held in custody (presumably awaiting a decision on the granting of political asylum). And we think we've got problems!

I continued to listen and, after a rather off-beat feature about a vegetable canning factory in Dakkar, the broadcaster announced that we would now listen to a traditional folk song about fishes which, she hoped, we would enjoy as much as she had.

Prior to the song itself, listeners were briefly instructed about the steps of the accompanying 'fish dance'. This entailed (no pun intended there) lifting both feet together in a swift jump while moving the arms in a generally 'fish-like motion'. I tried this, much to the amusement of a member of my family who was passing my room at that moment. I tried to explain that it was just the Senegal fish dance but, perhaps not surprisingly, she laughed even more.

Then the song started; I had a little trouble translating the words — it's 12 years since I did French at school after all — but, with my French dictionary by my side, I translated as best as I could, and the words, accompanied by a jaunty Eurovision-style tune, went something like this:

"The fish, the lovely fish is writhing in the mud,
at the bottom of the stream in the mud;
His face is pleased because he sees the sun
and the sun is happy when he shines on Senegal.
The fish, the joyous fish, is swimming with his friends,
in the middle of the stream in the water;
His face is with a smile because he sees his friends
and his friends are gay and fat.
The fish, the merry fish, is jumping in the net,
in the boat of the Senegal fish-man;
His face is pleased because he sanctifies the economy,
and the notoriety of the fish industry is a Government priority."

Either my translation went haywire at this point, or there was some political moral to the song! Whichever, I think it loses something in translation . . . I did wonder if I had my words 'poisson' and 'poussin' mixed up for a minute, but then I realised that baby chickens wouldn't be writhing in the mud or swimming in the middle of the stream — unless, of course, Senegalese chickens are substantially different to English chickens.

The song ended and I pondered for a short while. The radio was silent for a few minutes, no doubt so that those of us listeners who had attempted the fish dance could get our breath back.

I remembered a Panchax that I once kept, which had been imported from Senegal (or, at least, somewhere in West Africa), and imagined the fish collector sailing in his boat singing the song. I realised that he might be out of work if it were not for the trade in tropical fish. I realised, in turn, that the purchase of my Panchax perpetuated the tradition of the fish song and dance — and wondered if that, in its own turn, was of benefit to mankind generally.

As my mind's thoughts tumbled over one another, the lady announcer returned. She said that she hoped listeners enjoyed the song and that they had participated "vigorously and joyously" in the dancing, as she had in the studio. We were to write in with our "experiences" and the best and most interesting letter would receive an unspecified prize (perhaps a picture of the fish-man with his "gay fat fish").

Anyway, I have added the Senegal fish song to my repertoire and if any readers have their own favourite fish song, I'd be very pleased if . . . well, if they'd keep it to themselves, actually. I think many tropical fish are welcome imports, while national fish songs are probably more meaningful if left in their country of origin.

I'm concerned enough already with the breakdown of European barriers — all those new songs and dances we'll be learning — "The Ballad of the Portuguese Sand Eel", "The Belgian Smelt Song", "The Greek Ling Dance", not to mention our own "English Minnow Chant". You don't know it? Ah, well, maybe sometime I'll tell you about it . . .

Keeping and Breeding:

THE RED PIRANHA

PART 2 Hatching and Rearing

Lee Batley completes his two-part report with a very useful 'Diary of Events'.

In Part 1, I reported on my method of keeping the Red Piranha. I must have been doing something right since, taking me somewhat by surprise, my two pairs decided to spawn! I ended Part 1 on the actual day of spawning, which I called **Day 1**. In this, the closing part, I will take up the story on **Day 2** and present a 'diary of events' which highlights my experiences trying to hatch and rear the fry.

FIRST HATCHING

Day 2:

I returned from work at 9 pm and all the eggs had disappeared from both nests.

I inspected the gravel for about an hour, but finding nothing, I was convinced the adult fish had eaten them. The strange thing was that both males were still circling the nests; this added curiosity to disappointment.

Day 3:

I inspected the gravel for about 10 minutes, to find minute, transparent tadpole-like creatures scattered around both nests, their presence being given away by the yellow yolk sac in place of their stomach.

Day 4:

The males were still constantly circling the nests, snapping at anything that wandered near them (leaves, etc). The fry's eyes were now visible (seen as little black dots).

Day 5:

The current flowing along the bottom of the tank was quite rapid and the fry seemed to have problems stabilising themselves, this accounting for most of them staying hidden deep in the gravel.

The gravel I used for this tank was one bag of Pea Shingle for gardens or driveways. The reason for using this type of gravel was to allow more circulation through the stones, as these stones are quite big in size and provide perfect caves for fry.

The fry hadn't changed at all this day.

Day 8:

The fry had used nearly all their yolk supply, and were nearly transparent.

At the front of the glass (front view of tank), I could clearly see the fry wriggling about between the glass and stones.

There was quite a number that had been trapped and died. The male Piranha were still circling the nests, and the females were now being allowed closer.

SECOND MATING

Day 10:

I noticed about 10% of the remaining plant was afloat. Upon looking into the tank, it struck me that the Piranha had mated again during the night.

Day 11:

I expected the eggs to have hatched quite early, and my conclusion was correct. By 9 am all the eggs were gone.

The females had wandered away from the nests and the males were circling like crazy. At lunchtime, I inspected the gravel and found nothing. Then, as I searched round the tank, I noticed three of the first batch of fry struggling against the current at the surface of the water.

Day 13:

The Piranhas' colour had changed back to a silvery/white body with a pink/red belly. The males were still circling the nests, while the females were lying around in the neutral zone. I could see a few fry from the second batch wriggling in the gravel, but, from the first batch, I could see nothing.

Day 14:

I had quite a few baby snails in the tank and didn't want to destroy them in case I disturbed the courting. However, as I had cleaned the tank two days before and the Piranha were not put off in any way at all, I decided to eliminate all the snails. It was another long and dangerous task of having my hands defencelessly in the tank with four brooding Piranha for 45 minutes.

While carrying out this chore, I placed my hand slowly over the right nest. The Piranha darted with fright up to the other end of the tank. With my fingertips about an inch above the gravel, I waved my hand, and roughly 500 wriggling fry were pulled up into the current I had made.

I pulled my hand out of the water and, as I watched, the current dispersed the fry all over the gravel, at the right end of the tank. I was rather worried after this, that I might have distressed the male Piranha who now had no fry to protect.

Ten minutes later, the Piranha had settled down after the anxiety I had caused them, but one male, upon returning to his nest, didn't seem to notice the fry were missing.

THIRD AND FOURTH SPAWNINGs

Day 15:

The Piranha had changed colour.

I watched the males trying to furnish the secondary nests with leaves, but they were unsuccessful. They started spawning at 8.30 pm and finished at 12.15 am.

As spawning became more frequent, damage to the mating pairs became more serious.

Day 16:

The eggs started hatching at about 10.30 pm. This lasted until about 2 am. There was no sign of any of the fry from either the first or second batch.

The males were guarding the eggs, but not as viciously as the first time they had spawned.

Day 20:

I noticed all four Piranha had changed colour. One of them bit a leaf off a plant and spat it at the gravel. I realised they were preparing to mate.

After the spawning, I noticed that all the eggs from both nests were transparent. I could see in some of the eggs that were closer to the front glass, an opaque dot in the centre. There were also quite a few white eggs in both nests.

Day 21:

About 70% of the eggs had hatched and the rest were still white.

PREDATION

Day 23:

An algae problem had arisen, so I decided to clean the glass.

The most common alga I have come across is the green velvet kind, but in the Piranha tank, I have two types: cottonwool algae, and the one I have previously mentioned. I cleaned the glass of velvet algae, and when I got to the 'cottonwool' I realised that, due to natural camouflage, hundreds of fry were hidden in it. They measured roughly 10mm (0.4in) and were all white in colour.

JOHN DAWES

Wild-caught Piranha (these are Black Piranha) can be relatively easily sexed. The smaller fish with the flatter belly is a male. This particular specimen did not exhibit the 'hooks' referred to in the text.

Other Piranha breeders have also reported having seen food being brought to the nest by one or other of the parents.

Day 28:

I could see a few fry from the last batch hovering over the gravel.

I observed the tank for hours. During this time, I saw the female from the right nest, who had not been expelled from the breeding patch, randomly eating careless fry that had been pulled by the current into the space where she hovered. Strangely, this was the

WILLIAM DEARMAN

only fish I saw eat any of the fry.

It took the Piranha about an hour to change from silver to black. I knew immediately they were going to mate again.

They started to tidy up the previous nests. At about 8 pm, the 'right hand' pair started the courtship, but of the left pair only the male could be seen. The female was hiding behind the bogwood in the corner of the tank. The male, realising the right pair had started courting, swam behind the wood and chased the female out. It was as if he didn't want to be left out. They started courting as well.

After the courtship, I put a chick in the tank, feeling the fish had surely earned their meal . . . and they showed it; the chick only lasted 38 seconds between the four of them!

It was not until I sat down to look at the eggs that I realised they were all clear again, in both nests. This, however, did not worry me at all, as the last batch of eggs were all clear and some white, and most of them hatched.

Egg-burying

I occasionally saw the males biting at the gravel, and I have to add that my first impression was that the males were eating the eggs, but as I watched them closely, I realised they were burying them! This had happened before, but not during the courtship. It seems that, on the occasion I thought they had not laid quite so many eggs, they could have buried some of them.

I noticed a single fry from the first batch hidden behind the right powerhead. It had a red patch to its body, but the rest of it was silver, it measured about 1.5cm (0.6in) in length. This is the only fry I have seen from the first batch.

My fish have mated several more times since **Day 28.** The last time spawning took place was only between the male and female from the right nest. The female from the left nest had been bitten on her stomach, and as she was the most timid of the four, every time she came out from behind the bogwood, she was chased back again.

During the courtship the male from the left nest showed quite an envious characteristic, he kept darting up to the right courting couple and snapping at the closest fish, then darting back again.

Fry-feeding

I have also gained evidence of one particular male who, after feeding, dragged a chick's leg back to the nest, giving the impression that he was feeding the fry.

I was told that the way to distinguish the sex of a Piranha is that the males have a hook on the bottom of the anal fin which the females do not, but I recall no such hook on any of my fish before mating. However, since mating, during which time both males had their anal fins damaged, these have now regenerated with hooks!

The steps I took to rear the fry from one spawning were quite simple. I suspended a small plastic tank measuring 12 x 12 x 12in (30 x 30 x 30cm) in the community aquarium with an oxygen line and roughly half a pint of 'cottonwool' algae. I then filled this tank with water from the Piranha tank.

After one of the pairs had spawned, I took half the eggs from the nest using a net and put them in the 'maternity' aquarium. Nearly all of them hatched and found cover in the algae. On the fifth day from hatching, I boiled an egg and put some of the yolk into the tank, but this rotted. After removing the yolk, I tried baby tropical flake food. As the flake was tipped into the tank the fry came out of the algae and started to feed.

I also tried hatching shell-less brine shrimp but, unfortunately, I did not succeed. I was told the fry can eat the unhatched shrimp eggs, so I put them into the tank. They hardly paid any interest to the eggs, but favoured the flake. As, at the time of writing, the fry seem to be feeding well, I will keep using the flake for a week, then try some frozen bloodworm and *Daphnia* which are guaranteed food sources for fry at this age.

Rewarding Challenge

The spawning of Piranha and the rearing of the fry is highly interesting and challenging. However, if you want to gain a financial return from fry reared to a saleable size, it will take more money and effort than it's worth. The experience of keeping, breeding and rearing Red-bellied Piranha, though, is more than ample reward in itself. AMP

Paper Round

By Dr Ian Winfield

CHA . . .

One of the most beautiful fish in the UK is the Arctic Charr, *Salvelinus alpinus*. Unfortunately, and as its name implies, most of our lakes are too warm for its liking and so it is restricted to a relatively small number of deep and cool sites towards the north of the country.

H H Parker of Cheltenham overcame this obstacle to Charr research for the UK-resident by teaming up with **L Johnson** of the Freshwater Institute in Canada and travelling to study the Charr of four lakes in the Canadian high Arctic at an impressive latitude of 80°N! In such lakes, the ice-free season typically amounts to no more than eight weeks per year, and the only fish to be found are Charr.

Parker and Johnson found that the Charr consisted in two distinct forms, 'dwarf' and 'normal', which differed in appearance and habitat and also varied in relative abundance among the lakes. The dwarf fish occupied the more marginal habitats and retained the markings typical of young Charr, while the normal fish were more silvery. The young of the two groups were, however, identical in appearance.

A high proportion of normal Charr in a lake was associated with a relatively high growth rate in the first few years of life. The authors accounted for the coexistence of the two forms by suggesting that each had its advantages in different circumstances and so they existed in a dynamic equilibrium.

(**Source:** *Journal of Fish Biology* **38,** 123-147.)

CHA . . .

The subject of different forms, or polymorphism, of Arctic Charr, was also considered by **Kjetil Hindar** and **Bror Jonsson** of the Norwegian Institute for Nature Research in Trondheim. The genetic basis for dwarf and normal charr forms observed in Lake Vangsvatnet in western Norway was investigated by a series of rearing experiments in which crosses were made using sperm and eggs from the two forms.

When fish were reared under identical conditions in a fish farm, the offspring of the two forms differed little in size at the same age, and they shared the same development rate and pattern of maturity.

In addition, the presence of markings typical of young and dwarf fish depended purely on body size and not the parentage of the fish. However, genetic differences were found to be responsible for growth rate during the second year of life, and for the appearance of the jaw.

The experiments thus suggested that the dwarf and normal polymorphosis of Charr is largely determined by the environment, rather than by the genetic make-up of the individual fish. In particular, it appears that differences in growth conditions between different habitats are crucial.

(**Source:** *Biological Journal of the Linnean Society* **48,** 63-74.)

CHARR!

Bror Jonsson, together with colleague **Arnfinn Langeland** of the Norwegian Institute for Nature Research, **Jan Henning L'Abee-Lund** of the University of Trondheim and **Ola Ugedal** of Finnmark College in Norway, has also been busy with another study of Arctic Charr. This time, rather than investigating the polymorphism of this species, the aim of the study was to determine how different sizes of Charr use different parts of a lake.

Many fish and other animals have been shown to face a conflict when going about their daily lives because, very often, the areas offering the best feeding conditions also involve the highest risk of predation. For Charr, examples of such differing areas include:

(i) lower parts of the deep offshore zone where food is scarce but predators cannot see very well because of low light levels;

(ii) the upper parts of the same zone where zooplankton food is abundant but there are no hiding places from predators, and

(iii) the inshore areas where such food is less available but cover in the form of rocks and boulders may be easily found.

The four Norwegians made a detailed study of the relationships between Charr size, distribution, water clarity and the presence of large, predatory Brown Trout, *Salmo trutta*, in a series of five lakes in central Norway.

Juvenile Charr were found to stay near the cover of the inshore areas until they reached a length of 13-18cm (5-7in), after which many moved into the upper open water areas to feed on zooplankton during the summer.

However, very few juvenile Charr made this move when large trout were present in the lake, producing a positive relationship between the size of the smallest Charr in the open water and the size of the trout. Increasing water clarity was also linked with an increase in the size of Charr in the open water.

The results of this study show that juvenile Charr, like many other animals, face a trade-off between food demand and the presence of predators. Consequently, their distribution among the parts of any one lake may be explained in terms of food availability and risk of predation.

(**Source:** *Journal of Animal Ecology* **62,** 160-168.)

A young male Arctic Charr.

INSTITUTE OF FRESHWATER ECOLOGY

STRIPED SECRETS OF THE

Dr George Cust settles the 30-year controversy surrounding the true identity of one of the hobby's most popular fishes. *Photographs by Trevor Ashworth*


Male Zebra x female Leopard parental cross.


Zebra and Leopard brothers and sisters obtained from hybrid crosses.

The Zebra Danio (*Brachydanio rerio*) was first described in 1822 (Hamilton-Buchanan)[1], the type fishes (that is, the specimens on which the official description was based) being collected from the wild. The natural range for the Zebra stretches from Bengal to the Coromandel Coast of India. In contrast, the Leopard Danio (*Brachydanio frankei*) *"is something of an enigma and no one really seems to know where this fish comes from. It appeared in the hobby scene in the early 1960s but wild fish have never been located"* (Hunziker[2]).

Axelrod[3] gives an interesting account of its introduction: *"The well-known German expert Hanns-Joachim Franke found them in the tanks of a Russian dealer where they were sold as Gold Danios. Herr Franke wrote an article in an East German magazine which published a picture as well. Doubt was expressed as to whether this was a new species or a hybrid. Herr Franke expressed the opinion that this was a genuine newcomer, which was confirmed by Herman Meinken, who named it in Franke's honor"*.

Some authorities[4] assert that the Leopard Danio is a native of Thailand, while others believe it to be mutation bred from the Zebra in an aquarium in Czechoslovakia.

MY THEORY

There seemed to be enough doubts about the origin of the Leopard Danio to justify some experiments. The hypothesis I decided to test was that the Leopard Danio was a recessive* colour variant of the Zebra.

[*See box entitled **Some Genetic Terms** at the end of this article.]

Spawning Method

The best way I found to breed these Brachydanios was to keep the males and females separate and condition them well with both live and dried foods. The pair was then placed in the breeding tank in about 4in (10cm) of water inside a nylon mesh breeding trap. Water temperatures in different spawnings ranged between 78-82°F (25.5-28°C), and pH ranged between 6.5 and 7.8.

The fish were placed in the trap at night and usually spawned the next morning. Eggs fell through the mesh onto the glass bottom, where they could be counted. When spawning was complete, the trap and parents were removed.

EXPERIMENTAL CROSSES

① Zebra v Zebra Crosses

Three pairs of Zebras and three pairs of Leopard Danios were purchased from a local dealer. The first task was to ensure that these fish bred true. The following crosses were therefore carried out:

Zebras

Pair (a) Zebra x Zebra
Pair (b) Zebra x Zebra
Pair (c) Zebra x Zebra

All the offspring from these crossings were striped fish, i.e. phenotype Zebras. The phenotype is the observable characteristics of the fish, i.e. what it looks like. It was assumed that the genotype (the genetic constitution or make-up) of these fish, as far as spots was concerned, could be referred to as $s^+ s^+$ and the crossing could be represented as:

Parents	Zebra $s^+ s^+$	X	Zebra $s^+ s^+$
Gametes (Sperm and Eggs)	s^+ s^+	↓	s^+ s^+
F^1 (First Generation)	$s^+ s^+$ $s^+ s^+$ $s^+ s^+$ $s^+ s^+$		

(all Zebras)

First generation (F1) offspring from 'pure' Zebra x Leopard crosses were all Zebras.

② Zebra Backcrosses

Back crossing to parents resulted in the offspring all being Zebras. Crossings of brothers and sisters in the F^1 generation all resulted in Zebras.

③ Leopard x Leopard Crosses

Similar crossings of the three pairs of Leopard Danios resulted in all the offspring being Leopard Danios. It was assumed that the genotype of these Leopard Danios was *ss* and the crossings could be represented as:

Parents	Leopard Danio			Leopard Danio
	ss		X	*s s*
Gametes	*s*	*s*		*s* *s*
F^1	*ss*	*ss*	↓	*ss* *ss*

(all Leopard Danios)

④ Zebra x Leopard Crosses

Having established that my Zebras and Leopard Danios were pure, now came the time to see if I could cross them. The methods used were the same as described previously. Zebra and Leopard Danio spawnings take place as easily as Zebra x Zebra or Leopard x Leopard.

Nine crossings of Zebras and Leopard Danios were carried out, and a total of 780 fish were raised to a sufficiently large size to be able to see stripes or spots, identify them clearly as Zebras or Leopard Danios, and sex them.

All the F^1 generation from these spawnings were striped fish indistinguishable from Zebras. At the gene level it is assumed that the following took place:

Parents	Zebra			Leopard Danio
	s⁺ s⁺		X	*ss*
Gametes	*s⁺*	*s⁺*		*s* *s*
F^1	*s⁺s*	*s⁺s*	↓	*s⁺s* *s⁺s*

(all Zebras)

⑤ Leopard x Zebra Backcrosses

About five months later, when these F^1 fish were sexually mature, three back crossings were made, crossing the Leopard Danio (*ss*) parent with the F^1 hybrid offspring (*s⁺s*), with the following results:

Parent	Leopard Danio			Zebra (F^1 hybrid)
	ss		X	*s⁺ s*
Gametes	*s*	*s*		*s⁺* *s*
F^2 (Second Generation)	*s⁺s*	*ss*	↓	*s⁺s* *ss*

(50% Zebras, 50% Leopard Danios)

The total number of fish raised from the three spawnings were 243 Zebras and 237 Leopard Danios. The numbers in each spawning were (i) 89 Zebras: 95 Leopard Danios; (ii) 115 Zebras: 107 Leopard Danios, and (iii) 39 Zebras: 35 Leopard Danios. These ratios are significantly close to the expected 1 : 1 ratio.

⑥ Hybrid Crosses

The next crossings were to mate males and females from the F^1 hybrid generation of the Zebra x Leopard Danio cross. The results were as follows:

Parents	Hybrid			Hybrid
	s⁺ s		X	*s⁺s*
Gametes	*s⁺*	*s*		*s⁺* *s*
F^1	*s⁺s⁺*	*s⁺s*	↓	*s⁺s* *ss*

(75% Zebras, 25% Leopard Danios)

Eight *s⁺s* x *s⁺s* crossings using different pairs of parent fish were made from which a total of 1,619 fish were raised. Of these, 1,235 were Zebra and 384 Leopard Danios. This ratio is significantly close to the 3 : 1 ratio expected from Mendel's Laws of Heredity. Of the 75% zebras, one in three are 'pure' homozygous (*s⁺s⁺*) Zebras and the other two-thirds are heterozygous (*s⁺s*) Zebras. There is no way of distinguishing these Zebras except by further crossing. The 25% Leopard Danios were 'pure' homozygous (*ss*) fish.

LEOPARD DANIO

One of the parental crosses: a male Leopard Danio and a female Zebra.

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⑦ Second-generation Leopard Crosses

A final crossing was to mate Leopard Danios from the F^2 generation. The following results were obtained:

Parents	Leopard Danio			Leopard Danio (brother/sister crosses)	
	ss		X	*ss*	
Gametes	*s*	*s*		*s*	*s*
F^3 (Third Generation)	*ss*	*ss*	↓	*ss*	*ss*

(all Leopard Danios)

Three different pairs of Leopard Danios from the F^2 generation were spawned, with a total of 279 fry raised. All were Leopard Danios.

⑧ New-Parent Crosses

A similar series of experiments were carried out with new parent fish obtained from different locations. The results of these crosses, from which 3,010 fish were raised, gave exactly the same results:

Zebra (s^+s^+) x Leopard Danio (*ss*)
All Zebras

F^1 Zebras (s^+s) x Leopard Danio (*ss*)
50% Zebras, 50% Leopard Danios

F^1 Zebras (s^+s) x F^1 Zebras (s^+s)
75% Zebras, 25% Leopard Danios

CONCLUSIONS

① *Brachydanio rerio* (Zebra Danios) breed freely with *Brachydanio frankei* (Leopard Danios).

② The results from the crossings, which obey the classical Mendelian Laws of genetics, support the hypothesis that the Leopard Danio is a recessive colour variant of *Brachydanio rerio*, the Zebra Danio.

③ These results support the views that *B. frankei* is not a separate species. ALP

SOME GENETIC TERMS

1. **Gametes.** These are the sex cells, spermatozoa in the male, eggs in the female.
2. **Genes** are the genetic units of function and control the biochemical pathways within the cell which determine the growth, development, sex, colour, shape, etc, of an organism. Rapid advances in molecular genetics over the last 40 years, have shown that the gene is a sequence of **DNA** that carries the code for a protein, or **RNA** molecule, and frequently includes regulatory regions at either or both ends.
3. *Brachydanio rerio* — the Zebra Danio — has 50 **chromosomes** arranged in 25 pairs, one member of each pair coming from each parent. At molecular level, each chromosome consists of one DNA double helix ('spiral' structure). It is helpful to think of the genes as long beads arranged in pairs along the length of the chromosomes.
   In all cells except the gametes, the genes are arranged in pairs, one of each pair coming from the male parent the other from the female parent.
4. **Alleles** are alternative forms of the same gene, e.g. longfin (f+), short fin (f).
   With **recessive** characteristics, both members of the pair of genes (alleles) are the same, e.g. (s), (s), coding for spots in the Leopard Danio. The fish in this case are said to be **homozygous.** When only one recessive allele is present, its effects are not expressed.
   In a fish with a **dominant** characteristic, such as stripes in the Zebra, both of the pair of genes may be the same (s+), (s+), and this fish is also **homozygous.** However, a dominant characteristic need only be present on one of a pair of genes to produce its effects, e.g. (s+) (s), and such a fish is called **heterozygous.**
5. A **Hybrid** is an offspring of unlike parents, e.g. the F^1 (First-generation) Zebras from a *Brachydanio rerio*/*Brachydanio frankei* cross.

Books

The Most Complete Colored Lexicon Of Cichlids

By: Dr Herbert Axelrod
Published by: **T.F.H. Publications Inc**
ISBN: 0-86622-422-X
Price: £69.95

Setting oneself the task of collecting and photographing all known cichlids must have been akin to setting off to search for the Holy Grail for Dr Axelrod, all of 40 years ago. No doubt, at varying intervals along the way, he must have stopped to enquire of himself, "Why am I doing this?" as the quest seemed to get longer and longer, rather than shorter.

To put it in perspective, right back at the beginning, the majority of cichlids were accepted by most hobbyists as originating in South America (in worldwide geographic terms, almost in Dr Axelrod's backyard). Then, just look what happened: the great Rift Valley Lakes began to yield up their cichlid secrets and the author's itinerary was subsequently seriously lengthened.

Just how much things have changed is brought home very forcibly indeed by this latest publication from T.F.H. Apart from the brief introductory section, it is not until you reach page 565 that you come across descriptions of any fishes from the New World, and this out of a book of 786 pages of species descriptions!

O.K., you might say, suppose the book had been assembled the other way around with the American species first? Well, then the American species would again only have taken up slightly over 200 pages, still well below half the coverage given to African fishes.

On this return from his personal Crusade, the author is to be congratulated on staying the course and successfully realising his dream although, as he honestly points out, not all species surrendered themselves conveniently to net, or camera lens, and in these instances John Quinn supplied excellent substitute artwork. The book is a real tour-de-force and everyone involved in its production can be well satisfied with the result.

As described earlier, the work is divided up into two main parts, with each part being split as necessary into geographic areas: Africa and Asia come first (divisions are Lakes Tanganyika, Malawi and Victoria, Southern and Eastern Africa, Western Africa, the Middle East and Asia, and the Island of Madagascar. A separate chapter, the Tilapias, deals with these species separately which, despite being African in origin, have been introduced into many internationally-widespread areas other than their originating waters.

The Americas form the second part and are divided between the Central America and South America.

The main use for this indispensible book will be for positive identification of species, rather than for cultivation information, but neither the introductory chapter nor the last chapter should be skipped. The first contains many interesting details about these fascinating fishes and, if you want to know why they are called cichlids (and what their connection with birds is), then the last section tells all.

In order to detail the minutest differences between many of the almost 'lookalike' sub-species, the illustrations have to be excellent, and they are. Location shots and maps also bring a sense of 'being there' on the grounds (and in the water) with the species.

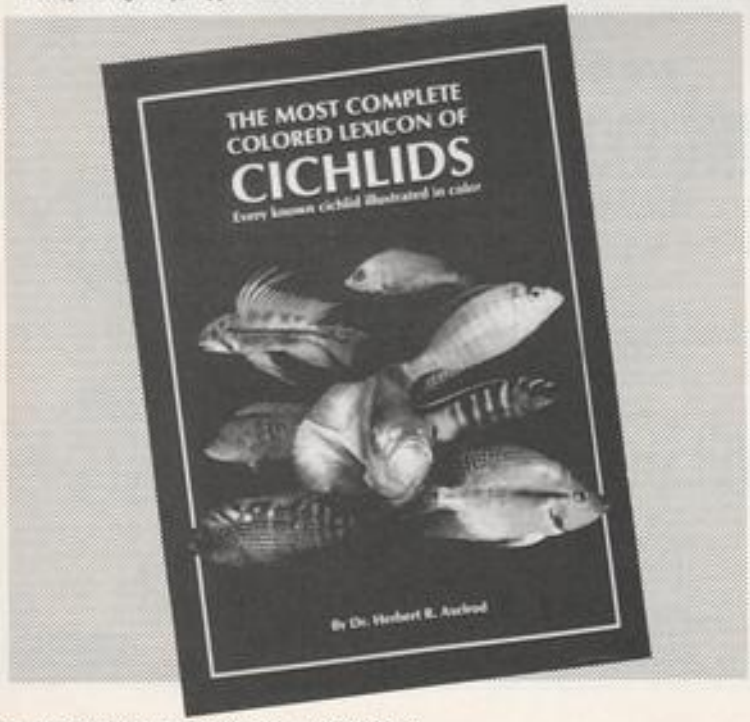
In keeping with this auspicious publishing event, the book is also leather-bound and carries the author's autograph.

Of course, things change over the years, nowhere more rapidly (nor as often) as with fish names! In acknowledging these constant upheavals, Dr Axelrod bites the bullet courageously and includes both old and currently new scientific names in a very comprehensive Index. The reader can thus identify fish by whatever name s/he thinks it is called. For this alone, the author will be thanked by thousands, if not millions, of serious aquarists.

It may come as a surprise (even a shock) that the use of common names is not overly-used. Some familiar names may occur in passing, in a caption or in textual information, but not in the species headings for every entry, nor in the Index. Sorry folks, you'll just *have* to get used to those scientific names!

People dismissing cichlids as 'that ugly bunch from the Americas, with a few African species thrown in', are certainly in for a shock and, perhaps, a revelation. Forty years is a long time to wait but, on the resulting evidence, some things are surely well worth waiting for.

Dick Mills



System For A Problem-free Aquarium

Published by: **Dennerle Natur Aquaristik**
Price: £10.99

Strictly speaking, this book is a catalogue without prices. However, with 225 high-quality colour photographs of aquatic plants, accompanied by full cultural and characteristic details, plus 15 aquascapes described and illustrated by coloured photographs and plan diagrams, it is a catalogue with a difference.

Dennerle deals in depth with all the theoretical concepts behind the hi-tech approach which the continentals take on the subject of producing perfect planted aquaria.

Sections on substrates, carbon dioxide, water chemistry, heating, filtration, lighting, fertilisation and combating algae prob-

lems are accompanied by details of all the equipment available to facilitate the systems described.

For many years a bible for countless German aquarists, this book is now available for the first time in English and French. It is 130 pages long — all in colour — and is available from all Dennerle stockists.

Barry James

The Cichlids Yearbook — Volume 3

Edited by: Ad Konings
Published by: **Cichlid Press, St Leon-Rot, Germany**
ISBN: 3-928457-13-6
Price: £19.95*

This year, Ad Konings has gathered together articles by 19 different authors (five of them new contributors) in his latest *Cichlids Yearbook*, including his own invaluable contributions on Central American and Rift Valley cichlids. As we have come to expect of anything with the Konings name on it, this latest volume is an absolute goldmine of useful and interesting information about cichlids, illustrated by photographs which can justly be described as superb.

Following the pattern established in the two earlier volumes, the latest edition is divided into sections on the various areas where cichlids are found: the Rift Valley Lakes (with separate sections for Lakes Tanganyika, Malawi and Victoria); West Africa; and Central and South America, with a section apiece. These are followed by a concluding section titled 'Cichlid Literatim', which, like its counterpart in Volume 2, contains theory and reviews, the former in the shape of a fascinating article by Martin Geerts on the possible evolution of livebearing cichlids.

But there are not just similarities; there are new ventures as well — in both style and content. In Volumes 1 and 2, the main emphasis was on short pieces dealing with individual species. This time, the articles tend to be of greater length (and are consequently fewer in number). And for the first time, taxonomic material has been included — a revision of the Lake Malawi genus *Sciaenochromis* by Konings himself, and the description of a new *Herichthys* species from Mexico by Juan Miguel Artigas Azas.

I hasten to reassure those to whom taxonomy conjures up visions of lists of counts, measurements and ratios, that *'Yearbook'* taxonomy, while retaining the traditional elements required to establish the physical identity of a species or genus, also includes descriptions of living fishes, their habitats and their ecology. The whole should prove of considerable value and interest to scientists and hobbyists alike.

Past *Yearbooks* have dealt with what is new and unusual in the world of cichlids, and Volume 3 contains its fair share of this type of subject matter. But, in addition, there is coverage of some well-known cichlids — the *Neolamprologus brichardi* complex, *N. leleupi*, and *Julidochromis ornatus*.

The percentage of non-Rift Lake material continues to increase as well, providing a better balance, which should make the book more attractive to keepers of West Africans and Neotropicals, while continuing to appeal to East African fans.

It is wrong to think, as some uninitiated aquarists do, of the *Cichlids Yearbooks* as 'annuals' of transitory value, as that is neither the intention of the editor, nor the nature of the actual end product. They are, in fact, invaluable works of reference, containing unique and original information on cichlids, and are likely to remain of interest for many years to come, especially as the currently 'new' species make their way into the tanks of the 'ordinary cichlidiot' (if I may be forgiven a contradiction in terms!).

I can only urge every serious cichlid enthusiast to obtain a copy of this new book — and, if (s)he does not already have them, its predecessors, while they are still available.

* Available from retail outlets or from the **British Cichlid Association, Dept PFK, 7 Delamere Avenue, Sale, Cheshire,** price £19.95. Cheques/POs payable to British Cichlid Association. Non-members please add £2.50 for p&p.

Mary Bailey

PRODUCT ROUND-UP

BY DICK MILLS

Spin-cleaned Water

CFCs we all know about, but CFFs? Don't worry, unlike CFCs, CFFs are good for you. Well, to be more precise, they're really good for your fish, especially if they are Koi.

Looking a bit like something vital from a 747, CFFs are CENTRIFUGAL FILTERS, and the latest designs from **BRIT KOI** were revealed recently at Fishworld '93 held on their premises.

Standing approximately 48in high, the component units comprise a 28in cylinder (diameter 32in) on top of a base conical section. Water enters the first, deliberately left empty, chamber just above the joining point between cylinder and cone, and is swirled around centrifugally, settling out its dirt before overflowing into the second chamber, again entering at the conical level to ensure further swirling.

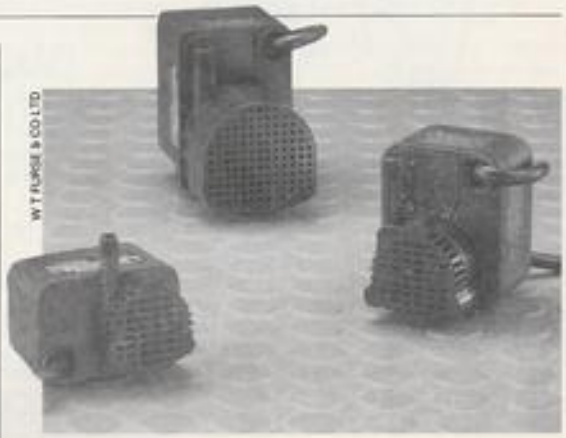
Water then rises up through the filter medium (supported on plastic grids resting on the top of the conical section) to overflow into the subsequent two chambers, each having a suitable filter medium. Inlet feeds can be 4in or 6in; a clever design feature allows you (and a hacksaw) to choose which is the most suitable; 2in discharge pipes from each component allow for easy cleaning.

Naturally, the system has immense cleansing power, but performance figures are dependent upon the ratio between fish waste load and the body of water the fish are kept in. On one hand, a few fish can be kept in excellent conditions in almost vast amounts of water, but as the stocking levels rise, so a more realistic attitude has to be taken. Even so, for the serious Koi keeper, these units, at less than £800, represent remarkable value and are well worth considering. Mind you, there's still the hole to be dug!

The Centrifugal Filter System can be seen at: **BRIT KOI, Syon Park, Brentford, Middlesex TW8 8JF. Tel: 081 847 4730.**

From Puddles to Ponds

Within the rapidly-expanding interest of water gardening as a whole, often comes the disappointing realisation that you just haven't got room for the whole kit and caboodle of a pond and/or fountain/waterfall.



M.T. Marsh & Co Ltd

However, thanks to the LITTLE GIANT range of pumps, a water feature within very confined spaces is quite definitely possible for that spot on, say, a flat's balcony, a small conservatory or patio. When incorporated with a flat pack, 'knock-down' liner pond there is no longer any need for 'space-deprived' people to forego this fascinating aspect of the hobby.

On the other hand, where a pond is a practical possibility, then, at this larger end of the water-gardening scale, there are pumps of suitable size and performance for the 'real thing'.

With over 50 years experience built into them, LITTLE GIANT PUMPS can fulfil all your needs. Water can be removed down to a depth of 0.3cm with even some of the larger sump-type models. Standard manual versions can be upgraded to automatic operation by means of optional diaphragm- and flat-switches.

The smaller submersible pumps have performances ranging from 6-18 lpm (at 1 metre head). All have rigid polypropylene/polyethylene screens to prevent ingress of solids; one model can also be used as a 'surface pump' when fitted as an 'in-line' closed water circuit installation.

Pumps are available in various voltage modes: 110-120, 220-240, for example; different voltage frequencies (50 or 60 hertz) can also be accommodated, but care should be taken to see that models are used at the correct voltage setting and frequency all times.

Looking onward from the pumps themselves, although descriptions of such practical applications might seem unnecessary, attention should be drawn to the company's other products which include WATER LANDSCAPING KITS (Waterfall and Fountain kits) complete with header pool-sized liner and water hoses and clamps, fountain heads, control valves, diverter 'T' pieces, etc. The Fountain Ring kits are even more interesting with 5-jet, 10-jet and 10-jet with 6-jet centre piece configurations, all with complete fittings. Note that all Waterfall/Fountain kits exclude the pump, whose

DICK MILLS

Centrifugal filter system showing transfer ports in each chamber.

model selection is determined by individual needs.

Details of Little Giant Pumps and Accessories from: **W T FURSE & CO LTD, Pump Division, Wilford Road, Nottingham NG2 1EB. Tel: 0602 863471; Fax: 0602 860538.**

Pebble-dashed Ponds and Black-lined Tanks

At one time, camouflaging cascades and water courses had to be a fine art as their (then) plastic-looking finishes hardly blended in harmoniously with the rest of the pond surroundings. Then came the re-constituted stone/concrete type of preformed cascades which soon 'weathered-in', especially if you painted them with a covering of yoghurt (yes!) to encourage the growth of lichens.

Gravel-faced models are now quite commonplace, as are the PEBBLEFINISH WATERFALLS from **BLAGDON WATER GARDEN PRODUCTS;** recently to complement these even further, PEBBLEFINISH POOLS have been added to the range.

A new range of powerful high-quality pumps, each with a correspondingly high 'lift', has also made its appearance. Known as HI-FLO PUMPS, these have been specially constructed for water garden use, where continuous and reliable performance is required. Said to be especially suited to power biological filtration systems, these pumps are, nevertheless, well-suited, too, foe high-performance fountain and waterfall displays.

Performance figures range from 85-235 lpm (1,150-3,180 gph), with maximum heads (zero flow) of 5.5-11m (18-36ft). All have 1.25in threaded outlets and 10 metres of cable.

Re-painting, refurbishing or repairing a concrete pond? POOL PAINT is a new water-based formula needing no primer; available in clear, black, blue or stone colours, it will cover 6 square metres per litre.

POOLGLAZE is a unique product to neutralise lime in new concrete ponds and if you

BLAGDON WATER GARDEN PRODUCTS

only want a small amount to treat a waterfall or cascade, etc, then there's a new 300g size just for you.

POOLMENDER is an easy way to repair cracks in any concrete-based area — ponds, cascades and even garden ornaments.

As far as pond hygiene is concerned, any of the three models of UV FILTERS (8, 15 and 30 watt) will control algae and harmful bacteria and improve water clarity and quality. Two additions to the POOL CLINIC product range are ALGAE CLEAR and POOL SAFE.

Filling planting baskets with hessian and then with soil and gravel can be a messy and inaccurate business. Now, by using FILL-LINE AQUATIC BASKETS you can save a lot of stress and time too: no hessian-liners are needed, and there's a clear line indication on each to show the top level of soil needed.

At one time, aquarists were worried whether or not their fishes were confused by not being able to see the outlines of their then new all-glass tanks; if you still have this on your mind, then the BLACK-LINE range of aquariums should put your, and your fishes', minds at rest.

Trimmed with black, and also sealed with black silicone, these aquariums not only look very smart, but by being more-readily defined, could be safer, too. The aquariums are available in several 'standard' sizes from 24 x 15 x 12in to 60 x 18 x 12in; two intermediate sizes have 15in front to back dimensions.

Either the Blackline or the BASIC range of aquariums can be fitted to ready-assembled BASIC or FLAT-PACKED STANDS (STANDARD or DE-LUXE); to top them off (literally) matching black hoods (BASIC or DE-LUXE) are available.

Details of all products from: **BLAGDON WATER GARDEN PRODUCTS plc, Bristol Road, Bridgwater, Somerset TA6 4AW. Tel: 0278 446464; Fax: 0278 446155.**

Growing Plants? It's A Gas!

With all the emphasis on water quality these days, and the increasing efficiency of modern devices to 'clean' the water, it is quite possible (and very probable too) that you may actually be removing some desirable constituents from the aquarium water, as well as rightly-removable toxins.

Take carbon dioxide for example; constant water movement assists in expelling this gas from the aquarium right enough, but pH stability depends on its presence to a large degree. A rising pH, plus the appearance of calcium flecks on the walls of the tank or the plants could mean an actual shortage of CO_2, as will stunted plant growth (although lighting levels are also critical in this respect).

The answer is to replace the missing CO_2 directly; anyone using a pressurised soda siphon will be familiar with the necessary CO_2 bulbs and will, consequently, find no problem in their use and installation into the CO_2 COMPACT SET as marketed by **BIO-PLAST.**

The gas is fed, via a pressure-reducer, control valve and non-return valve to a reactor chamber not dissimilar to that of an ozoniser; water flow from the outlet of a power filter passes into the top of the chamber in which it is exposed to bubbles of CO_2.

The downward-flowing aquarium water has its path deflected by means of baffle plates mounted around the supply tube within the chamber. The purpose of these is to provide turbulence to the water flow, thus extending the period of time of exposure to the upwardly-rising bubbles and ensuring maximum assimilation of the gas.

Bubble flow rate is adjusted by a needle-valve to a particular number per minute, corresponding to the water capacity of the aquarium (approximately 20 per minute per 100 litres of water). By adjusting a screw, this flow if further split up into a flow of tiny gas 'pearls', whose extra-fine size means even more surface area of gas/water contact, enabling easy diffusion into the water.

Full details of BIO-PLAST aquarium system accessories from: **BIO-PLAST (UK) LTD, Unit 1, Old Railway Goods Yard, Kildwick Crossing, Crosshills, Keighley, West Yorkshire BD20 7DA. Tel: 0535 630230; Fax: 0535 633690.**

BIO-PLAST

Your questions *Answered*

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. **Marine,** Gordon Kay.

KOI

WAXY GROWTHS

During my first winter season keeping Koi, some white marks (milky) appeared on the fins of one fish. When the water started to warm, some of the marks disappeared and others took on a waxy nodule aspect. Last winter, the problem extended to four other smaller fishes; evolution was the same as the previous winter.

I've read an article on viral infection of fish (Aquarist & Pondkeeper — *Feb 93 — by Peter Burgess and Stan MacMahon page no 46) and feel that this seems to describe exactly the problem I am facing. I have talked to some other Koi keepers, who said that this is not a big problem and that it will disappear in time.*

I don't know what to do with the fishes and the pool in order to fix this problem before next winter. Would you please give me some advice? Do you know if it is possible to remove the waxy nodules, and, if so, how?

Carp Pox is unsightly but not normally dangerous.

I'm sorry to be unable to add much more to what you already know regarding Carp Pox. Unfortunately, this is a recurring ailment about which very little is known, apart from the fact that it is viral in origin and normally quite harmless, apart from being unsightly.

Once having been infected, a fish can have repeated bouts of infection each year, but can also suddenly have the symptoms disappear without warning. There is no available treatment as far as is known, but the infection is believed to be non-contagious.

I have heard of cases where the growths on the body have been removed by surgery, but I, personally, feel this to be both cruel and unnecessary, apart from the fact that damage to scale patterns could be caused.

GROWTH RESTRICTIONS

I am planning to set up a pond measuring 6 x 7 x 4 ft. (1·8 x 2·1 x 1·2m). How many Koi could I keep in it?

If you intend to keep Koi seriously, the size of pool you plan is a little on the small size, as Koi not only grow very large, but also quite rapidly. Your proposed pool will not allow them to grow to their full potential.

If you were to place, say, a dozen 6-inch (15 cm) Koi in a pool this size, within, perhaps, two years, they would be struggling for living space and would probably be showing signs of stress through being restricted for swimming space.

My own feeling is that 10 x 10 x 4 ft (3 x 3 x 1·2 cm) is the absolute minimum size of a pool which will happily support Koi, allowing them plenty of growing space.

PLANTS

FOAMING POND

I wonder if you could explain why my pond is 'foaming up'. (See photograph).

It is approximately 12 x 8 x 4 ft (c3·7 x 2·4 x 1·2 m) and holds about 800 gallons (c 3,640 litres) and is made of prefabricated fibreglass.

I have seen this situation a few times, and it generally starts as a result of a heavy growth of 'blanketweed' or filamentous algae. When treated with an algicide, the dead algae tend to break up, and tiny bubbles become trapped in the decaying filaments,

'Foaming' pond — unsightly, but not normally dangerous.

as the water pours into the pool, trapping air in the turbulence as it does so.

Because foam and debris float, they are not picked up by the pump and transferred to the filter. In swimming pools, a skimmer can be used to take care of this; similar devices are also available for garden ponds.

Although unsightly, the situation is not normally dangerous and is probably best tackled manually skimming off the foam with a bucket. You might have to do this a couple of times, but then the problem should right itself.

DISCUS

EBERHARD SCHULZE CALLS IT A DAY

Eberhard Schulze, our long-standing and highly respected Discus expert, has emigrated to sunnier, warmer climes. After struggling for several years with a particularly painful and distressing back problem, and having undergone major surgery which has only been partially successful, he's decided to call it a day and move out to Thailand, Far East home of the Discus industry he has graced for so many years.

Eberhard reports that the country, climate and people of Thailand are so delightful — and suit him so well — that his aches and pains are now

BILLY WHITESIDE

only minor, compared to their intensity in the colder conditions experienced in the UK.

Emigration does not, however, mean retirement, and Eberhard continues to be involved in publishing (his *Discus — The King of All Aquarium Fish* is now available in several languages) and other areas of Discus activity.

Having put his world-famous shop **The Highgate Aquarist** on the market, he still makes regular visits to the UK to oversee the sale, but returns to his Far East retreat as soon as the pain makes its presence felt, which is usually sooner, rather than later.

Eberhard Schulze will be sorely missed by UK Discus hobbyists and all those countless readers who have sent in queries to him over the past two decades or so. We, at *A & P,* wish him good health and happiness for the future and offer him our deepest thanks for his unwavering, invaluable service and support over the years.

We also plan to keep in regular touch, of course, and hope to publish further contributions from him as and when the pleasures of the country, climate and people of Thailand allow him some 'respite' to put pen to paper . . . or fingers to keyboard.

Although Eberhard will no longer be able to respond to any Discus problems which our readers may have, he's left his 'department' in the very capable and willing hands of Aquarian's **Dr. David Ford** who has kindly agreed to take over from him within his own **Tropical** section of **Your Questions Answered.**

TROPICAL

BREEDING ANGELS AND FIREMOUTHS

I have a 48 in (120 cm) tank with three Angels and three Firemouths.

Would you please give me some advice on how to breed these fishes and on how to tell the sexes apart?

The fish you possess will not normally breed in the mixed aquarium. Even if spawning occurs, the eggs or fry will be eaten. You should therefore set up a separate breeding tank with just a pair of fish therein.

The Angels, *Pterophyllum scalare,* are easy to breed, pro-

LAURENCE F. PERKINS

Firemouths (this is a male) are easy to sex and breed, but a separate tank should be set up for spawning.

viding you have a true pair. It is impossible to tell the male and female until spawning does occur, but you can assume a pair bond has been formed if two fish swim together and start ritual cleaning of a leaf or the glass.

The eggs are adhesive and tended very well by the parents. After hatching, the fry are also treated as a family, and feeding is easy; use powdered fry food, followed by freshly hatched Brine Shrimp.

The Firemouths, *Cichlasoma meeki,* are also easy to breed. Again, they make a good pair and parents, but note that if the female is not ripe, the male can damage, even kill her, for not responding to his spawning rituals. So choose a female swollen with eggs.

She will also be obviously smaller than the male, less colourful and her fins will be shorter.

Feeding of the fry is the same as quoted for the Angels.

MARINE

ANGELIC CONFLICT

I am planning a marine aquarium of around 100 gallons nett capacity (overall size 60 x 24 x 24in).

I would like to keep two large Angelfishes to provide a focal point, but I have been told that I should only keep one, as two will fight. What do you think?

This is tricky. If I say no, then you will either ignore me and get away with it, in which case I will be a fool, or begrudge it forever, and always wonder. If I say yes, and one fish kills the other, then it will be my fault. I can't win!

I myself keep a Queen Angelfish with a Blue-Ringed Angel, with no problems.

My advice is this: If you want to do it, then the two Angels should be of a different genus (as mine are). They should also be a different colour and, if possible, as different in size as you can manage.

No-one should attempt to keep two large Angels in a smaller tank than yours. You will need to black out the aquarium for a day or two with a blanket to minimise aggression, and even then, there can be no guarantees.

Remember, fish are only human(!) and no two specimens of any species behave exactly alike.

MICHAEL GILROY

Blue-ringed Angel *(Pomacanthus annularis).* If kept with another Angel, its tankmate should belong to a different genus, (eg) *Holacanthus ciliaris.*

COLDWATER

DEFECTIVE FANTAIL?

I recently purchased two beautiful Fantails. After reading an extremely interesting book on the subject, I now realise that one of my fish has only one anal fin.

I am wondering why this fin is missing. Could it have been caused by injury or disease?

Whether or not your fish has two anal fins or one, or even none at all, matters little unless you were thinking of entering it into competition at a show, where it would, of course, be disqualified. Show Standards dictate that the twin-tail varieties of Goldfish must have paired anal finnage.

However, just because one or both of these fins are missing detracts little from an otherwise attractive fish, which can still give pleasure and interest, even if it is not the most perfect of specimens (at shows they, obviously, are striving for perfection).

I doubt that injury or disease has taken away this fin. The fish would have developed only one, but any number of baby fish from any spawning could have such a defect, and this is one such defect where swimming is not impaired.

PAULINE HODGKINSON

Young Fantails. Whether they develop all the 'perfect' characteristics or not matters little unless you are looking for show specimens.

HERPETOLOGY

A MATTER OF DEPTH

Can you explain why Common Toads tend to spawn in relatively deep water, whereas Common Frogs deposit their spawn at the edges of ponds or near the surface of the water?

Common Toads (*Bufo bufo*) tend to spawn in very much deeper water than Common Frogs (*Rana temporaria*). For example, toad spawn has been found in water as deep as 4·5 metres (15 feet) and Common Toads have been trapped at a depth of 6 metres (20 feet) in Windermere in the English Lake District.

It is probable that the bitter glandular skin of toads (and their tadpoles) gives them some protection from predation by fish, and so these amphibians can inhabit deeper water.

Common Frog tadpoles do not have such protection and usually remain in shallow water and at the edge of ponds to avoid being eaten. Even so, there are exceptions to any rule and Common Toads sometimes spawn in water as shallow as 15 cm (6 inches).

JULIAN SMS

Common Frog and spawn in shallow water.

August '93
SUPPLEMENT

POPULAR KOI VARIETIES

PUBLISHED BY
AQUARIST & PONDKEEPER

POPULAR KOI VARIETIES SUPPLEMENT

PUBLISHED BY

AQUARIST & PONDKEEPER

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Supplement Contents

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TELEPHONE: ADVERTISING AND PRODUCTION 0233 621877, **FAX NUMBER:** 0233 645669

Buying Koi

Selecting fish of a particular variety is one thing. Selecting *healthy* fish is quite another. **Barry James** of Everglades Aquatic Nurseries offers some useful tips on how best to approach the subject. *Photographs by the author.*

A healthy Tancho . . . but how do you ensure that the specimen you buy is as healthy as this one?

One aspect of Koi purchase should be considered right from the beginning, when the decision to build a Koi pond is taken: the size of the pool. This will obviously determine the number of fish which will be stocked. How often I hear hobbyists bemoaning the fact that the pool they had lovingly constructed is too small. Although, provided the garden is big enough, a larger pool can be added, it does mean additional expense in upgrading or adding larger filters, ultra-violet sterilisers and higher capacity pumps.

EARLY DECISIONS

However, stocking density is still the first aspect of buying Koi that should be considered. Decide how many fish the pool will accommodate, and make a list of the varieties you wish to stock.

How many fish you decide to stock will depend on a number of factors, such as depth, surface area and the size of the fish. For instance, a small pool of around 100 square feet surface area could, with first class filtration, support around 20 fish of mixed sizes. Allow about 24 square inches of surface per inch of fish (c 900 sq cm/2.5cm of fish).

The next decision concerns the quality of fish you intend to keep. If you intend to join a Koi society and partake in shows, or simply want the best, then you will have to go to a specialist dealer, buy high-grade fish and pay correspondingly high prices. If, on the other hand, you simply want healthy, colourful fish at an affordable price, then other, more generalised, outlets may suit you better.

USEFUL BUYING TIPS

I always recommend that beginners buy smaller fish to start with, so if (because of inexperience) disaster strikes, you lose the fish, but the financial 'exposure' is not so great.

Traditionally, the best Koi have come from Japanese fish farms such as this one. Other countries are catching up fast, though!

The best time to buy is between November and May. This is because, although most fish are bred in warmer climates than our own, they still originate from the northern hemisphere. Therefore, because fish suffer less stress, and therefore arrive in better condition during the cooler months, it makes sense to buy at this time if the fish have been freshly imported.

Koi are bred (mainly) in Japan, China, Singapore, Israel and the USA. The best fish still come from Japan, but at a premium. Chinese, Israeli and American fish are, in general, of lower grade but still make nice specimens for the non-specialist.

Singapore produces healthy Koi of indifferent colours, as there is no attempt at selective breeding. They, of course, have always been exposed to high temperatures, so a long period of acclimatisation is necessary before they can be put outside.

Talking to other aficionados can help when deciding on the dealers to visit. However, one must take into account prejudice in this respect. You are under no obligation to buy, so shop around to start with, and look at a few outlets.

What to look for in a dealer

① Firstly, choose a dealer as near to home as possible. This will decrease the stress suffered by the fish in travelling.

② Check that the holding tanks are clean and well filtered and that the fish are displayed under natural daylight; fluorescent tubes can distort the colours of fish.

③ The fish themselves should be active and curious, moving towards the surface in the hope of food when one approaches the tank. Koi that hug the bottom are suspect, especially if they are lying on their sides!

④ Fish mouthing the surface indicate either gill infection or the possibility that there is a problem with the water.

⑤ The way a fish swims is a great indicator of its health. Jerky movements may indicate either an external parasitic infection or, more insidiously, an internal blood flagellate infection.

⑥ The colours should be bright; any suggestion of cloudiness or dullness should be viewed with suspicion.

⑦ Gills should lie close to the head; protruding gills are a sure sign of trouble.

⑧ The head should form a smooth line with the body. If enlarged in relation to the body, it could indicate either a genetic malformation, or a sign that the fish has other problems.

⑨ Fish with protruding scales are almost certainly suffering from Dropsy, even if the accompanying symptom of a bloated abdomen is not present.

⑩ All the above are signs that are easily detected from observing the fish from above. If a purchase is contemplated, ask that the fish be put in a polythene bag so that you can look at it from the side. Infections by Anchor Worm or Fish Louse should now be visible. Ulceration, inflamed or damaged areas, cloudy eye, finrot, fungus can now be seen clearly and the fish rejected if necessary.

⑪ Finally, if the fish looks bright and lively, with upright finnage, it is probably all right and the purchase can be proceeded with.

Gold or silver sheens on the scales — as exhibited by this Kohaku — are particularly popular among Koi keepers of all levels of experience.

Once you've established that the fish on sale are healthy, you have to face the next challenge: choosing your favourite from the wide range of colours and scaling available.

POST-BUYING TIPS

Fish should be packed with enough water to cover them. The bag should then be inflated with air for short journeys, or oxygen if several hours will elapse before reaching home. Preferably, fish should be double-bagged or, at least, a spare bag provided in case of leaks. Large Koi should be packed in a sturdy cardboard box.

The question of quarantine (acclimatisation) is always a thorny one. In an ideal world, every Koi keeper should have a small pool or large aquarium where fish can be kept and observed for a couple of weeks before being introduced into the main pool. However, very few hobbyists have such a facility.

Therefore, I always advise treating the pool whenever a new fish is introduced. Malachite Green and Formalin will guard against an outbreak of common parasitic diseases, but there are many others which a carrier fish can introduce with lethal results.

The introduction of a new fish into the pool must be done carefully. Allow the bag to float in a shady spot for about half an hour. Open the bag and allow the water from the pool to mix with that in the bag; then gently release the fish.

During the last few years there have been epidemics of quite lethal fish diseases including ulcerative conditions caused by bacteria, as well as viral complaints.

There are no real cures for either condition. These diseases progressively find their way around the world. A country with clean fish one year can send out nothing but infected fish the next, causing massive losses, both to the trade and the buying public. It is therefore wise to keep your ear to the ground, so as to be aware of what's going on in the various Koi exporting countries around the world.

A superb and very friendly Ai Goromo was just one of the hundreds of Koi in the 1992 "National" Show.

People descend upon Billing in their thousands to see some of the best Koi in the country on display.
Ferdi the Clown will be available to entertain the children.
Craft and refreshment tents will supplement a huge collection of dealers offering, not only Koi, but a wide variety of dry goods as well.
Billing Aquadrome is a superb setting to hold a Koi show with water all around, and even a resident funfair for the children. Open Saturday 9.30 am to 4.30 pm and Sunday 10 am to 4.30 pm.

29/30 — South East Section BKKS Open Show. Ravenswood School, Oakley Road, Bromley, Kent. This Bank Holiday (Sunday and Monday) Show which attracted over 3,500 people through the gate and over 500 Koi entries last year, is looking forward to breaking records again this year. Twenty-plus Koi dealers will be housed in large marquees and, in addition, there will be various arts, crafts, Bonzai, refreshments and other attractions. £2 adults, children and car parking FREE. Contact **Brian Edwards** on 0634 718943.

FUTURE SHOWS
September

4/5 — Mid-Somerset Section BKKS, Closed Show. Royal Bath & West Showground, Shepton Mallet.

5 — Hull Koi Section. Closed Show. Springfield Water Gardens, Burshwick, Nr Hull.

11/12 — Central Section BKKS *"Midlands Open Show"* at Avoncroft Museum of Buildings, Bromsgrove, West Midlands. **NOTE: Changed venue.**
South Hants Section BKKS. Open Show. The Queen Elizabeth Country Park, Petersfield. Contact **George Rooney** on 0420 473169.

26 — East Riding Section BKKS. Open Show. Beverley Westwood Racecourse. Lots of dealers and Craft Fayre. Contact **Rod** on 0482 866770 or **Phil** on 0482 799920.

October

2/3 — Northern Koi Club Winter Open Show.

November

6/7 — Aquatic Festival at Pontins, Sand Bay, Weston-super-Mare.

WHAT'S ON IN AUGUST

1 — South Hants Section BKKS *visit Birmingham Section ponds.* Contact **George Rooney** on 0420 473169.
Lower Thames-side Section BKKS. Monthly meeting. Contact **Val Radley** on 0702 529675.
Mid-Somerset Section BKKS *visit Kennet Valley ponds.* Contact **Alan Purnell** on 0458 72132.
Worthing & District Section BKKS. Preston Scout Hall, Bognor Regis, Sussex. Contact **Steve Willard** on 0243 267893.

2 — Kennet Valley Section BKKS. 8 pm, Newbury Rugby Club, Pinchington Lane, Newbury, Berks. Contact **Bob Thompson** on 0734 713640.
North Lincs Koi Society. *Open Forum evening.* 8 pm, Brackenborough Arms Hotel, Fotherby, Nr Louth. Contact **Anne Mawer** on 0472 826605.

3 — Yorkshire Section BKKS. The Holme Leas Inn, Ossett, Nr Wakefield. Contact **Fred Harston** on 0226 722578.
New Forest Section BKKS. Monthly meeting at Tiptoe, Nr Sway. Contact **Mrs Chris Middleton** on 0425 272732.

4 — Suffolk & North Essex Section BKKS. 7.45 pm, Prince of Wales PH, London Road, Marks Tey, Colchester, Essex. Contact **Dennis Preou** on 0371 856450.
Leicestershire Koi Society. Old Aylestone Constitutional Club, Leicester. Contact **Ian Oliver** on 0533 839707.
Plymouth & District Section BKKS. 7.30 pm, The Lyneham Inn, Plympton, Plymouth. Contact **Trevor Ridley** on 0752 690087.

5 — Middlesex & Surrey Borders Section BKKS. CIU Norbiton Club, Kingston-upon-Thames. Contact **Marie Martin** on 0372 272462.
North Wales Koi Club. 7.45 pm, David Bryant Bowling Centre, Frith Beach, Prestatyn. Contact **Eileen Price** on 0745 591730.
The Potteries & District Koi Keepers Society. Guest speaker: **Bill McGurk.** The Thistleberry Hotel, Newcastle-under-Lyme. Contact **Ivan Rwatschew** on 0782 45864.

8 — Northern Koi Club *visit to ponds of Heart of England Koi Society.* Contact **Tony McCann** on 061 794 1958.
Central Section BKKS *Members' pool* visit. Contact **Sue Finney** on 021 747 2733.
The Potteries & District Koi Keepers Society visit *ponds of the West Wales Section BKKS.* Contact **Ivan Rwatschew** on 0782 45864.
Scottish Section BKKS. Meet at Tillicoultry. Contact **Archie Dick** on 0786 832073.

9 — Northants Section BKKS. Contact **John Byles** on 0604 718648.

10 — Nottingham Section BKKS The Rose & Crown, Derby Road, Nottingham. Contact **Shirley Hind** on 0602 810923.
Chiltern Section BKKS. Contact **Ann Howard** on 0462 679315 or **Mike Reed** on 0525 375418.

11 — Merseyside Section BKKS. Millbrook Manor Restaurant, Knowsley Village. Contact **Robbie** on 051 549 2001.
South Hants Section BKKS. 8 pm, Denmead Church Hall, Hambledon Road, Denmead, Hants. Contact **George Rooney** on 0420 473169.

12 — East Pennine Section BKKS. Monthly meeting. 8 pm, The Phoenix, Platts Common, Barnsley. Contact **John Timmis** on 0226 289507.

15 — Yorkshire Koi Society. Monthly meeting, Wetherby, 2.30 pm. Contact **Graham Baines** on 0423 864297.

16 — Border Koi Club. Lanes Library, Carlisle. Contact **Amy Fisher** on 0228 513623.

18 — Mid-Staffs Section BKKS. RNA Club, Elmore Green Road, Bloxwich. 8 pm. Contact **Don Dyche** on 0543 425178.
Crouch Valley Section BKKS. Laindon, Basildon. Contact **Alan Ward** on 0268 543600.

19 — Wirral & District Section BKKS. Lever Sports & Social Club, 8 pm. Contact **Cilla Hardisty** on 051 645 7832.

21 — Crouch Valley Section BKKS. Laindon, Basildon. *Beginners' class.* Contact **Alan Ward** on 0268 543600.

22 — Lower Thames-side Section BKKS. *Koi Auction.* Contact **Val Radley** on 0702 529675.
Northern Koi Club. Speaker on *Landscape Gardening is* **Bob Langrish.** Laporte Sport & Social Club, Great Sankey, Warrington. Contact **Tony McCann** on 061 794 1958.
Crouch Valley Section BKKS. *Norwich Section BKKS visit our ponds.* Contact **Alan Ward** on 0268 543600.
Central Section BKKS visit *Yorkshire Section BKKS ponds.* Contact **Sue Finney** on 021 747 2733.
Essex Section BKKS. North Stifford Village Hall. Contact **Bobbie Barton** on 0702 611750 or **Margaret Bishop** on 0702 522388.
South East of England Section BKKS. Monthly meeting. 2.30 pm, Community Centre, Chelsfield, Kent. Contact **Mick Wright** on 0634 718943.
The Potteries & District Koi Keepers Society. *West Wales section visit Potteries ponds.* Contact **Ivan Rwatschew** on 0782 45864.

24 — Mid-Lincs Section BKKS. West Ashby, Nr Horncastle. Contact **Brenda Goodwin** on 0522 688631.

25 — London Section BKKS. Ruskin House, Coombe Road, Croydon, 8 pm. Contact **Keith Nind** on 081 673 3574.

31 — East Riding Section BKKS. 7.30 pm, Grovehill PH, Holme Church Lane, Beverley. Contact **Tim Goodyear** on 0964 542762.

OUT AND ABOUT

The Best of British Koi in the Worst of British Weather

Stephen J Smith visits Epperstone Park Hatcheries
Photographs: Epperstone Park Hatcheries

Good British-bred Koi *can* stand scrutiny among some of the best imported fish, as this two-year-old Yellow Ogon bred by Colin and Bill Peat clearly illustrates.

To make arrangements for a visit to a British Fish farm just two days before a Bank Holiday weekend simply has to be tempting providence. So why was I so surprised that, come the day that I was due to visit **Epperstone Park Hatcheries** in rural Nottinghamshire, I was greeted by torrential rain which lasted throughout the whole of the day . . .?

Despite such a setback, however, I was able to experience first-hand just how much British Koi breeding has developed over recent years.

I shall state my conclusion first: OK, so Japanese Koi *are* spectacular; Israeli Koi *are* an exciting alternative — but what is all the fuss about when, in terms of quality and hardiness, there are British-bred Koi which would stand scrutiny alongside many of the rest?

With the assistance of two additional staff, Epperstone Park Hatcheries' proprietor **Bill Peat** and his son **Colin** have achieved what, a few years ago, may have been thought impossible: to establish a fish breeding establishment in Britain which can produce quality Koi. For me, the advantage of this is that any fish acquired from such an establishment will have been spawned, hatched, and reared in *British* climatic conditions, and stand a better chance, therefore, of withstanding the vagaries of long, cold, British winters.

Bill Peat could be classed as an 'old hand' in the fish breeding business, having bred fish for some 25 years. Until five years ago, the 20-acre establishment was dedicated to producing fish for the coarse angler (mainly carp). However, Bill's own interest in Koi keeping, and his son's graduation from university, led the partnership to turn Epperstone Park Hatcheries over to producing Koi for the hobbyist.

"We set out to provide reasonable-quality fish at a reasonable price for the average fishkeeper, rather than for the serious Koi collector," explained Bill. "However, some of the fish we have produced have been so impressive that Koi society members have purchased individual fish especially for showing."

Indeed, his fish have been so impressive that a party of Koi breeders from Japan have arranged a mission to the establishment to see 'how it's done', while some British wholesalers have been known to *export* fish from Epperstone!

Part of the secret of Epperstone's success is the water supply, which is drawn from a 300-foot borehole and piped throughout the establishment with no fewer than two miles of four-inch diameter pipe; while the ponds are continuously aerated from a central pump and supplied, again, by two miles of air hose.

Bill explained that aeration is especially important in keeping the water quality good: "Many people believe that aeration simply allows them to keep more fish within a given body of water. Far from keeping more fish, we use aeration continuously in all the ponds to help keep water in good condition."

Consequently, growth rates are said to be approximately 10in in two years and, although the fish were originally spawned from Japanese broodstock, further generations have produced a good range of quality offspring.

Spawning is achieved by hand-stripping; "less stressful than letting the fish damage themselves", Bill added, before explaining that he achieves a 95% fertilisation rate and a 99% survival rate, from an annual production of around 50,000 fish.

The majority of sales are to wholesalers and retailers, although the couple have recently begun to sell Koi at specialist auctions and shows, as well as receiving the occasional single customer. To accommodate the increase in individual customers, the company is planning a Koi showroom to be opened during next year. Added Bill: "the place is a working fish farm and is therefore not the most attractive place for visiting customers. However, a comfortable showroom will enable customers to see the Koi displayed at their best".

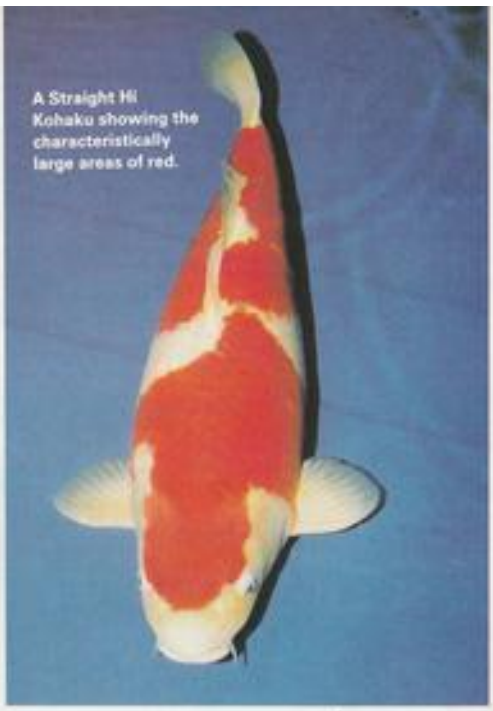
I will certainly be making a return visit to Epperstone (hopefully, on a fine day, when I can take some reasonable photographs!). And, from what I saw, I feel sure that retailers, wholesalers, and individuals, will be making regular visits, too.

Epperstone Park Hatcheries, Epperstone By-pass, Woodborough, Notts. Tel: 0602 64410. Contact: Colin or Bill Peat.

Epperstone Park Hatcheries are particularly proud of their recent spawning of Shusui, of which proprietor Bill Peat explained: "These are just a selection of what we could gather, with some even better examples in the pond".

Go-Sanke, Shiro Utsuri and Tancho

How do you tell one Kohaku from another, or a Sanke from a Sanke, or a Showa from a Showa? **Nigel Caddock** provides the answers to these and other important questions. *Photographs: Nishikigoi International.*



A Straight Hi Kohaku showing the characteristically large areas of red.

Excellent (albeit small) black patches dominated by red and white: a quality Sanke.

Of all the aspects of Koi keeping, it is perhaps Koi varieties, and their appreciation, that offers real enthusiasts almost limitless learning opportunities. There are thirteen basic varieties of Koi, and within these there is an almost infinite number of variations that offer something for absolutely everyone.

The thirteen main varieties are:

Ⓐ **Non-Metallic Koi**
Kohaku, Sanke, Showa (Go-Sanke Varieties)
Utsuri Mono
Bekko
Tancho
Koromo
Asagi-Shusui
Kin Gin Rin
Kawarimono

Ⓑ **Metallic Koi**
Hikari Moyo
Hikari Utsuri
Hikari Muji

Within the thirteen there are three main non-metallic varieties which are known as 'Go-Sanke': Kohaku, Sanke, Showa. More recently, Shiro Utsuri has challenged for Go-Sanke status. The Go-Sanke varieties are regarded as representative of all the excellent features of Nishikigoi.

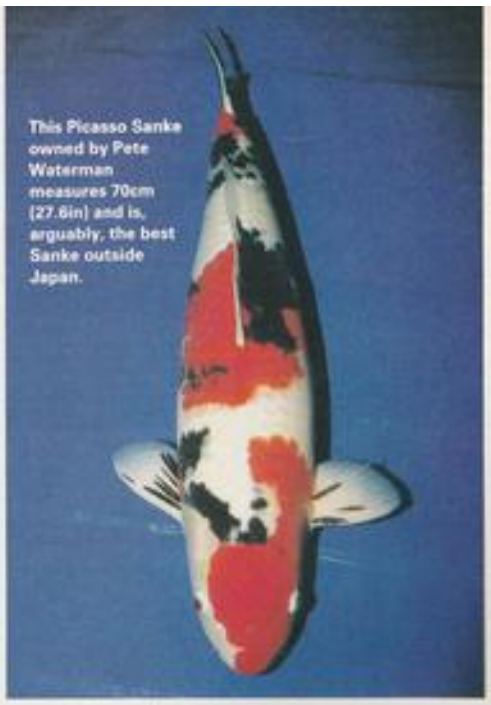
In order to help readers identify these important varieties of Koi and to help you appreciate some of their key attributes, I have pleasure in offering a pictorial review of the Go-Sanke varieties.

It is important to appreciate that what I am offering is an introduction and guide only, as a definitive review of these varieties would take an entire book, never mind a single magazine feature! In addition, although each Go-Sanke variety has its own individual characteristics and attributes, which I will cover later, some generic manifestations are common to all three. Specifically, Gin and Kin Rin, and Doitsu (Scaleless, like Leather Carp) occur, not only in Go-Sanke varieties, but many others as well.

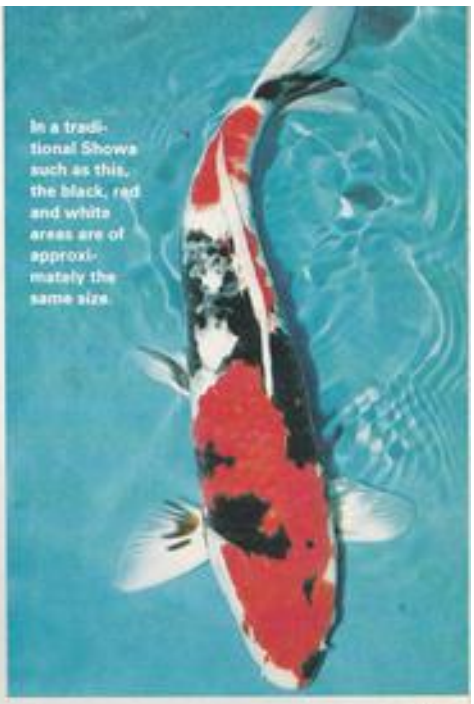
Count the patches of red and you will see why this fish is a Godan (five-step) Kohaku.

KOHAKU

A Kohaku is a white Koi with red markings, called *hi* (pronounced 'he'). It is, by far, the most popular variety in Japan, where there is a famous saying: "Koi keeping begins and ends with Kohaku". Whatever



This Picasso Sanke owned by Pete Waterman measures 70cm (27.6in) and is, arguably, the best Sanke outside Japan.



In a traditional Showa such as this, the black, red and white areas are of approximately the same size.

your personal likes and dislikes, of all the thirteen varieties of Koi, it is perhaps the Kohaku that is the most beguiling, its almost mystical qualities being the stimulus that may have inspired the Japanese saying.

When enthusiasts embark on their Koi careers, they are often drawn to the impressive contrast offered by the bright red *hi* layered onto snow-white base skin, that occurs in almost infinite pattern variations which are often most impressive.

When Koi keepers develop their skills of appreciation, they learn to tell the difference between 'boring' and 'simple'; this is one of the subtle but vital differentiations that ultimately opens the gates to the beginnings of true understanding, not only in relation to Kohaku, but all the other varieties as well.

All Koi are unique, so in order to begin to appreciate the difference and to help us make informed decisions about selections, it helps to be aware of the general types of Kohaku patterns that are available. The classifications are not formal, but have been developed simply to help identify the various general types.

Hi Showa exhibit a predominance of red.

① Stepped Patterns

Danmoyo hi patterns are those identified by the clear locations of areas of separated *hi-ban* (*hi-ban* are areas of *hi*). There are four main types, *Nidan* = two step, *Sandan* = three step, *Yondan* = four step, *Godan* = five step.

② Straight Hi

Kohaku with straight *hi* are those where the red runs the entire length of the top of the Koi. Within this general classification, there are limitless combinations. Some people may regard this type of Kohako boring, but the better informed would appreciate its simple complexity.

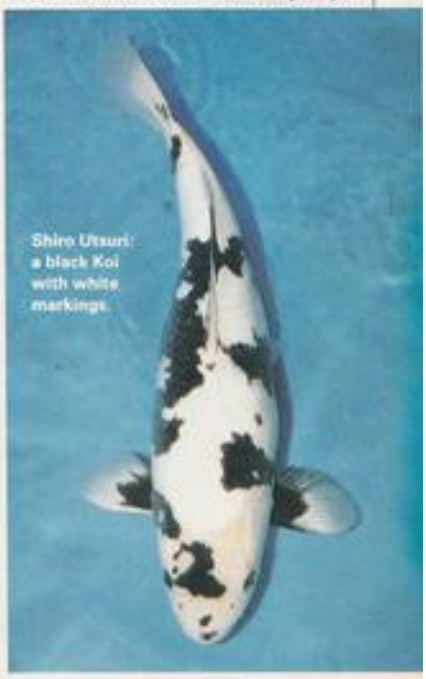
In some examples, too much *hi* is not always an advantage. A balance of *hi* and white should be sought. It is the overall impression given by the Koi that is the most important factor, as the individual components contribute to the final effect.

③ Flowery

This is a classification attributed to a Kohaku with large areas of white skin with scant but well placed and quality *hiban*. In Showa, such a Koi would be called a Kindai Showa, as you will see later in the article.

It is, again, vital that, despite being dominated by white areas, flowery Kohaku should have sufficient *hi* as to offer a pleasing overall impression. This is especially important with smaller Koi, because while the domination of white areas may be pleasing now, as the fish grows and develops, the effect of insufficient *hi* will be exaggerated.

When buying baby Koi to grow on, it is vital to pay particularly close attention to key factors, such as skin quality, and location and distribution of the *hi*. Basic quality is



Shiro Utsuri: a black Koi with white markings.

In a Shiro Bekko, there's no black in front of the shoulder area.

vital, otherwise, as the Koi grows, it may not improve as you may initially have hoped.

④ Maruten

Maruten Kohaku are determined by the location of a circular or roughly circular area of *hi* on the head, a little like a Tancho spot. This can also combine with other Kohaku classes, for example Maruten Nidan Kohaku or Maruten Inazuma (lightly shaped *hi*) Kohaku.

⑤ Kin Gin Rin

All the afore-mentioned types of Kohaku also occur with reflective scales and are referred to as Gin Rin or Kin Rin Kohaku. Silver reflective scales are called *Gin Rin* and gold reflective scales are called *Kin Rin*.

When selecting Koi, the existence of Kin or Gin Rin scales is a matter of personal preference, but for the purposes of shows, Go-Sanke varieties are only benched into the Gin Rin class. Thus, a Gin or Kin Rin Kohaku, Sanke or Showa would go into Gin Rin class. All others, e.g. Gin Rin Ogon, go into their own classifications.

SANKE

A Sanke is, basically, a Kohaku with *sumi* or black markings, a white Koi with *hi* (red) and *sumi* (black) markings. Like Kohaku, Sanke also come in limitless combinations.

It is often said that the measure of a good Sanke is to imagine it with the *sumi* removed. If you have a good Kohaku, and if the *sumi*, when replaced, is well located and of good quality, then the Koi may be regarded a 'good' Sanke. More recently, the emphasis has refocussed away from obsession with detail points of appreciation only, towards a more enlightened approach of considering the overall impression a Koi offers.

This is especially important in Sanke, but the previous advice is useful when looking at a Koi you may be considering purchasing. The quality and location of *sumi* on Sanke is absolutely vital. Not only must it be well located to offer a balanced impression, but it must also stand individual scrutiny and be

Brilliant white body with blood-red circular mark on the head — the hallmark of a great Tancho Kohaku.

excellent, appearing like lacquered ebony.

'Bitty' and grey *sumi* often indicate a poor bloodline and is also less stable and prone to disappearance, rather than further development and consolidation.

Sanke *sumi* comes in two basic types: *sumi* located on the red areas is called *Kasane sumi*, while that located on the white skin is termed *Tsubo sumi*. *Tsubo sumi* offers a clearer indication of the overall potential and quality of the Koi, but it is very much a matter of personal preference. Well balanced black stripes in the pectoral fins are also considered important.

Sanke can be great fun to grow and develop, and 'unfinshed' or Tategoi Sanke, can be fascinating to buy and grow on. Fully mature excellent Sanke can often be quite awesome and, of course, don't come cheap!

SHOWA

Showa are black Koi with red and white areas of skin. Within the general Showa classification, there are three main sunclasses.

① Traditional

Here, the black, white and red areas occupy roughly equal proportions of the overall pattern.

② Kindai

This is the main culprit of the widespread confusion of how to tell the difference between Sanke and Showa. Kindai Showa are dominated by areas of white skin.

③ Hi Showa

Hi Showa are dominated by *hi*, with little or no white skin visible above the lateral line of the fish.

TANCHO

Tancho is designated by the existence of a large red circle or roughly circular *hi* marking located on the head. Tancho do not have *hi* in any other areas of their bodies. All three Go-Sanke varieties have Tancho versions, thus there are basically three types of Tancho.

① Tancho Kohaku

This is a white Koi with a red circular hi marking on the head.

② Tancho Sanke

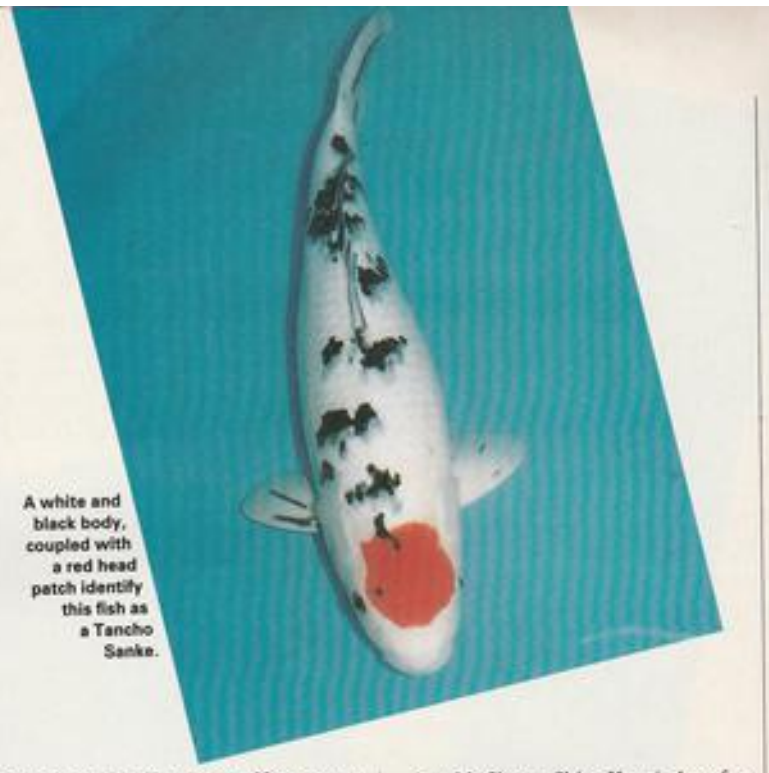
This is a white Koi with black markings and a red circular *hi* marking on the head. It can also be described as a Shiro Bekko with a large red spot on its head.

③ Tancho Showa

This is a black Koi with white markings and a red circular *hi* marking on the head. It can also be described as a Shiro Utsuri with a large red spot on its head.

To emphasise just how things can change, at one time the single most important factor when assessing Tancho was the symmetrical roundness of the Tancho spot. Not too many years ago, the Tancho was just about Tancho spots. Even if the rest of the Koi was lacking in quality, if the Tancho spot was round, red, well located and symmetrical, that was the one to choose.

As our understanding of Koi has developed, the overall 'imposing' nature of the Koi is now also important.



A white and black body, coupled with a red head patch identify this fish as a Tancho Sanke.

THE SANKE/SHOWA DILEMMA

Sanke are differentiated from Showa primarily by the difference in location, type and features of their respective *sumi*. A Sanke is a white Koi with red and black markings, whereas a Showa is a black Koi with white and red markings.

Sanke and Showa *sumi* are subtly, but totally, different. Sanke normally do not have *sumi* at the base of the pectoral and other fins, and also, NOT forward of the Koi's shoulder area. *Sumi* located on the Koi's head, nose and face generally indicate a Showa, but Koi being Koi, there are, of course, exceptions, just to confuse things!

Of all the varieties, the Showa is perhaps the one that is prone to the most dramatic changes in appearance, sometimes for the better, sometimes for the worst. In all cases, it is quite a fascinating variety, especially when you select a very average-looking baby and watch it grow, develop and flourish into something really special.

SHIRO UTSURI

Generally classified in Utsuri Mono, the Shiro Utsuri has emerged as a very important variety in its own right. Shiro Utsuri are black Koi with white markings, and are often confused with Shiro Bekko which are white Koi with black markings.

As with Showa, Shiro Utsuri also often have *sumi* on the head, face and base of pectoral fins, whereas Bekko do not have *sumi* beyond the shoulder area and have stripes, rather than solid areas of *sumi* in the pectoral fins.

SELECTION CONCLUSION

The last point especially illustrates the fickle nature of Koi assessment and, although trends may come and go and preferences and emphases may change, this should not affect your particular personal choice or preference in Koi varieties.

It is important that you choose and buy exactly what YOU like, irrespective of what any, or all, the many alleged experts may say you should buy.

If YOU like Hariwake, but a friend tells you Sanke are better, buy the Hariwake. If YOU like Doitsu Kujaku, but have heard Kohaku win more shows, buy the Kujaku.

The quality and merit of any particular Koi is not a matter of opinion, it's a matter of fact. Conversely, personal preference and selection of Koi is totally a matter for each individual Koi keeper. So, although there will usually be lots of advice available when you are making your purchase, some welcome some not quite so welcome, it is perhaps best to use all available information and advice selectively to provide you with the knowledge and Koi appreciation skills to help you develop your own personal likes and dislikes.

In the final analysis, Koi keeping is a hobby and it's for fun! Staying true to your own preferences at all times will, all things being equal, give you years of enduring pleasure and enjoyment which, in my opinion, is exactly how it should be. ASP

Shusui, Asagi and Goshiki

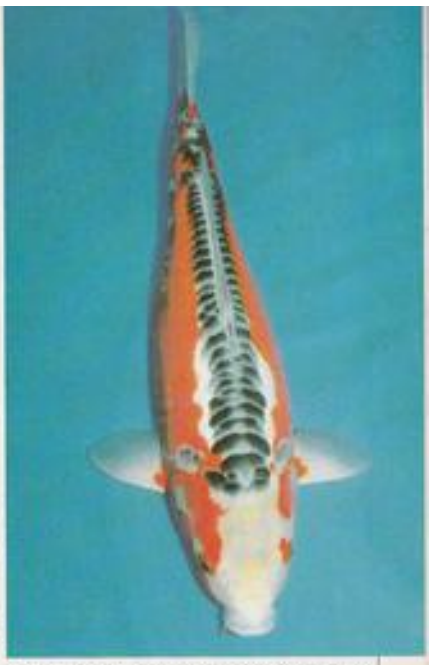
Red, white and blue . . . with a little bit of black, can lead to some beautiful combinations which, as *A & P* editor **John Dawes** explains, can captivate the hearts of new and established Koi keepers alike. *Photographs: Nishikigoi International*

In the highest echelons of the Koi keeping world, life can get rather serious. This is quite understandable, of course. When you are talking about a £20,000 Koi suffering from ulcers, or carrying a scar from a heron attack, it's difficult not to be serious.

There is also a lighter side to Koi keeping, of course. It just depends, to a large extent, on your personal philosophy and general approach to life. Take, for example, the conversation I overheard at a recent Koi show. Well, it wasn't really a conversation — more a way of bringing a touch of welcome light relief to the rather 'heavy' proceedings surrounding the judging of a large selection of some rather prime Koi.

Deadpan, but with a very obvious underlying sense of humour, this Koi keeper kept pointing out the outstanding qualities of a striking 'Wacky Harry', an elegant 'Agassi' and a beautifully scaled 'Sushi' to his equally deadpan — but probably every bit as nicely 'warped' — partner.

'Wacky Harry', I hasten to add, was not a 'Krazy Koi Keeper', nor was 'Agassi' the flamboyant emotion-packed tennis ace we all know. As to the 'Sushi' — raw fish couldn't have been further from this Koi



A Hi Shusui with as much red on its body as this specimen is truly hard to beat.

Dark-coloured Asagi need to be exhibited properly to be fully appreciated.

Top-quality specimens of Asagi, such as this 78cm beauty, don't necessarily have to have blood-red coloration to make them special.

How about this for a brilliant (five-colour) Goshiki? This was the Grand Champion fish in the 35 Bu Gin Rin Goshiki class at the 1993 all-Japan Show held in Tokyo in January.

keeper's mind or menu! He was, of course, referring to Hariwake, Asagi and Shusui — three of the best-loved types of Koi around.

Hariwake are being dealt with by **David Twigg** elsewhere in this **Supplement**, so I won't be referring to them any further. I will therefore concentrate on Shusui and Asagi, with something reserved for that 'partially related' variety, Goshiki.

SHUSUI

While it is true to say that virtually all experienced Koi keepers share a passion for Kohaku, it is probably also true to say that many beginners to the hobby find Shusui particularly attractive. Some of us never outgrow that initial love for this somewhat unusual variety. And why should we?

Take a Doitsu Koi, i.e. one with large scales restricted to the dorsal ridge (the line stretching from just behind the head, down to the root of the tail) and the lateral line, then throw in some blue, red and white, and who could fail to be impressed by such a fish? I certainly am!

Obviously, there's more to a Shusui than this, but basically, what we are talking about are variations on this common theme.

Types of Shusui

There are four main types of Shusui (plus several others which, for various reasons, are generally classified under other categories, e.g. under Kawarimono or Hikarimoyo). In alphabetical order, these four basic types are:

(i) ***Hana Shusui*** — these fish have quite a bit of visible red (*hi*) on their bodies, mainly between the belly region and the lateral line, and between the lateral line and the dorsal ridge. The red can also extend into the head.

(ii) ***Hi Shusui*** — these fish have even more red (*hi*) on the body, with the pigmentation stretching — in the best specimens — all the way from the abdomen to the dorsal ridge.

(iii) ***Ki Shusui*** — the exception to the rule (there's always one!). These fish have yellow pigmentation with a greenish dorsal fin.

(iv) ***Pearl Shusui*** — probably even rarer than Ki Shusui, Pearl Shusui have silvery scalation.

ASAGI

Give a Shusui a fully scaled body . . . and you end up with an Asagi. In some ways, Asagi are not as spectacular as Shusui, probably because even Hi Asagi tend to have less red than their Hi Shusui counterparts. Nevertheless, if you like Shusui, you'll almost certainly also like Asagi.

Many Koi keepers 'outgrow' Asagi, moving on to some of the more strikingly coloured varieties. Yet, numerous well established specialists will still keep at least a token Asagi as a constant reminder of their early days in the hobby.

Often, this token specimen will be larger than most, if not all, the other fish in the pool, an indication that it was bought as part of the first-ever batch of fish, and is being fondly retained as the 'real pet' of the collection.

Types of Asagi

As with Shusui, there are various types of Asagi, the first four probably being better known than the last two:

(i) ***Hi Asagi*** — these fish have red (*hi*) extending above the lateral line.

(ii) ***Konjo Asagi*** — these are Asagi with dark blue pigmentation. In a black pool, such fish can merge with the background and are sometimes not fully appreciated.

(iii) ***Mizu Asagi*** — the opposite to Konjo, these fish are light-coloured.

(iv) ***Narumi Asagi*** — these are the 'classic' Asagi, i.e. the ones most often seen.

(v) ***Asagi Sanke*** — these fish have light-blue dorsal regions, with red on the head and sides of the body.

(vi) ***Taki Sanke*** — the body pigmentation is (unusually) separated from the red coloration of the sides by a white band.

GOSHIKI

When a Goshiki is referred to as a five-coloured Koi, it can conjure up an image of a fish boldly splashed with yellow, blue, black, red, orange, white . . . or any other colour of the rainbow.

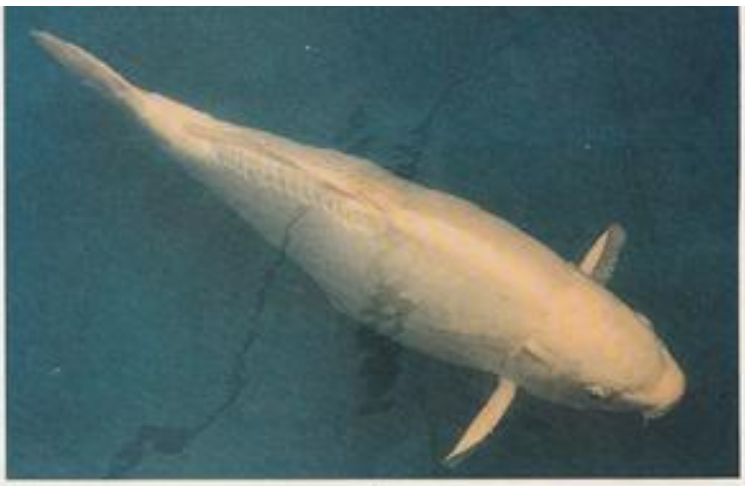
In reality, the five colours always consist of red, black, white and two shades of blue. However, the actual combination of these colours, plus the extent to which they overlap, can create what many regard as a purplish sheen to parts of the body.

Goshiki can be either fully scaled or Doitsu. However, whatever their scalation, they are all non-metallic Koi and are therefore classified under the Kawarimono in many countries (this category embraces non-metallic Koi which do not fit other, perhaps more tightly defined, varieties). For several years, though, Goshiki have been judged in their own right in Japan and, since where Japan goes, other countries often follow, it's very possible that this classification will become universally accepted before too long.

I have included Goshiki with Asagi and Shusui in this article, simply because this variety was originally created by crossing an Asagi with a Sanke, the latter having been dealt with by **Nigel Caddock** in his own feature in this **Supplement**. It might therefore have been equally valid to have included Goshiki with Sanke but, it matters not a jot — these fish are fantastic, whichever way you look at them, and that is one of the most important criteria when selecting a Koi, isn't it? AKP

Ogon, Hariwake and Bekko

David Twigg selects some of his favourite varieties of Koi
Photographs by the author



The Doitsu version of the Ogon.

A well-shaped Yamabuki Ogon.

Many people today have wonderful collections of Koi in their garden ponds. If we were to ask them which were the first Koi purchased, then, I guess, that the majority response would be for Koi with a metallic sheen.

Metallic Koi, because of their very shiny skin, are easily spotted in a pond and, as they come in a variety of colours, are an extremely pretty, and consequently popular variety of pondfish.

The first Koi that Lyn and I purchased and that found a home in our original ornamental 10 x 4ft preformed fibreglass pond, was a lovely golden Ogon. That, however, was in 1981, and I was not aware of the Japanese name for this lovely Koi which we admired so much.

Unfortunately, this fish was so bright and lively that it also caught the eye of the neighbour's cat and 'that was that'. This Koi was most definitely the one that got me and my family 'hooked' and we were quickly off to the local aquatic centre to add some more of these attractive fish to our collection.

OGON

The Ogon, a single-colour metallic Koi, comes in a range of shades of colour, from orange through gold and brilliant yellow, to silver and platinum.

The smaller Ogon will be easily seen and identified by the onlooker, owing to its completely different presence to the other fish in the pond. The larger the Ogon grows, the more imposing its presence will be.

From the appreciation point of view, it is the head coloration, as with all Koi, but even more so with the Ogon, that is of prime importance. Apart from being 'clean', it should have smooth and even density of colour from the tip of the nose to the back of the 'cap'.

Because the Ogon is a single-colour Koi, it becomes all the more necessary that body coloration also has this characteristic. Scales should be well lined up and the metallic skin should appear deeply lustrous.

The fins are also metallic, and there can be nothing better than watching a large Ogon gliding through the water and displaying a large pair of luminescent pectoral ('chest')

'Double take' — the Orange Ogon with its excellent scale reticulation (left) and the scaled Hariwake (right) with its equally excellent clear head and lovely white skin.

The Gin Matsuba is a member of the Ogon 'family'. It is identified by its pine-cone scalation.

fins. The metallic finish really does set them off.

The majority of Ogons that you will see will be of the scaled variety. Occasionally, however, a Doitsu or Leather variety will also be seen. These two varieties are scaleless, other than for a row of scales along the dorsal line and, in the case of the former, a single row along the lateral line.

Ogons come, as mentioned above, in a range of colours, but will normally fall into one of the following categories: Orange Ogon, Yamabuki (Golden Yellow) Ogon, Nezu (Silver/Grey) Ogon and — most impressively, perhaps — Purachina (Platinum Ogon). A pond, in my view, is not complete without the majesty of a golden Ogon.

HARIWAKE

Another early favourite Koi, again owing to its metallic lustre and bright colours, is the Hariwake. The Hariwake is described as a two-colour metallic Koi with the base body colour white and a yellow pattern along its back. The pattern would normally be described as 'patches' rather than 'spots' of colour.

As the Hariwake is an Ogon cross, it is imperative that the metallic lustre is good. The edges (*kiwa*) of the yellow pattern should be sharp and the head clear.

As in the Ogon, the Hariwake needs a clean head and comes in a range of colours, from very pale yellow, through to a deep golden orange. Hariwake can also be found in the Doitsu form but, if of the latter coloured variety, are generally called Kikisui (pronounced 'key-key-soo-ee').

A good Hariwake will enhance a pond by its bright colour and overall beauty.

BEKKO

The two varieties described above are of metallic Koi. There are, however, many non-metallic varieties, and the Bekko is one of them. The Bekko is described as a two-

The skin quality of this Doitsu Yamabuki Hariwake is quite stunning.

This superb Aka Bekko shows off the black 'spotted' pattern beautifully.

A Doitsu Hariwake — now generally called Kikisui.

coloured Koi. The base body colour can be white (*shiro*), red (*hi* or *aka*) or yellow (*ki*), each with a simple pattern of black marks along the back of the fish.

These markings should not appear on the head nor below the lateral line and, ideally, will not appear to be any more than small groups of black scales. Also because of the Bekkos' Sanke lineage, 'stripes' will often be found in the pectoral fins and, indeed, these set off or help to balance the pattern and appearance of the fish.

A Doitsu variety of the Bekko is occasionally found. Because of the lack of scales, there is a sharpness to the edges (*kiwa*) of the black 'spots' which cannot be matched by the scaled version and, consequently, the Doitsu Bekko can be a really quite stunning Koi.

The Bekko, by virtue of its large white areas, will also brighten up a pond considerably. Really good skin quality can give it an almost metallic look.

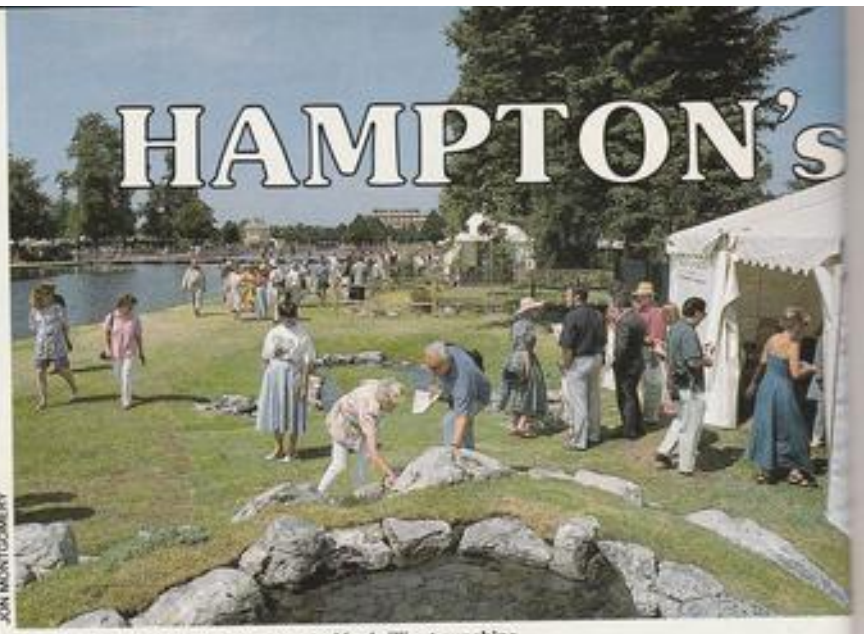
Although not falling into the Bekko Classification there is also a 'metallic' version of the Bekko, known as the Gin Bekko.

GENERAL POINTS

Although the metallic versions of Koi are not as highly prized in Japan as the Go-Sanke varieties (see article by **Nigel Caddock** elsewhere in this **Supplement**), they do have their plus points. From my own experience over the past eight years, the metallic varieties of Koi seem far less prone to skin complaints and don't appear to suffer to the same degree from 'bumps and bruises' in the way that non-metallics do.

I hope that this and the other articles in this **Supplement** will give you an insight into some of the many varieties of Koi and help you make the choosing of that next pet so much easier. **AMP**

HAMPTON's



JON MONTGOMERY

Preview day at Hampton was greeted by brilliant sunshine. Other days were not so fortunate.

It's incredible when you realise that convincing 'established' scenes like this one by Courtyard Garden Design are created a mere few days before the Hampton extravaganza.

Peter Furze of the FBAS reports on a hugely successful show.

Once again, the 'aquatic villagers' arrived at the Hampton Court Palace Flower Show in force in early July to transform the banks of the Long Water into their very own close-knit environment. Right from the moment the first pick-axe (or JCB) bit into the turf, you knew that if you were stuck for a lump of rock or a helping hand, any of your neighbours would be only too pleased to help — even though they were all in direct competition with each other in the hunt for awards.

VILLAGE EXHIBITS

The range of Aquatic Village designs extended over the whole width of the financial spectrum. There was, for example, the unsponsored display from the **Federation of British Aquatic Societies** (AQ6) which showed how water gardening could be enjoyed on the most modest budget (within the most restricted spaces, too) with its **Portable Ponds.** Here too, a pond installation demonstration (albeit, on a table top) took the novice through all the planning and practical steps, while a short step away, expert advice on filtration systems was on hand. Finally, a Society Location Service provided a back-up source of further help, should newcomers require local practical assistance if difficulties arose in the future.

The Federation were grateful to **Anglo Aquarium Plant Co** for supplying aquatic plants for their displays this year. Filtration advice was supplied by the **Aquavita Centre** of Rickmansworth. (The F.B.A.S. were advised by **Chris Skilton** [Aquarist] that the R.H.S. were very impressed with their efforts, and that they were very close to an award.) The stand was built by Federation council and local society members.

Perhaps a typical example of the 'middle of the road' installation was **The 8K Garden** of **Town and Country Gardens** (AQ5). The very tranquil scene, featuring a paved seated area, together with a split-level pool (impressive sheet waterfall), added a considerable extra dimension to a level 13m x 17m site using basic materials (**Silver Award,** one of two such awards).

The **Rushing Waters** theme of the ***Aquarist & Pondkeeper*** (AQ3) — conceived and designed by Gary Sharpe of Howe Green Garden Services, Chelmsford, Essex — was quite ambitious and also eye-deceiving. Water from a top pool careered around a curve, only to disappear from view, emerging several feet away, as an equally racing current in a horse-shoe shaped stream which, in turn, disappeared into the ground. Obviously, some very clever underground plumbing was responsible for this phenomenon which clearly baffled one personal enquirer, who wanted to know the cost of the bottom section without realising the two halves were connected.

Another very real attraction was the free distribution of the sister publication to *A & P, The Water Gardener*, a gesture so popular that copies were severely rationed towards the end of each day. (**Bronze Award,** one of three such awards).

Last year's *'trompe l'oeuil'* Slate Garden formed the elemental material for the **Teeside Renaissance** by **Heritage Stone** (AG10) the whole scene being converted to a much more horizontal aspect. Again, racing waters (representing a white-water, canoe-slalom course) dominated, but with an area of calmer reed beds too, each aspect reflecting local interest — the Teeside Barrage and the 2,4500 acre wetland scheme in the River Tees. (**Bronze Award**).

Water-Ways by **Airport Aquaria** and **Interpet** (AQ10) showed just that: ways with water. The foaming geyser in the principal fountain display demanded 32,000 gallons of water per hour to look its best, while the nearby smaller displays were quietly impressive, bubbling water through, or over, boulders or pebbles, courtesy of 24v 130 gph water pumps.

Returning a pond to a more relaxing

Our editor with two very welcome guests from Chile: *A & P* reader Carolina Zagal (on John Dawes' right) and her friend Macarena Guzmán.

GWEN McNEIL

JON MONTGOMERY

AQUATIC DELIGHTS

JOHN DAVIES

Part of Dorking Aquatic Nurseries' gold-medal-winning display.

JON MONTGOMERY

Bird's eye view of the *A & P* display by Gary Sharpe which caused a great deal of interest . . . and puzzlement!

JON MONTGOMERY

Slates and rushing water on Heritage Stone's impressive exhibit.

purpose following, perhaps, years of surrounding toil, was the theme of **The Farmyard** by **Courtyard Garden Design** (AQ2). Here, a plough was silently decaying, a discarded millstone had slipped into the water and, yes, there was even a rusty semi-immersed bucket! The nearby farmyard buildings had been converted into recreational areas, the duckpond now holding ornamental fish; the cattle-troughs were now planters and flowers had taken over from vegetables. **(Silver Gilt Award).**

Similar in theme, but quite different in execution, were the **Underwater Meadows** created by the **Aquatic Design Centre** (AQ4). Here, the underwater meadows were made up within many exotically-planted freshwater aquariums, the theme being continued into marine aquariums by way of equally-attractive substrates and coral formations. All were featured in modern aquariums fit to grace the most modern home, office or hotel.

The permanent symbol of the Hampton Court Flower Show is, of course, the Tudor Rose, so it was not surprising that someone should incorporate this logo into a pond design. The **Tudor Rose Pool** by **Pantiles Aquatics** (AQ9) was probably a technical headache to build and to balance the water flows around the various petals which formed the rose. Each petal's colour, incidentally, was mirrored by the colours of the Koi swimming in it. Although excellently executed, it was a pity that there wasn't a nearby really high vantage point from which its whole design could be viewed completely (many a photographer nearly backed into the Long Water trying to get it all in the frame!).

With all this water movement around, credit should be paid to the moving force — the water pumps. Supplying the equipment for the displays were **Lowara (UK) Ltd** (AQ8) whose **Three Coins in the Fountain** more than reflected the connection between the English and the parent Italian companies. The Italianate formality of the design was tempered nicely by the softness of the traditional English bedding plants surrounding the tiled areas.

There was also a practical benefit to the display, too, for every coin thrown into the fountain was to go to Water Aid, a charity bringing much needed water supplies to Third World countries. **(Silver Award).**

Everyone was looking to see if **Tony Howells** could win again for **Tetra UK** (AQ3) with his **Island of Dreams.** Despite giving it its best shot with superbly-engineered pebbled islands in the midst of the design (just how did those pebbles stay in place?) headed by a triple waterfall, he lost out on the day in a close finish which must have had the judges really splitting hairs in order to get the decision. **(Bronze Award).**

So, who won the top award? Well, with the accent much on natural ponds this year, it was fitting that **The Caledonian Garden** by **Dorking Aquatic Nurseries** (AQ6a) should triumph. The pond was surrounded by a mass of native plants and flowers, based on a Scottish theme, much of the all-natural materials coming from North of the Border, but reflecting the company's special interest in wild flowers.

All the aquatic and bog plants came from the company's own extensive nurseries. Incidentally, maybe the Federation of British Aquatic Societies should share some credit for the winning company: for the past two years, the company exhibiting alongside the FBAS has won! **(Tudor Rose Gold Award).**

I was really pleased to see **Dorking Aquatic Nurseries** win this year. As you may remember in my report of the show last year, I felt that they should have won then.

The spirit of the show continues to be fiercely competitive, with a tempering of good fellowship. We'll all, hopefully, be there next year, picks and shovels at the ready, bringing all that's best in water gardening to the thousands of daily visitors. Now, while we may be experts with ground-level water . . . if only we could stop it raining on the odd day or two . .! A&P

Pantiles' Tudor Rose: impressive from every angle, but particularly so from above.

What's your opinion?

By Billy Whiteside, BA, ACP

MOSQUITO CONGRATULATIONS

In the May issue of *A & P*, a couple of my photographs were used to illustrate an article by my nephew, **Colin Adrain,** about Mosquitofish. In response to the article came a letter to me from **Steven Potts,** of 18 Gordon Street, Darwen, Lancashire.

Steve says: "Firstly, I would like to congratulate, through you if I may, Colin Adrain for his interesting article on Mosquitofish. Congratulations are also in order for his spotting *Gambusia affinis* in an aquarium shop, as I have never seen them in any retail outlets.

"Indeed, my only contact with this fish was while I was on holiday in Blanés, in Northern Spain. There was an ornamental, semi-circular pool in the Marimurtra Gardens which was teeming with Guppy-like fish. I had a clear view of the fish and upon my return from holiday, identified them as probably *Gambusia affinis*.

"There were also some more natural pools in the Gardens, and although I did not clearly see any fish, I suspect they were present there, too. Since that holiday, which was in 1989, I have kept my eyes open for these fish in dealers' shops but, so far, have not seen any. No doubt, I could obtain the fish through the Livebearers' Group but, as yet, I'm not that fanatical about livebearers in general.

General Availability

"On the subject of fish availability, it is some years since I last saw the other Mosquitofish, *Heterandria formosa*, in an aquarium shop. Other fish that I have had difficulty in obtaining are the Spotted Rasbora, *Rasbora maculata;* American Flagfish, *Jordanella floridae;* Pygmy Sunfish, *Elassoma evergladei;* and Killifish — although in the case of the Killies, one or two of the more common species are becoming available in my area. Those available are usually *Aphyosemion australe* and *A. gardneri*.

"Thanks again to Colin for the interesting article, and to you for the **WYO?** column. Maybe the fish I find interesting are just not popular in the aquarium trade."

I, too, enjoyed Colin's first article, Steve. I was also lucky enough to have offers of stock from him and was more than happy to accept some of the tiny, peaceful *Heterandria formosa* Mosquitofish.

However, it was quite the converse in the case of the *Gambusia affinis*. I declined Colin's offer as the fish are not too exciting to look at; but, worse, seemed to be somewhat aggressive towards other fish and species. If you've kept either species, please drop me a few lines giving details of *your* findings.

SPLASHING OUT

Some of my large reference books on fishes are decades out of date and do not contain references to more-recently-introduced species. Most of the fish I own cost me something between about 80p and £3 each, but I was more recently happy to splash out £10 for a pair of a species I had not seen before and which a dealer friend raved about.

Beautiful Streamliner

The fish is called — and I had to copy this down carefully — *Cyprichromis nigripinnis*. Latin was, without question, my worst subject at school; but the FBAS Book No 10 (my edition was published in 1977), *National Technical Information: Scientific Names and their Meanings*, confirms that *nigri* means either black or from the River Niger; *pinnis* means fins; *chromis* means colour. *Cyprinus* means from Cyprus, but I don't think this is the meaning of *Cypri* in this instance.

So, what did I get for my £10? A beautiful pair of streamlined creatures with a lovely blue sheen. They are said to like non-acidic water and to be mouthbrooders. Can any readers tell me anything more about them? If so, drop me a few lines, please.

No matter about the meaning, *C. nigripinnis* is a beautiful, browny-gold-coloured fish with hints of steel-blue shining from its fins and tail. I don't think my photograph does it justice but it will give you an idea of the fish. It seems a lively, peaceful, smallish species that feeds easily and is not particularly shy.

BILLY WHITESIDE

My latest — and one of my most expensive — acquisitions was a beautiful *Cyprichromis nigripinnis*.

Red-mouthed and wonderful: my new Rummy-Nosed Tetras.

Red-mouthed Favourite

Its present tankmates include another fish that I like a lot: the Rummy-nosed Tetra, *Hemigrammus rhodostomus*. *Hemigrammus* means half line, and *rhodostomus* means red mouth, as opposed to red nose. I managed to photograph my pair as they paused for a second. They are peaceful, colourful and lively, and not at all shy.

Experts might well say that the mouthbrooder and the Rummy-Nosed Tetras should have different water conditions, but neither species has read the books and both seem quite happy in the same aquarium. The Rummy-Noses lose some of their colour when asleep — as do many fish — but return to bright red when they are wide awake, contented and in good condition. Try a pair — or a shoal!

IMPRESSIVE FLUVALS

A couple of months ago I bought myself a Fluval 203 power filter for my Goldfish tank. I have been so impressed by it that I have bought another, for my tropical aquarium.

They are highly efficient and very quiet, which is what one would expect from a filter costing about £42.

PET THEFTS

I was amazed to read on Teletext recently of the theft of ten Koi valued at £100.00 each from a pet shop in Bangor, County Down. One stolen fish, known as a 'Four-step Kohaku', is about 9in (23cm) long, with four red bands round its body, and is worth £200.00.

Only this afternoon (as I write) **George Proctor,** owner of Petworld, in Newtownabbey, County Antrim, told me of the theft from his store of a large, tame cockatoo. It is thought that someone stole the bird by hiding it under a raincoat!

Mr Proctor has offered a reward for the return of the bird. Today, he received two 'phone calls from the same person suggesting the person knows where the bird is, and asking about the reward. The large cockatoo was very popular with customers, especially children, and it is hoped that it will be returned.

Only a couple of years ago people would have laughed at the suggestion of the theft of any animal other than a horse. Now birds and fishes are as fair game as any other creature. Please drop me a few lines if you have had any experiences concerning the theft of pets, especially fish.

Coldwater jottings

By Stephen J. Smith

JILL WON!

There is always something special about participating in a fish show — and it is even more special when you win. Such was the event which prompted **Jill Stephenson** (wife of *A & P* contributor and a regular correspondent to **Coldwater Jottings,** Alex) to telephone me late one recent Sunday evening with the immortal words, "I've won".

There was a certain air of triumph in her voice, and I'm sure her expression was somewhat similar to that of the chap in an Australian lager TV advertisement who makes a similar proclamation. And rightly so. Jill explained that Ken (the prizewinning Goldfish) had caught her eye at an aquatic retailer. "It was a good-looking Goldfish, so I bought it and grew it on in the garden pond."

Jill's Goldfish received first placing in the FBAS Championship class at **Corby and District AS** Open Show earlier in the year, accompanied by a third placing for a Comet which she acquired at a local pet shop.

According to Alex, the fish were up against some strong competition: "It was a strong class, which even included a Bristol Shubunkin which had won its class at last year's GSGB show."

ENGLISH VEILTAIL INFO

"I am writing in the hope that you can tell me the origins of the English Veiltail Goldfish," writes correspondent **Joe Lightcap** from Nathalie Va, USA. "This year marks the one hundredth anniversary of the American Veiltail Goldfish. In 1893, at the Columbian World's Fair held in Chicago, USA, the Japanese exhibited a group of Fancy Goldfish called 'Imperial Veils'. These were given to William P. Seal, who was the American caretaker of the fish exhibition.

"He later sold one male to a Franklin P. Barrett who blended these fish with other Japanese Calico Telescope Goldfish and produced our line of American Veils, also called Philadelphia Veiltails."

Joe would be delighted to receive any information on the development of the Veiltail in the UK, and I feel sure that there are several Goldfish enthusiasts who have a 'tale to tell' about the early days of the variety.

So please, do let me have your comments and I shall compile them to pass on to Joe Lightcap for his research.

PUMP UP THE VOLUME

Fred Barber of Hornchurch, Essex, contacted these offices for advice on the purchase of a pump for his garden pond. Fred has kept fish in his fibreglass pond for the past 20 years, and has been a keen fishkeeper since the age of 10. He was disappointed to note that, following a recent acquisition of fish, several of his collection of Orfe had died.

He had thought initially that a heron may have taken some of his fish, while he had been told by a friend that some of his problems could have been caused by a lack of oxygen in his pond, causing the fish to stay on the surface, and that a fountain would solve his problems . . .

Now then, a fountain is a very good idea in your pond — if you want a fountain. But, don't get carried away with the idea that it will cure you of all evils. Yes, a fountain *will* help to oxygenate the water, to the extent that water *quality* is improved for the fish you have, but it really should not be considered to be a short-cut to obtaining greater numbers of fish to put into your pond.

Similarly, waterfalls, cascades, airstones, and even venturi (which introduce air into the water as it is pumped, usually from the filter, into the pond) are no panacea. Where they *are* important is in maintaining water quality.

This is especially important during the 'muggy' months of the summer (usually August) when the fish can often be seen gasping at the pond surface. This is because water holds less oxygen at higher temperatures, and is sometimes made worse by the fact that the process of photosynthesis in pond plants (which produces oxygen during the hours of daylight) stops at night. During darkness, therefore, the plants (which have been respiring throughout the day, but in conditions of high oxygen concentration) compete with the fish for a dwindling oxygen supply.

So, a useful expedient at this time of the year is to trim back those bushy clumps of so-called 'oxygenating' plants (usually *Elodea* and Crispa') and, if you do see your fish gasping, try spraying the hose directly onto the pond.

Returning to Fred Barber's query, by all means obtain a fountain if you wish to have one. I would also advise though, that you check that the size of the spray does not cause the water to end up all over your path or lawn; as much as the grass appreciates a dousing of pond water, you would very soon have no water remaining in your pond!

ANTI-PREDATION-SHAPED RYUKIN?

One of my favourite publications (after *Aquarist & Pondkeeper,* of course!) is *National Geographic.* As with *A&P,* it is read avidly just as soon as I can hide myself away to enjoy its contents.

So I was intrigued to read a small item in the magazine's 'Geographia' section (May 1993) about how carp have evolved a large back muscle to avoid predation, mainly from pike.

According to **Christer Brönmark,** of Lund University in Sweden, and **Jeffrey Miner,** of Miami University, Ohio, this is the first documented example of a vertebrate permanently changing its body shape to avoid predation. "When Crucian Carp swim in pikeless ponds, they usually present the usual fishy profile. But when pike show up, carp that escape pike jaws begin to grow a mass of back muscle. Within five weeks, they have a pronounced hump, making them too large to swallow," explained the *National Geographic* article.

My subsequent ponderings led me on to consideration of the 'hump' found as a characteristic of certain varieties of Fancy Goldfish, particularly the Ryukin, and which is not dissimilar to the hump on 'predated' Crucian Carp. Could there be a connection? Who knows . . . ?

The Ryukin is an attractive and popular variety of Fancy Goldfish, distinguished by its pronounced 'humped back'. Could there be a connection with the development of the similar 'hump' in Crucian Carp?

STEPHEN SMITH

SPASS CELEBRATION

Wimbledon-based **South Park Aquatic (Study) Society** celebrated their 25th anniversary by holding their annual Open Show at **Fishworld '93,** organised by the **FBAS** with support from *A & P* at **Brit Koi** in the grounds of Syon Park, Brentford, Middlesex, in the middle of June.

The event, overall, was a pleasure to attend and, on the *A&P* stand, many of the regular contributors were in attendance to help visitors with their aquatic queries.

The SPASS Open Show attracted a superb selection of over 200 Fancy Goldfish (I was delighted to see a Bubble-Eye — owned by **Steve Seymour** — win the Best in Show award), as well as some fascinating herptiles and plants; while the venue provided, for many visitors, the first opportunity to see a coldwater Open Show in full force.

Congratulations to SPASS on their Silver Jubilee, and congratulations also to all those who exhibited. Mention should also be given to **Mary Franklin,** who received an award for the highest pointed plant, as well as a further award for the highest-pointed SPASS member.

The viewing gallery at Brit Koi's show pond provided a perfect location for the exhibits at the 25th SPASS Open Show, held at Fishworld '93 at Syon Park in June.

COMING NEXT MONTH: SPECIAL AQUARAMA EDITION OF COLDWATER JOTTINGS

OUT AND ABOUT

LIVING WATERS

By Dr Iggy Tavares

A Lake Victorian beauty — the Haplochromine referred to as "44".

Two of Living Waters' Julies: *Julidochromis dickfeldi*, accompanied by Albino *J. ornatus*.

The giant show tank.

Living Waters is paradise for any cichlid keeper. It opened some three years ago and was taken over by **Paul Blowers and Partners** in September 1992. The shop is now ably managed by **Brian** and **Kerry Paddick,** a very knowledgeable husband and wife team, who keep the shop spotless and who always have a smile and a cheery word for all their customers.

The outside of Living Waters belies the treasures which reside within. The most striking feature inside is a huge show tank of Lake Tanganyikan fish. The 1,200-gallon tank gives one an insight of what the underwater world of the lake might look like, and is arranged with rocks and boulders to provide numerous nooks and crannies for the inhabitants. This tank contains several colourful species of *Tropheus, Ophthalmotilapia, Julidochromis* (Julies) and *Neolamprologus,* to name but a few, and several species of catfish, including the rare *Auchenoglanis occidentalis.*

The retail section has just over 300 tanks, with a further 10 tanks soon to be added in the coldwater and quarantine section. The 28 tanks of Malawi fish and 27 tanks of Tanganyikans contain a variety of rare species, ranging from several *Aulonacarus* species (Peacocks) to *Labidochromis frieberg*i, and from albino *Julidochromis ornatus* to wild-caught blue *Cyphotilapia frontosa.* Also available are several of the small very attractive shell-dwelling *Lamprologus* species.

West African fish include several species belonging to *Hemichromis* (Jewels), *Pelvicachromis* (Kribs), *Nanochromis* (Dwarf) and *Paranannochromis,* while the Lake Victorian Haplochromines are represented by "Flamebacks", *nubilus* and the extremely colourful "44". None of these quality fish stay in the shop long, but there is always something new and exciting coming in every week.

A whole range of South American cichlids are available as well, with quite a strong emphasis on the dwarf *Apistogramma* species, which I am particularly fond of. Discus and several varieties of Angels are also on sale.

The catfish fancier will find a range of different *Peckoltia, Plecostomus, Panaque, Synodontis,* and Whiptail Cats, including "Gold Nugget", "Orange Seams", "Royals", *angelicus* and *spinos.* As if this is not enough, there are at least ten different species of killifish also available.

Living Waters is well renowned for its cichlids, but, in addition, it carries a large range of community fish such as tetras, barbs, livebearers, danios and other more common species, as well as a good selection of aquatic plants. All are clearly labelled and priced. There are two dry goods rooms which carry a range of products, from aquariums to filtration systems, and from books to fish foods.

Paul Blowers first started keeping fish when he was seven and has, obviously, gained a wealth of knowledge, not only in the trade, but also on his fish collecting expeditions in Africa. His policy is quite simply to have the best shop in the UK, providing rare but healthy fish at a reasonable price.

To this end, Living Waters only import fish from reliable sources and Paul breeds several species of cichlids, tetras, rainbows, cats and killies at his own breeding facilities. Most of the fish are raised and kept in tapwater so that the hobbyist who buys fish from this shop has a good chance of success with even the more delicate species.

In my experience, Living Waters sells only healthy and good quality fish. This is proved because time and again, I have found several of the cichlids for sale, actually guarding or incubating eggs, demonstrating that they are in very good condition.

These have included the more difficult *Apistograma nijsseni,* several Malawi cichlids and even Tanganyikan species such as *Cyphotilapia frontosa, Ctenochromis horie* and *Paracyprichromis* species. Purchase them and you will have got more than you bargained for.

For further details, contact **Paul Blowers, Brian** or **Kerry Paddick, Living Waters, 28 Beddington Lane, Croydon, Surrey CR0 4TB. Tel: 081 680 3533. Fax: 081 680 4653. Opening hours:** Monday to Saturday 10 am to 5.30 pm. Closed Sunday.

Herpetology matters

By Julian Sims

HERON ATTACK

Many readers who keep fish in garden ponds will have experienced the loss of some (if not all) of their livestock because of a visiting Grey Heron (*Ardea cinerea*). Pondkeepers have tried a variety of methods to prevent such losses and discourage visits from these winged predators.

For example, after repeated losses of Common Frogs (*Rana temporaria*) and fish, **Terry Egan** from Wembury, Devon placed an ornamental heron by one of his ponds to deter the real thing from visiting. However, one morning, Terry noticed that the ornamental deterrent had actually attracted a male heron who was trying to mate with this impassive object!

Another deterrent which has been tried is anti-heron netting. Unfortunately, this can detract from the overall appearance of a pond. There is also the risk that if the netting loses its tension and sags into the water, aquatic livestock can become entangled and drown. Thus, if netting is used, it must be kept taught and supported well above the surface of the water.

My garden ponds are inhabited by large North American freshwater turtles. Even with these sizeable and relatively heavy animals, there is always the risk of predation — but not just from herons. Gulls (*Larus sp.*), Crows (*Corvus corone*) and Magpies (*Pica pica*) are all potential predators.

However, natural defence mechanisms are in operation. Ponds which are inhabited by freshwater turtles quickly become green due to the development of a thick 'soup' of single-celled algae. Although making it difficult to see the reptiles swimming about under the water, the algae also conceal the turtles from predators.

The unwelcome attention of foxes at night-time is less likely to be a problem because turtles spend most hours of darkness under water. During daytime, if the aquatic reptiles are disturbed while basking on land, for example, by a cat, they quickly slip into the water. This escape response has resulted in several species of turtle being called 'Sliders' in the USA. Thus, sudden attack from the air by birds would seem to be the most likely source of predation, and the greatest cause for concern.

Indeed, during August of last year, this very problem occurred in my ponds. During a warm summer morning, I disturbed a heron which was visiting my largest pond. Having thwarted its attention to my aquatic livestock, I thought no more about the incident until later in the afternoon.

It was at this time that my wife found a small, very bloody juvenile Hermann's Tortoise (*Testudo hermanni*) in the garden. Both halves of its shell (the upper carapace and lower plastron) were badly pecked and bore the outline of pointed beak marks.

In fact, the front of the carapace had been almost entirely pecked away to expose the head and front legs of the reptile. Fortunately, although the shell was bleeding badly, the soft tissue of the head and legs had not been damaged.

Heron damages on the carapace of a young Hermann's Tortoise.

The plastron (lower shell) was also badly damaged.

Medication

The wounds to the shell were washed and cleaned with lukewarm water and sterile cottonwool. They were then treated with Betadine antiseptic solution. This kills bacteria and fungi. Betadine solution (Povidone-iodine) is manufactured by:

Napp Laboratories Ltd.,
Cambridge Science Park,
Milton Road,
Cambridge CB4 4GW.

This antiseptic can be obtained across the counter from large chemist shops without prescription. For example, Boots pharmacy department will order Betadine if they do not already have it in stock.

Although the injured tortoise bled excessively for several hours and refused to eat for a week after the attack — probably as a result of shock — it did recover and was hibernated as usual through the winter. One year later, the shell has healed in its damaged areas, although it remains scarred and unpigmented.

This unfortunate incident is of interest because it is an attack on a land-living reptile by a predator which usually

hunts for prey in water or on marshland.

Betadine is a suitable antiseptic for use on **external** injuries to reptiles (including freshwater turtles) and infection by bacteria and fungi. For example, if Red-eared Sliders (*Trachemys scripta elegans*) are not given the opportunity to bask in sunlight (which contains ultraviolet) or under a suitable fluorescent tube, and dry their shells from time to time, then their shell might become infected with fungal and algal colonies. Algal colonies are relatively harmless, but fungi can cause 'necrosis' — resulting in holes forming in the shell.

If fungal infection is present, or if injuries occur — for example if one turtle bites the neck or webbed feet of another turtle — these damaged areas should be treated with Betadine.

The antiseptic solution must be applied to the wound or infection when the turtle is dry. Sterile cottonwool can be used to dab the antiseptic onto the required area. Once treated, the turtle should be kept dry for between 12 to 24 hours.

A cardboard box lined with newspaper can be used to house the turtle during the treatment with Betadine. However, care must be taken that the box is not placed in a draught or in very cool conditions, as turtles kept out of water are prone to bacterial infection of their respiratory system.

After 24 hours, return the turtle to an aquarium for one or two days, and then repeat the treatment with Betadine on the third day. Keep going with this pattern of treatment until the wound or fungal infection is healing — a protective 'crust' tends to form over a wound on a turtle.

Other freshwater turtles will attack and bite an injured animal if it is maintained in the same aquarium or pond. Therefore, until the injured reptile has recovered, it is advisable to keep it in solitary confinement in a 'hospital tank'.

NEXT MONTH

Interested in **Breeding Corydoras catfish** — the most popular cats of all? If so, we have a great article from **Derek Lambert** next month. It's part of our **Focus on Catfish** special, which also includes:

- **Dr David Tipping** — an insight into the life of the **Airsac Catfish.**
- **Ray Hocking** — **Cascudo Bonanza:** a report on surprise spawnings of **Hoplos** (Armoured Catfish).
- **Janet Marshall** — setting up a tank for **South American catfish.**

★ Moving away from cats, **Peter Skinner** presents the latest of his popular Koi articles, this time concentrating — in his own inimitable way — on **Pool Construction.**

★ If you keep marines and are moving house, read what **Philip Hunt** has to say about his own experiences in **Reef Removals.**

★ **A Shocking Tale** — **Dr Gareth Evans** treads (carefully!) through the 'current-based' world of electric fishes.

We also have a great batch of one-offs on a wide range of interesting topics, all vying for a spot in our September issue. Which ones will make it . . . and which will have to wait until October? To find out . . . and to keep abreast of all our ever-popular regulars, make sure you order your copy of next month's *Aquarist & Pondkeeper* early. Or, why not take advantage of our unbeatable-value-for-money subscription offer?

Whole families earn their living off the breeding and export of Siamese Fighters. The males are packed in small plastic bags containing a small amount of water but plenty of air.

Spotlight on:

THE SIAMESE FIGHTER

Arend van den Nieuwenhuizen reveals some of his, and other people's, secrets regarding the breeding of this immensely popular, 'dramatic' species.
Photographs by the author

Who has not looked at males of the Siamese Fighting Fish in a pet shop or the tanks of aquarist friends and wondered which of them is more beautiful than the rest? Now just imagine: you are intending to keep *Betta splendens* for the first time, but do not know anything about them. Unable to bring yourself to choose just one male, you pick out two or three and buy a couple of females to go with them. You take them home and put them all together, possibly in a community aquarium, with no regard for the temperature.

After a while, you notice that two of your males are swimming around each other, with their fins spread wide and their colour brighter than usual. But you are like one who, in ignorance, uncorks a bottle in which a little genie is living. Soon, all hell is let loose! The fishes, who did not get their name without good reason, set about each other, and, in no time, shreds of fin are floating around in the water. The lesson to be learned: only one male per tank.

AQUARIUM CARE

Once you have this basic rule about keeping Fighting Fishes firmly in your mind, the next question is the ideal temperature for them, a question to which there are several different answers.

Some aquarists are of the opinion that Fighting Fishes do not become fully active at temperatures below 28-30°C (82-86°F). In my experience, however, they can be maintained successfully at the lower temperatures of 24-25°C (75-77°F). I will discuss their requirements during breeding later on.

Diet

If you now nurse the ambition to breed Siamese Fighters — and what aquarist does not want to do so at least once — then, first of all, some attention must be paid to their food.

Fighting Fishes are inclined to fatty degeneration, and thus require a varied diet, which should include water fleas *(Daphnia)* and other foods which provide roughage.

I will, however, relate one instance which appears to contradict my personal experiences. Some 38 years ago, I had the opportunity to witness such an exception when visiting the proprietor of an aquatic business. This person was a noted specialist in Fighting Fishes. He had worked with this species for years in the tropics, and later on, back in Holland, had continued his interest by selectively breeding *Betta splendens*. He bred fabulously beautiful fishes in a small warm fish house.

When I visited him one morning I found him busy feeding his pets. To my astonishment I saw that he was using only Whiteworms (Enchytrae), and thought to myself: "Surely, he doesn't do that all the time". But I soon learned better. Together with water fleas, Whiteworms were actually one of the main foods offered, the two being used in a 1 : 1 ratio. My expectation of finding obese specimens proved to be wrong after I had closely examined all the breeding stock.

BREEDING
Selection of Broodstock

This is best done by judging the quality of males. If, after a one-day fast, the belly is still as rounded as if normal feeding had taken place, or like that of the female, then in general this indicates fatty build-up. For this reason the slimmest males should be selected if possible.

Bettas on sale at the weekend market in Bangkok.

Thousands of Betta pots at an exporter's premises.

When I asked my friend why he regularly fed large quantities of Enchytrae, I received the reply that, in his experience, the females produced large numbers of eggs on such a diet. Once a female had filled up with eggs, then breeding should be undertaken immediately.

Size of Spawn

I was now interested to know the size of spawn, and was very surprised when I was given a figure of 600-750, sometimes even more. At that time, I had bred Fighting Fishes once, obtained somewhat more than 200 fry, and thought this was a rather large number.

Tank Size

There was one catch, though. My companion told me that the size of a spawn was greatly influenced by the size of the tank in which breeding took place. Because he was sometimes short of space, he would occasionally keep a pair in a breeding tank measuring 20 x 15 x 15cm (8 x 6 x 6in) in which the two fishes had to be separated by a sheet of glass.

When the male came to build his bubblenest, his territorial requirements were larger than the capacity of the tank and could only be satisfied in a larger aquarium.

In such a case, the male would drive the female out of his territory. In the small container, to avoid major conflict, the divider was not removed until the male had completed the construction of the nest and was ready to display and pair off.

After spawning, the female was best removed immediately, or at least as soon as possible, in order to avoid her fins being reduced to shreds hanging from her body. Using this method of breeding, the number of fry would be far smaller than that mentioned above, with 250-350 hatching.

After the '*Betta* lesson' had gone this far, a light began to dawn on me, and I related the following experience to my 'teacher'. My female had spawned in a breeding tank measuring 40 x 25 x 25cm (16 x 10 x 10in), after which I moved her to a smaller tank. After three days, she built a bubblenest in

her new quarters. I found that quite unnatural, and was even more surprised when, a few days later, I found a mass of eggs in the nest.

Briefly: larger spawns will be achieved by using a tank measuring approximately 50 x 30 x 30cm (c 20 x 12 x 12in), planted so as to create a few hiding places for the female — ideally, in the rear corners.

When the female has spawned, it is not necessary to remove her, as there is plenty of space for both partners. They should now get fed as much as they can eat. After four or five days, sometimes only three, then — if the fishes were in good condition to start with — a further batch of eggs may be laid.

The female takes absolutely no notice of the fry from the first spawn, which, by now, will be hanging from the underside of the nest. She should be removed after the second spawning, and, after a further two days, the male should also be removed. In the meantime, well-fed males will tend the nest and care for the eggs and fry.

Rearing the Fry

One drawback of this breeding method is that there will be fry of two different ages which require different foods. Later on, this difficulty can be avoided by feeding irregularly sized food. In addition, a rearing tank measuring 50 x 30 x 30cm (c 20 x 12 x 12in), or even 70 x 25 x 25cm (27.5 x 10 x 10in), will be needed as the fry may number more than 500, which is a fair number.

If the spawn is even larger, then it can be divided into two, three, or even four 'portions' which can be reared in separate containers. This will make feeding easier. If one considers the number of food animals used, and the degree of pollution which can arise in a single aquarium from a number of them dying off — not to mention that resulting from the fishes' excreta — then one can see the sense of splitting the brood.

After the young Fighting Fishes have hatched from the eggs and are free-swimming, they will remain immediately beneath the surface of the water. It is best to lower the water level at this stage. The advantage of doing so is that there will be a higher concentration of food. The water level can be raised gradually by the daily addition of new, conditioned water.

Temperature

I would like to add the following regarding temperature: it is often advised that *Betta splendens* should be bred at 28-30°C (82-86°F), but my personal experiences have shown that spawning will take place at a temperature of 25°C (75°F) or, if necessary, even at 21°C (70°F)! I prefer a water temperature of 23°C (c 73.5°F) in Labryinthfish aquaria, and find this results in an only slightly different air temperature above the water surface.

This is extremely important when the fry begin to take in atmospheric air. If the water temperature is 28-30°C (82-86°F) then the air temperature can be kept close to this by using a cover glass. However, since the cover glass will need to be removed frequently for feeding, its effect does not last for long.

If there is an aperture in the cover glass to accommodate an airline, then it will be possible to aerate the water and produce a good circulation of the food. But why use such high temperatures if a lower one will produce similar success? Obviously, there should be no aeration while the bubblenest is in use!

Growth Rate

Quite naturally, the fry will grow rather more slowly at a temperature of 23°C (c 73.5°F). I have, in fact, never used temperature to control growth in my fishes, as a good feeding regime is relatively more important.

To begin with, the Fighting Fish fry should be fed on pond infusorians (micro-organisms), but as early as the third day, they can be given freshly hatched brine shrimp nauplii (larvae). It will then not be long before the diet of the growing fry can be enriched with small water fleas and, later on, they can be given lots of black mosquito larvae — if these are available — in addition to their normal menu, as Siamese Fighters are very fond of these.

One obvious spin-off of a good diet is that the young fish will grow quickly. Then, as long as there are large numbers of juveniles in the tank, the males will not normally fight among themselves.

SKIN DEEP IN COLOUR

PIGMENT CELLS

Dr Violet Phang, Gideon Khoo, Soo Yin Chan and **Tit Meng Lim,** of the National University of Singapore,
get under the skin of some of our best-loved fishes to reveal what really makes them so colourful and desirable.

The kaleidoscope of colours seen in tropical ornamental fishes has held fish hobbyists spellbound for generations the world over. From the finely exquisite colours of the flamboyant long-finned Siamese Fighting Fish (*Betta splendens*) and the solid, well-defined pigment patterns of the stately Oscar (*Astronotus ocellatus*), to the muted pastel shades of the Albino Platy (*Xiphophorus maculatus*), fishes are the most varied vertebrates in colour and pigment patterns.

Tropical aquarium fish breeders are constantly on the lookout for new colour varieties, knowing that if these take the fancy of fish hobbyists, a substantial fortune can be made by intensive breeding to supply the demand. The more exotic or unique an aquarium fish, the higher its commercial value.

The tropical fish industry is a thriving one in Singapore, with exports totalling 72 million Singapore dollars in 1991 (nearly £3m). Despite the scarcity of land, Singapore is the major breeding and export centre of tropical ornamental fishes.

The metallic blue iridescence of this long-finned Siamese Fighter is produced by a combination of black melanophores and iridophore reflecting platelets, hence refracting (bending) and reflecting light only in the blue wavelength.

COLOUR IN FISHES

Much has been said of the fascinating colours in fishes and the value of the different colour varieties to the aquarium fish industry. However, what exactly is the basis of these vibrant colours? Are these colours a result of pigments, or are they due to other causes?

Colours and pigmentation in fishes are due to the presence of pigment cells called *chromatophores*. Fish chromatophores are found on scales, fins and within the dermal layer of the skin. The outer layer of skin is called the *epidermis* and the layer beneath it is the *dermal* region. A thin layer covers each scale with a posterior pigmented region, while an anterior non-pigmented region is embedded in the dermal pocket of the skin.

What may come as a surprise to many is that the whole spectrum of colour variations is caused by only five types of chromatophores: *melanophores* (black/brown), *erythrophores* (red), *xancho-erythrophores* (yellow with red periphery), *xanthophores* (yellow), and *guanophores* which comprise *iridophores* (reflective/refractive, i.e. capable of 'bending' light rays) and *leucophores* (white/hyaline, or glass-like).

CHROMATOPHORE SHAPES

All chromatophores can take on three basic shapes. In fact, the cell boundary of a chromatophore does not change, merely the distribution of pigment granules within the cell.

When pigment granules are aggregated/concentrated in the central region, chromatophores appear dot-shaped and are termed *punctate*. Flower-shaped chromatophores with petal-like extensions from the cell body are called *corolla-* or *stellate-shaped*. Finally, when pigments are fully dispersed to the extremities, the shape — which is irregular with numerous fine processes radiating from the cell body — is known as *dendritic*.

Each chromatophore type can produce any of the described shapes in response to neural (nervous), hormonal, physiological, photo (light) or environmental stimulations. Thus, the actual shapes of chromatophores are determined by the extent of pigment dispersal within the cells.

MELANOPHORES

Black, dusky or brown coloration is caused by melanophores that contain either brown or black melanin pigment stored in membrane-bound organelles ('mini organs') called *melanosomes*. Under the light microscope, at high magnifications (1000X), melanosomes are clearly visible as discrete granules.

Any dispersal of melanosomes or increase in amount of dense melanin pigment in melanophores will create an overall darkening *(dispersive)* effect and block out the effect of other colours (red, yellow, etc). Conversely, a paling *(aggregative)* reaction enhances the brighter colours.

ERYTHROPHORES

Red and orange coloration in most fishes are caused by erythrophores. The coloured pigments in this type of chromatophore are usually red pteridines (see Glossary in Part 2) which are found within discrete cytoplasmic organelles called *pterinosomes*.

Besides coloured pteridines, pterinosomes also contain colourless pteridines.

Erythrophores possess another type of pigment, carotenoids, in smaller quantities; these contribute to orange pigmentation. These lipid-soluble (fat-soluble) carotenoids are stored in vesicles.

XANTHOPHORES

Xanthophores are the chromatophores responsible for yellow coloration in fishes. These are found in large numbers in any yellow or golden region.

The main pigments in xanthophores are yellow-coloured carotenoids stored in large vesicles, and not within membrane-bound intra-cellular (within-cell) organelles.

Unlike melanophores and erythrophores, the contents of xanthophores do not appear granular under high magnification (1000X). In addition, most of these cells seem diffused due to their indistinct cell outline.

XANTHO-ERYTHROPHORES

In *Xiphophorus*, which includes aquarium fishes like the Swordtail *(X. hellerí)* and Platy *(X. maculatus)*, a unique chromatophore called the xantho-erythrophore can be found in red and orange regions.

This chromatophore type contains both red pteridines and yellow carotenoids. The xantho-erythrophore is typified by a dense yellow central region with a red periphery containing red pterinosome granules.

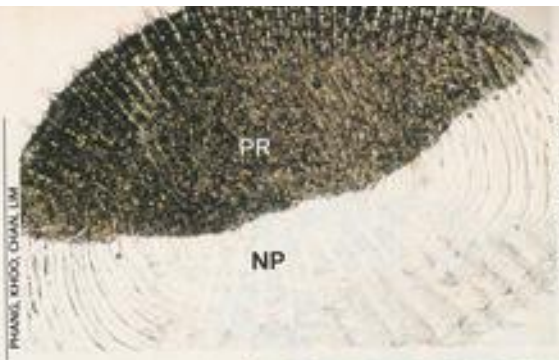
GUANOPHORES

The flanks and ventral regions of most fishes are either pale-coloured or white. These regions show a predominance of yet another type of chromatophore known as guanophores which consist of two cell types: iridophores and leucophores.

The main component of guanophores is the *purine* guanine (see Glossary in Part 2). Both types are colourless, but iridophores are reflective, while leucophores are not.

Iridophores are responsible for iridescence and metallic or silvery colours in fishes. Each iridophore has several flat vesicles arrayed parallel to each other. Each vesicle, in turn, contains a thin guanine-loaded reflecting platelet. On the other hand, leucophores have granular guanine particles randomly distributed in the cell cytoplasm.

(TO BE CONTINUED)

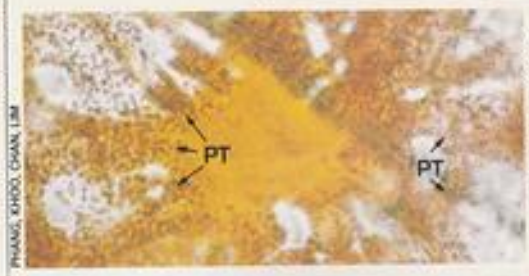


PHANG, KHOO, CHAN, UM

Scale from a Dark Blue Siamese Fighter showing pigmented region (PR) and non-pigmented area (NP) which is embedded in the dermal pocket of the skin (see text for details). Magnification: X40.


HOSY

The blood-red coloration of these Red Swordtails is attributed to high densities of erythrophores and xantho-erythrophores.



PHANG, KHOO, CHAN, UM

Corolla-shaped xantho-erythrophore from a Red Swordtail, showing yellow central region and reddish periphery (edges). Magnification: X1000. PT = pterinosome granules (see text for details).


HOSY

The delicate colours of this Green Variegated Guppy are due to melanophores, yellow xanthophores and reflective iridophores.

PHANG, KHOO, CHAN, UM

These iridophores, magnified 1,000 times, contain reflective platelets such as those responsible for some of the iridescence or silvery coloration exhibited by the Green Variegated Guppy.

Trade Talk

DoE Help From OFI (UK)

The Department of the Environment has sought help from OFI (UK) for assistance in drawing up guidelines on the **Convention on International Trade in Endangered Species (CITES).**

The organisation was invited to a meeting with the Department of the Environment to discuss the regulations and has been asked to comment on a range of proposals in preparation for the next round of international talks.

Keith Davenport, chief executive of OFI (UK) commented: "The ornamental fish trade collects from the wild on a sustainable basis. The organisation takes a strong stance on conservation issues, not only in terms of habitat preservation, but also in giving local communities the right incentives for sustaining the correct collection levels and techniques".

He concluded: "The latest round of talks with the Department of the Environment indicates the growing consultative role of OFI (UK) in official decision-making".

Polyclip Saves Skin at Queensborough

The installation of a multiple clipping machine to seal polythene bags has, literally, "saved the skins" of staff at **Queensborough Fish Farm,** Wraysbury, Staines, Middlesex.

The equipment, a Poly Clip Clipper, has replaced the need to seal polythene bags of fish by hand using elastic bands. Queensborough Fish Farm proprietor **Terry Lindridge** explained: "On an average day we seal around 300-400 bags of fish for dispatch throughout the UK and, while elastic bands work well, it takes experience by the staff to put them on properly to ensure a good seal. On a busy day, staff using elastic bands have literally ripped the skin off their fingers!"

The alternative method of using metal clips first came to Queensborough's attention when they noticed imported fish arriving in bags which were clipped. "It turned out that the clips are the same as those used for sealing casings on delicatessen sausages and patés," continued Terry Lindridge. "Since the Poly Clip is designed for use in the food industry, it is able to work well in the harsh environment of a tropical fish farm, which is always very hot and humid.

"Also, the Poly Clip works on compressed air and requires no electricity, which makes it very safe. The biggest benefit, however, is that anyone can use it and achieve the high standard of seal which is essential for our business — not to mention saving our skins!"

FOOD INDUSTRY EQUIPMENT EUROPE

Bags of tropical fish at Queensborough Fish Farm are sealed using a Poly Clip — saving the skins of the operators.

For further information, contact **Tracey Dutton, Food Industry Equipment Europe, Unit 2, Sunters End, Hillbottom Road, Sands Industrial Estate, High Wycombe, Bucks HP12 4HZ. Tel: 0494 471831; Fax: 0494 471830.**

Zoomark '93

The fifth **Zoomark** exhibition is to be held, for the first time, at the pavilions of the Fiera Milano, Italy (1-4 October).

Organisers report that they have been overwhelmed with enquiries, with 400 exhibitors from 20 countries having responded to an initial mailing of application forms. In addition, over 20,000 visitors are expected to attend (the show is open to the public on Sunday 3 October).

Visitors to Zoomark '93 are promised "the widest and most complete selection of food, accessories and equipment available for every kind of pet imaginable," according to the organisers, **Vimax srl.** "New products will also be on display that have been designed to improve pets' diet and living conditions (aquariums, terrariums and kennels), their health (medicines and modern equipment for veterinarians), and their beauty (shampoos, collars and other accessories).

For further information, contact **Vimax srl, via Rezzonico 23, 22100, Como, Italy. Tel: +31/301059; Fax: +31/301048.**

New Look For OFI Journal

The third issue of the official journal of Ornamental Fish International has a new look following the appointment of **John Dawes** as Editor/Co-ordinator.

John is perhaps better-known for his editorship of *Aquarist & Pondkeeper,* and published the first "new-look" issue of the *OFI Journal* in May. He remarked: "We have had a tremendous response to our first issue, from OFI members and even from non-members."

Among the topics covered in this (the third) issue are news of this year's Florida Tropical Fish Farms Association show, contributions from around the globe and an introduction to CITES.

"We are also appealing for new members," added John. Ornamental Fish International has been in existence since June 1980 and is a worldwide organisation representing wholesalers, importers, exporters, manufacturers, breeders and other members of the ornamental fish, water, plant, food and aquatic equipment industries."

The Journal is published quarterly and annual membership of OFI is £262.50 per annum (UK sterling), $409 (US dollars), Hfl782 (Netherlands Guilders). **Contact: OFI Secretariat, PO Box 445, Corsham, Wiltshire SN13 0RQ. Tel: +225 810084; Fax: +225 811215.**

New Name For Jollye's

One of the UK's leading pet superstores has changed its name to **Pet City** as part of a major expansion programme.

The company reports a growth in turnover of over 54% per year to £20m, and has 11 stores situated around the country, with a further eight planned for opening this year.

Giles Clarke, chairman of Pet City, commented: "We are investing over £2m in our expansion programme over the next 12 months and it seemed a sensible time to change our name. We have known for some time that another pet company has been operating under our former trading name and this could have led to confusion".

According to Pet City, the company provides over 7,500 product lines, including food and other products needed to care for domestic pets, birds and fish. They also sell a large selection of small mammals, birds and fish under the supervision of a former RSPCA inspector.

Naturalist's notebook

By Eric Hardy

RUSSIAN WILDLIFE NEWS

One outcome of the political change in Russia has been the sudden availability of much more information on its fishes and aquatic life. Probably the greatest evolution of caddisflies occurred in the great biological world of Lake Baikal. Some are flightless, running on the surface like pond-skaters.

1,200 of Baikal's 1,800 animal species are exclusive to it, including 255 endemic species of gammarid shrimps and over 50 fish, 25 cottids or bullheads alone. Many of these make the lavishly illustrated coffee table book *Realms of the Russian Bear*, by John Sparks, published by the BBC at £18.95 to accompany the recent TV programmes of that title, which were so interesting. The most abundant commercial fish of this great lake is a land-locked whitefish, the Omul.

But the story of Russian aquatic life is not all so pleasing. The USSR's appalling record of industrial pollution killed the world's 4th largest inland sea, the Aral, which has little hope of recovering like Lake Eyrie.

Its feeding rivers were drained off in an ecologically disastrous method of irrigating new cotton fields. The water fell, but its salinity rose, leaving a shallow, salty brew bereft of fish.

Russia has been left a strange mixture of conservation reserves for endangered species, and wholesale industrial destruction. Fifty kinds of fish live, with many Marsh Frogs, in the rich Volga delta, on the Caspian Sea, while the Siberian Salamander ranges more northerly than any other amphibian, the only land-hibernating amphibian in the Arctic tundra.

Unfortunately, the book does not go into much detail with these things, beyond general descriptions, except that the male salamander in courtship sits gaping scents from its yawning mouth. This lures the females to come and lay their eggs, whereupon the male fertilises them. The shallow Sea of Azov has over 80 fish: the Black Sea 180. Unfortunately the Grey Goral, a peculiar goat-like mammal of Ussuriland, is indexed as "Grey Coral"!

PLANT ESCAPES

Many of Britain's now-wild pond and river plants originated as 'escapes' from garden ponds, borne on the feet of waterfowl, or as aquarists' surplus throw-outs. Two new such Cheshire plants located recently in Wirral ponds include the peculiar South American floating water-fern *Salvinia*, probably *auriculata*, growing with the more frequent water-fern *Azolla filiculoides* on Meols Common. Neither would normally survive a hard winter's weather.

Scarcer is the smallest of our duckweeds, *Lemna minuta*, another American, formerly called *minuscula*, sharing with Lesser Reed-mace a field-pond in Pasture Road, Moreton. This grows in Llyn Helyg, North Wales, and east Norfolk, and tends to become smaller in winter, like our common duckweed *L. minor*, with which it may be confused.

UK DOLPHINS, SEALS AND WHALES

Aberdeen University biologists are researching the only known resident group of Bottle-nosed Dolphins in the North Sea, in the Moray Firth. Another colony appears to occupy Cardigan Bay and St George's Channel off West Wales. They identify these marine mammals by individual markings including skin-lesions on photographs, thus estimating survival and reproductive rates.

Some 88 individuals have been identified, some repeated in successive years. They mostly favour three separate areas around the narrow entrances to the inner firths, with relatively deep water and strong tidal currents, especially in summer. But the Sperm Whales trapped in Scapa Flow couldn't find their way out, until herded out by boats.

After virus diseases in recent years affecting Common Seals in the North Sea and porpoises around the British Isles, another virus infection is killing adult Striped Dolphins in the Mediterranean.

The Cardigan Bay coast between New Quay Head and Tresaith, extending a mile seawards, has been declared a Marine Heritage Coast because the bay shelters a school of Bottle-nosed Dolphins as well as Grey Seals.

At Craig yr Adaur, the seabird rocks below Penrhyn, just beyond New Quay Head, I've seen nesting Guillemots and Razorbills, as well as ubiquitous Herring Gulls. Fulmars and Kittiwakes also nest there, with a few Puffins, while lower rocks are occupied by Cormorants and Shags.

A few miles down the coast, in the cove at Cwmtydu, Grey Seals gave birth to their white pups in autumn. A local investigation of fish consumed by the seals involves identifying fish otoliths, or ear-bones, in food remains, but as seals don't usually eat the fish-heads, protein-analysis had to be used.

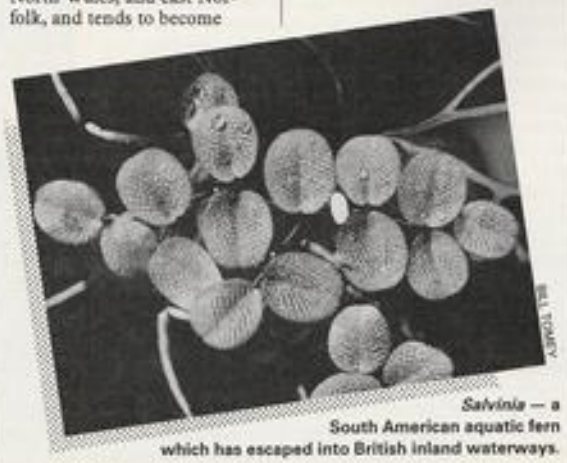
UPDATES

The Southampton Oceanography Centre, a new international centre for all aspects of oceanography, whose construction began in January of this year, should be completed early in 1995. Funded by National Environmental Research Council and the university, it will bring together several scattered research centres. It is at Empress Dock, near Ocean Village, and will include a research aquarium.

Elsewhere, the humble Guppy continues its prominent place in research. Over £55,000 has been granted by NERC to two Oxford and Swansea biologists to study the evolutionary basis of population differences in the Guppy, *Poecilia reticulata*.

£154,000 has been granted to two Aberdeen scientists to study variation in growth efficiency of flatfish, and over £81,000 to two Lancaster University professors to study the hydrogen ion and sodium uptake by the gills of freshwater fish. £144,969 has gone to a Glasgow biologist to study spatial memory in young Atlantic Salmon.

Other grants include £30,000 to study South African corals, £94,000 to research salt-tolerance in marine fungi, others ranging from sulphate-reducing bacteria to chemical communication in marine invertebrates.



***Salvinia* — a South American aquatic fern which has escaped into British inland waterways.**

A FISH SHOW

By Dr David Ford Photographs: 'Aquarian' Fish Food

The beautiful Syon Park in outer London was the venue for a special Fish Show by the Federation of British Aquatic Societies, with support from *Aquarist & Pondkeeper*. Held over the weekend of 12 and 13 June, **Fishworld '93** was based in several huge marquees sited on newly grassed areas belonging to **Brit Koi Ltd.**

The show coincided with the 25th anniversary of the Garden Centre at the park. This was celebrated with music and floral displays at Syon House and the start of the London to Brighton Vintage Car Rally.

Based at Syon Park are the London Butterfly Farm, National Trust Gift Shop, Hunza Wholefoods and an Art Centre. They all contributed to the event with special promotions.

The largest show, however, was the Fishworld '93 exhibition at Brit Koi. At only £1.50 for adults and free for accompanied children, visitors were able to tour 34 stands all under cover of the marquees.

The Federation arranged a fishkeeping exhibition that covered both ponds and aquaria, with the fish and equipment displayed by fish clubs or for sale by the trade.

The show also included the Silver Jubilee Year Open Show of the **South Park Aquatic Study Society.** This club specialises in pond and aquarium coldwater fishes and they had entries in 28 classes, ranging from Fancy Goldfish to amphibians, native fishes to coldwater plants.

The FBAS and *Aquarist & Pondkeeper* arranged Fishworld '93 with the firm Brit Koi Ltd who are based at Syon Park. Brit Koi was set up by the well-respected trader **Eric Devis** at Hollywell Rd in the East End in 1966. After Eric's death the new MD, **Tony Purdy,** took Brit Koi to Syon and started expanding the business. Their main claim to fame is that they only sell genuine Japanese Koi of pedigree stock. It was this high grade Japanese Koi that was offered for sale at Fishworld '93, including a special auction of exceptional fish.

The only disappointment at the Show was the attendance because of poor weather. It was the weekend of monsoon-like rains, with floods in Wales and Cornwall. Fishworld '93 did not suffer because of the protection of the tents, although the FBAS barbecue on the Saturday night had to be moved under cover. The sun finally shone on the Sunday afternoon, boosting attendance to a total of 3,500 but the show was capable of . . . and deserved . . . catering for treble this number.

INTERNATIONAL VISITORS

Representatives of the manufacturers of **Aquarian** fish foods and remedies were at the Show and they flew in two of their international Aquarian Advisory Service Consultants, **Rien Van Dam** from Benelux and **Pablo Siebers** from Spain. Rien was the President of the Dutch Federation (NBAT) and Pablo Siebers is President of the Spanish Federation (AEA).

A general shot of Fishworld '93 showing the marquees and water fountain displays.

International aquarists. FBAS Chairman Joe Nethersell is on the left and FBAS President Bob Esson on the right, with Spanish aquarists Carlos Tentor (Aquamar Editor), Pablo Siebers (Spanish Aquarian Advisory Service), José Martinez (President Iberian Societies) and Rien van Dam (Dutch Aquarian Advisory Service).

They were accompanied by two leading Spanish aquarists, **José Martinez,** President of Spain's largest Fish Society in Valencia and founder President of the Federación Ibérica de Sociedades Acuariofilos. This is the Iberian Society of both Spanish and Portuguese Fish Clubs. Also present was **Carlos Tentor** Editor of *Aquamar*, Spain's leading aquarist magazine, who owns an aquarium store in Madrid.

The foreign guests were welcomed by **Dr David Ford** and our Editor **John Dawes,** because both are Spanish speakers and so were able to tell them about the British aquarist scene. Brit Koi's assistant **Manuel** then took them around the Fishworld Show because Manuel comes from South America, and so is fluent in Spanish.

After spending a day at Fishworld they were then taken to the West End to see some

TRADE STANDS AT FISHWORLD '93

Aquarist & Pondkeeper	'Aquarian' Advisory Service
Underworld Products	Interpet Pond Products
China Dream Ornaments	Coral Reef Technology
Rocon Electronics	New Technology New Wave Products
Hagen Help Line	Spa Glass Craft Aquariums
Fishy Business T shirts	Bonsai
JMC fish and accessories	Aquavita Centre Pumps
TFH Books	Little Giant Pumps
Pond Supreme Koi Foods	Pacific Aquarium selling marines
Shark Power Filters	Anglo Aquarium Plant Co
Spirex Aquatic Filters	Purity on Tap water treatment
Waterlife Research	Shirley Aquatics selling Koi

UNDER CANVAS

Winner of Best Fish in Show, with a Bubble-Eye Goldfish, was Stephen Seymour seen here receiving his award from FBAS Chairman Joe Nethersell.

The Best Fish in the Show: a Bubble-Eye Goldfish owned by Stephen Seymour.

The Managing Director of Brit Koi, Tony Purdy, receives a thank you memento from the FBAS Chairman Joe Nethersell and President Bob Esson. It is an engraved silver notepad.

of the non-aquatic British life!

In addition to the trade stands there were several Clubs with special displays. The FBAS had their Hospitality Centre and the **British Koi Keepers Society** were selling everything from key rings to neckties embossed with their Koi emblem. **Stroud & DAS** had three Aquascapes and the **CAGB** had tanks of Catfish. The **IMMA (International Marine Aquarists Association)** had most of their committee, as well as marines, and even the **BBC** was there with a Gardener's World Live advertising for their Show at NEC 16 to 20 June. **Hounslow & DAS** had six display tanks. There were even owls and salamanders on the **Mobile Petz** stand with Sparsholt College's **Sue Oakey.**

The largest Koi exhibit was by Brit Koi, especially their famous glass fronted pond built to the memory of Eric Devis. To cater for the aquarist, **JMC** had 48 tanks of aquarium fish, as well as 6 mini-ponds and 2 water plant displays.

One of the show's many attractions was the scene awaiting visitors as they walked from the garden centre, through the high railings, towards Brit Koi. Welcoming them were two giant marquees, in front of which there was Brit Koi's own pool containing a variety of fountain displays which were lit up, creating a truly impressive exhibit, particularly at dusk. It was a pity the weather was not normal and all those aquarists who decided to stay home missed a very good, as well as unusual, fish show. AbP

RESULTS OF SOUTH PARK AQUATIC STUDY SOCIETY OPEN SHOW AT FISHWORLD '93

Best Singletailed Goldfish – Mr W Cumberland SPASS
Best Twintailed Goldfish – Mr S Seymour Independent
Best Native, a Rudd – S Bassett SPASS
Best Amphibian, a Bullfrog – Mary Franklin SPASS
Best Koi under 8in, a Kohaku – S & D Henman SPASS
Best Koi over 8in, a Shiro-Utsuri – E Franklin SPASS
Best Plant – Mary Franklin SPASS
Highest Pointed SPASS Member – Mary Franklin
Best in Show, a Bubble-eye – S Seymour

From Goldfish to Marines

David Lisk shares his experiences as he embarks on the challenging changes involved in going from coldwater to tropical marine aquarium keeping

Photographs by the author

First STEPS

My first fish (still going strong) were two Common Clowns.

Quite a jump, most would say, to proceed from keeping a small tank of goldfish for two years, straight to setting up a marine system. It is my intention to set out how, as a beginner, I went about setting up the system, and to relate the experiences and events which followed, both unsuccessful and successful.

Rather than write about the basics of setting up, etc, I have tried to address some of the aspects that the text books did not tell me, such as the various smells, algae growth problems, water quality monitoring and filtration required at different stages.

To date, I have had relatively few problems with my systems, so I have demonstrated, at least to myself, how a relative beginner can be successful if careful attention is paid to some basic principles. I would hope this article will inspire others to attempt marine fish keeping; it is not as difficult as some would make it out to be.

My Royal Gramma — a perfect hide-and-seek artist.

I was initially attracted to keeping marines after admiring the various species on view at my local dealer. I bought the excellent *Interpet Guide to Marine Fishes*, by Dick Mills, and, armed with the wealth of knowledge contained within it, set about deciding what equipment I needed to buy. Fortunately, a colleague at work has been keeping marine fish for about 16 years and I found his advice invaluable during these first critical months.

SETTING UP THE SYSTEM

My foray into marine keeping began on my birthday. A visit to the local marine dealer equipped me with necessary items to set up the tank, and I duly returned home heavily laden but light of pocket!

I chose a 36 x 12 x 18in (90 x 30 x 45cm) tank, about the smallest allowable to keep marines, supported by an undergravel filter system fitted with power head. The undergravel filter itself consisted of a layer of filter wool matting laid on top of the plastic subgravel filter plate, followed by three inches (c 7.5cm) of limestone chippings (well washed), another layer of filter wool matting and, finally, two inches (5cm) of coral sand. This combination of substrate layers was chosen for several reasons:

① To reduce filter-clogging; the coarseness of the limestone chippings, as compared to using coral sand on its own, allows a greater flow rate through the medium.

② To stabilise the pH of the water; it is generally accepted that limestone assists in keeping the pH of the water stable by calcium slowly dissolving into the water.

③ To provide adequate surface area for bacterial development; the top layer of coral sand provides a large surface area to promote bacterial growth.

The filter wool matting was laid to minimise any mixing of the strata and reduce the chances of the substrate materials being drawn under the filter plate.

The heater, tank decorations and synthetic salt water were then added. Lighting was provided by two Triton 25-watt fluorescent tubes. The system was turned on and allowed to settle overnight. The next day the water had become crystal clear and was ready for the introduction of a marine bacterial culture used to seed the filter and accelerate the maturation process.

Over the next fortnight I monitored the nitrite levels on a daily basis, finding the highest reading after about 9 days. Some 5 days later the nitrite reading had dropped to zero again. The system was then left like this for about **one month** to allow further maturation to take place and algae growth to get going.

During this period the power head was set at a maximum flow rate with full air induction. This ensured a high rate of flow through the filter and provided a high rate of oxygenation in the water. It was interesting to note that the water had a slight compost smell coming from it at this time.

THE FIRST FISH . . . AND FIRST PROBLEM

From addition of water, the tank had been running for about one and a half months. It was then time to add a fish. I did, in fact, add *two* fish (safety in numbers, perhaps?). They were small Common Clowns (*Amphiprion ocellaris*) about 0.6in (1.5cm) each in length.

At the same time, I reduced the water and air flow rate through the filter by about one-third as the Clowns were showing signs of distress when the filter was running at a high rate.

The other 'addition' to the tank at around this time was the growth of some rather unpleasant and unwelcome brown algae. The algae growth started as brown specks on the pure white coral sand and rapidly spread over everything. My first reaction was to remove the corals, scrubbing them clean, while at the same time replacing the thin layer of affected coral sand. However, the brown coating simply returned within a few days. I tried reducing the lighting, but this did not help the situation either.

On seeking advice I was assured that these brown algae would soon begin to change to the more characteristic green colour. Sure enough, the colour did change and, at one point, I had several varieties of algae growing at the same time: some filamentous, others leaf-like, 'stranded' and jelly-like. All types grew.

Indeed, growth was so rapid, it necessitated regular harvesting, especially of the jelly-type which grew on the surface of the coral sand. I feared this jelly-type would reduce the water flow to the filterbed bacteria, causing them to work less efficiently. It would, therefore, seem a good idea to disturb the coral sand each day by gently raking it. This stops the algae binding the grains of coral sand together thereby reducing the chances of filter clogging.

The rapid growth of algae indicates the presence of nitrates in the water. As they grow, they feed on these nitrates, absorbing them and processing them into nitrogen which, unlike the nitrates, is harmless to the fish. The regular harvesting of algae also removes the absorbed nitrates directly from the tank.

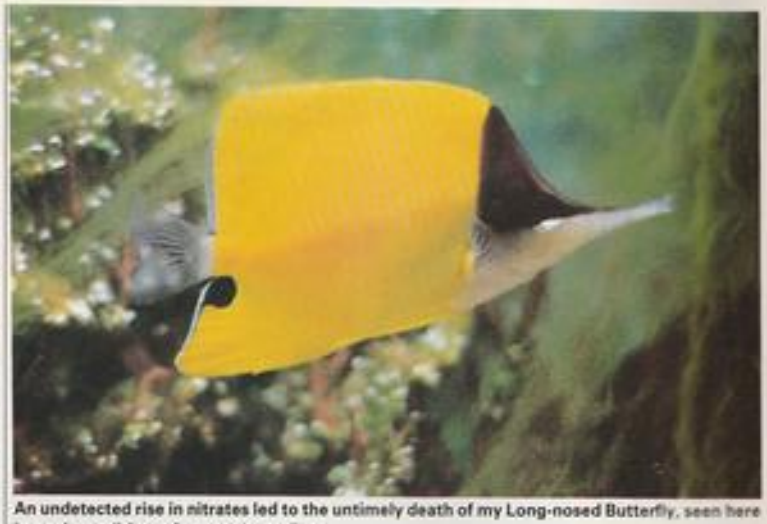
WATER QUALITY

During this time I was aware of the need to ensure a high standard of water quality. A weekly check was therefore kept on nitrite and specific gravity levels. I carried out 10% partial water changes every two weeks, while making any adjustments to the specific gravity at that time.

Regular water changes not only reduce the toxic effects of nitrites and nitrates but also provide a means by which a regular supply of trace elements can enter the system via freshly made up synthetic salt water.

The next addition to the tank, a month later, was a small Royal Gramma (*Gramma loreto*) that fed rather cautiously and took to living in one of the corals. This fish has a habit of escaping from the tank by various means. On one occasion, it escaped for over five minutes, by hiding in a coral I had removed for cleaning. I soon learned an important lesson: always to keep an eye on the whereabouts of the fish when carrying out routine maintenance.

It has been interesting to note that since I have been running the system, measured nitrite levels have always remained low. I put this down to introducing fish over an extended period of time, thereby allowing the number of bacteria to grow in relation to the number of fish in the tank.



An undetected rise in nitrates led to the untimely death of my Long-nosed Butterfly, seen here in peak condition a few weeks earlier.

Nitrites are produced when *Nitrosomonas* bacteria process the ammonia present in the system. Ammonia is a waste product which emanates from the fish themselves and from other decaying matter such as rotting food particles and the fishes' solid wastes. The nitrites are, in turn, converted to nitrates by *Nitrobacter* bacteria. Nitrites, ammonia and, to a lesser extent, nitrates are all toxic to the fish and must therefore be kept to a minimum at all times. It is, obviously, also very important to remove any uneaten food and fish waste from the tank.

If there is a sudden increase in ammonia levels, the *Nitrosomonas* bacteria will (usually) quickly convert this to nitrites. When this happens, though, the nitrites will remain at relatively high levels in the water if there are insufficient numbers of *Nitrobacter* bacteria to process them.

Ammonia levels will rise rapidly if too large, or too many, fishes are introduced to the tank at once, resulting in a 'nitrite overload'. This highlights the need to add fish over a period of time, allowing the *Nitrobacter* to multiply in relation to the fish loading.

This Flame Angel was added after five months.

FURTHER FILTRATION

Now that the tank had been established some five months, I decided to add a protein skimmer. As a tank matures and the main undergravel filter is put under increased load, the addition of a protein skimmer will ease this loading by removing undissolved proteins from the water. I currently clean out the skimmer's collecting cup each week and have been very surprised at the amount of material it removes from the water. In a tank as small as mine I consider this piece of equipment absolutely essential.

At this time I also added a very nice Flame Angel (*Centropyge loriculus*). Two months later, at seven months, I added the final fish, the unmistakable Yellow Long-nosed Butterflyfish (*Forcipiger flavissimus*).

Up to that point, I had been feeding all the fish on marine flake, but with the addition of a Butterflyfish, the diet would have to be widened. It took nearly two weeks before the Butterfly learned to eat the brine shrimp offered to it. It would swim about enthusiastically at feeding time but did not realise the particles of shrimp were edible. In fact, I had nearly given up on the chances of ever getting it to eat when, suddenly, it began to feed. The fish had probably been recently imported and therefore was not accustomed to feeding in captivity. This is one of the reasons why it is worth observing a fish feeding before you purchase it.

FIRST LOSS

I kept the Butterfly for nearly six months. The first symptom of its demise was splitting in the anal fin, followed by a listlessness. I suspected that the water quality might be deteriorating, as Butterflyfish are particularly sensitive to poor water conditions.

Continued on page 105

Keeping and Breeding:

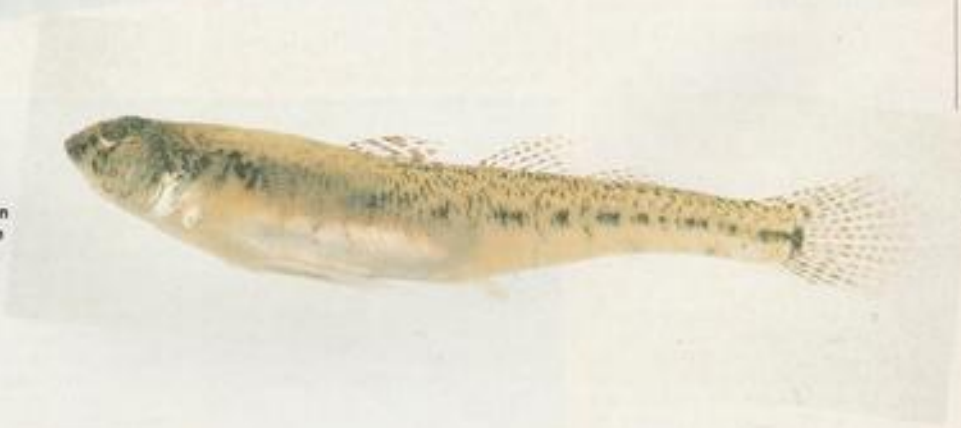
THE COMMON GOBY

Sandy creeks, such as these at Shaldon, are very suitable sites for collecting Common Gobies.

ANGELA HOLTHAM

A male Common Goby in breeding coloration.

MARK SHANNON



Female Common Gobies are rather drab.

MARK SHANNON

Dr David Tipping extols the virtues of one of our most widely distributed inshore species.

The Common Goby, *Pomatoschistus microps*, is an extremely abundant shore fish, which may be found in British and European waters. It is the most common estuarine fish species of western Europe. This article describes this interesting and hardy species and how to keep and breed it in captivity.

There are two attributes of the Common Goby which make it an ideal aquarium subject. Firstly, it is very tolerant of changing water conditions. It can withstand wide variations in temperature and salinity.

The second major asset of this fish is its small size. The maximum size achieved by males is 55mm (2.2in), with 45mm (1.8in)

the maximum seen in females. The small size of this species enables large numbers to be kept in modest aquaria.

An ideal size aquarium for this tiny shore fish is about 35cm (14in). Common Gobies are naturally sedentary, and do not require larger aquaria than this. This makes the fish an excellent choice for children, since they can be kept successfully with the minimum of financial outlay. Even the fishes are free, and may be easily collected from sandy estuarine channels, such as at Shaldon, using a shrimp net.

GOBY AQUARIUM

Common Gobies only survive for about 18 months in the wild, but this can be extended to about 30 months in aquaria. The natural breeding season extends from April until August. However, fishes can be caught all the year round.

Filtration in the Common Goby tank is best achieved by the use of an undergravel filter, together with a powerhead. The use of a vigorous powerhead, if used with an airline attachment, simulates the rapid water flow which gobies experience in nature. The fishes are not swept away in such an aquarium because the pelvic (ventral) fins are fused to form a sucker.

The precise salinity is unimportant, but my Gobies were kept in water with sea salt added at the rate of 20g/l (about 3oz/gal) with no problems.

Gravel should be of a small diameter, about 2-3mm, to allow the fishes to remain horizontal on the substrate. The addition of some empty mussel shells allows some cover, and will be used for spawning.

Feeding the Common Goby presents few problems; they readily consume frozen foods, particularly mussel and bloodworm. The bloodworm may need to be chopped for smaller specimens. They also relish live foods, especially brine shrimp, and will even accept tinned tuna and other fish.

Unlike many species of native marines, no precautions are necessary to prevent the fishes from becoming too warm. Common Gobies are equally happy at 7°C or 25°C (45 or 77°F). They will even tolerate temperatures of up to 30°C (86°F) for some time. If they are kept at the lower end of their range, they will naturally eat less than at warm temperatures, because their metabolism will be running more slowly.

BREEDING

One of the most appealing characteristics of this fish is the breeding coloration assumed by ripe males. The cryptic (drab) coloration seen in females and immature males is lost, to be replaced by a darkening of all of the fins, a redenning of the breast, and the appearance of black vertical bars.

Males in breeding colour guard territories, each containing a mussel shell and await the presence of females. Spawning occurs over a protracted period, and each fish will spawn many times in a season.

Males protect their eggs until they hatch. The eggs are very small, with the resultant fry being planktonic, so their successful raising is impossible in an aquarium. However, the colour change in the male, and his breeding behaviour, are themselves rewarding to observe.

The best time to collect males in breeding colour is in July, so they can be collected from the coast on the last day of a summer holiday. Females become extremely heavy with eggs prior to the breeding season, allowing the sexing of the fishes to be achieved without difficulty. The eggs appear yellow/orange through the body wall of the fish.

Ripeness is achieved more quickly if the pair are maintained on long daylengths (more than 12 hours of illumination), especially if they are kept warm (about 16°C — 61°F). Comfortable room temperature is ideal in this respect.

It has been suggested that some males are sneak fertilisers during the spawning procedure of another spawning pair. These 'sneaky' males are reported to be smaller than normal males and superficially resemble females. However, no photographs have ever been taken of three Common Gobies spawning simultaneously. If someone out there has recorded such activity, then you have made a scientific first!

In summary, the Common Goby is a small, abundant fish, free to collect, that is both tolerant and easy to keep, and which shows interesting reproductive behaviour, reminiscent of cichlids. AMP

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Testing for nitrite and checking pH showed these levels were fine. However, since the tank was now about a year old I was concerned that the nitrate level might have gradually built up over this period.

Regular water changes should ensure nitrates are routinely removed from the system, but I decided to buy a nitrate test kit to check on these levels nonetheless. Indeed, although the nitrate levels were not critical, they were up and, in fact, increasing. I carried out weekly partial water changes but I was unable to save the Butterflyfish.

It soon became apparent that the weekly water changes were not reducing the nitrate levels. I therefore suspected that I had been slightly overfeeding the fish for a period of time. I reduced feeding to a minimum and added an external power filter in addition to the protein and u/g filters.

To offset the increased nitrate levels I filled the external filter with Siporax (TM) sintered glass medium. This medium has the ability to provide suitable conditions for the culture of anaerobic bacteria which can process nitrates, via several stages, into free nitrogen which is harmless to the fish.

Over the past month this has lowered the nitrate level to nearly zero with no water changes at all. Incidentally, the lack of water changes were not part of a clever experiment but simply the result of my being on holiday.

A point to note: when a fish becomes ill or its behaviour alters, do not panic and start adding medication to the tank. Take your time, check the water quality carefully and correct if necessary. Adding medication or changing large quantities of water can do more harm than good. It is better to lose one fish than risk all the tank stock.

LATEST SITUATION

Having dealt with the nitrate problem, the tank has now turned red. Well, the algae have; there are no green algae to be seen anywhere. The red algae are of the type which sticks to the coral sand floor and requires harvesting twice a week. Perhaps the green algae will return again in the summer.

I have now set up a quarantine tank the same size as my show tank. It has a single external power filter and is stocked with two small Tomato Clowns (*Amphiprion frenatus*) to keep it running. This means that any new additions can be screened before transferring them to the show tank, thus reducing the risk of disease or parasites entering the main system.

CONCLUSIONS

What is needed to become a successful marine fishkeeper? I would suggest the following:

① careful monitoring of water quality;
② a knowledge of compatible fish;
③ the patience to add fish slowly and make changes to the system slowly;
④ the willingness to accept knowledgeable advice from a reputable dealer or associate with experience in fishkeeping.

The support of your family is also invaluable. In our case, the fish have become just like members of the family, and nicknames have been conferred, the Royal Gamma being fondly known as "Hector", although none of us can remember why! One very interesting feature has been the rapid growth of the dominant Clownfish; a really amazing transformation.

Something I have not mentioned is the pleasure gained from observing the tank, the whole point (in my opinion) in keeping these marine species. This small window of marine life in your own living room allows observation of the water currents, algal growth and, of course, the habits, characteristics and interaction of the fishes themselves.

I have been perhaps fortunate to have four of my five fish alive and well as I settle into my second year of marine fishkeeping during which, with the nitrate level reduced, I hope to introduce another Long-nosed Butterfly to my set-up.

ACKNOWLEDGEMENT

I would like to express my thanks to **Fred Wilgar** who shared his many years of experience with me and supplied a wealth of useful advice and tips during my adventure into marines. AMP

News from the societies

C.A.S.T. '88

The society would like to thank everyone who attended this year's Open Show and made it such a great success (305 entries).

Best in Show:

1st — *Pseudacanthicus leopardus* owned by Andrew Duck (N.A.C.G.)

2nd — *Iriatherina werneri* owned by Mr and Mrs B Dawson (C.A.S.T. '88)

3rd — Gelius Barb owned by M Jones and S Ford (Tameside)

The committee would also like to thank all those who donated prizes, particularly Bioplast (UK), *A & P*, 'Aquarian', Tetra, Hagen, Interpet, plus many others too numerous to list.

For further details of C.A.S.T. '88, contact **Peter Jones** (Secretary), 1 Hope Street, Caergwrle, Wrexham, Clwyd LL12 9AA., Tel: 0978 761829.

Diary dates

Sunday 1 August

Newtown D.A.S. — Open Show, Community Wing, Toronto Primary School, Howden, Livingston. Details from **Beryl Stalker,** 51 Nelson Avenue, Howden, Livingston EH54 6BZ. Tel: 0506 36915.

Sunday 8 August

Catfish Association of Great Britain — Annual Open Show, Heron Cross Sports and Social Club, Grove Road, Stoke. Bar and refreshments available. Contact: **Des Penny,** 0302 702917 or **Andy Stratton,** 0444 450132.

Robin Hood Aquarists — Open Show, Highbank Community Centre, Farnborough Road, Clifton, Nottingham. Part of the A of A Superbowl competition. Details: **Dilys Hinton,** 45 Woollaton Ave, Gedling, Notts NG4 4HY. Tel: 0602 876657.

Whitby & D.A.S. — Open Show and Auction, Whitby T.A. Centre, Stainsacre Lane Industrial Estate, Scarborough Road (A171), Whitby. Benching: noon-2 pm. Auction: 1.15 pm. Details: **Andy Ketch,** Tel: 0947 604352.

Saturday 14 August

Ilford D.A. & P.S. — Fishkeeping Exhibition, Vine Memorial Church Hall, Holstock Road, off High Road, Ilford, Essex. Contact: **R Donner,** 5 Suffolk Drive, Laindon, Basildon, Essex SS15 6PL.

Sunday 15 August

Salisbury & D.A.S. — Open Show. Details from **Jonathan Hill,** 2 Wiltshire Terrace, West Harnham, Salisbury, Wilts SP2 8HW.

NEXT MONTH: FOCUS ON CATFISH

Saturday 21 and Sunday 22 August

Cymru National Aquarist Association — Fishkeeping Exhibition Weekend, Newport Centre, Kingsway, Newport, Gwent, South Wales. Fish entries: post and phone free if received by Friday 20 August. Entries on the day: 30p per tank. F.B.A.S. rules and judge. Contact **Mrs K Durrant,** 7 Conway Close, Cefn Farm, Pontypridd, Mid Glam, South Wales CF37 3AW. Tel: 0443 491734.

Sunday 22 August

Northampton & D.A.S. — Annual Open Show, Gladstone Lower School, Tenby Road, Northampton. Championship Class: La (Botias). F.B.A.S. rules. Details from **Mrs D E Woodman,** 22 Fisher's Close, Little Billing, Northampton NN3 4SR.

Sunday 29 August

Dunfermline & D.A.S. — 22nd Annual Open Show, Parkgate Community Centre (Rosyth Institute), Rosyth. 54 classes; 25 trophies; snack bar; raffle; tombola. Benching: 10 am-1.30 pm. Judging: 1-4 pm. Fish Auction (entries permitting): 1.30-4 pm. Viewing of fish: 4-5 pm. Presentations: 5 pm. F.S.A.S. Standards. Contact: **Derek Long** (Show Secretary), 86 Whinny Hill Crescent, Inverkeithing, Fife KY11 1BD. Tel: 0383 413 275.

Sunday 5 September

Darlington F.K. — Open Show, Eastbourne School, Hundens Lane, Darlington. Championship Class: Cb; *A & P* Gold Pin; Brooch scheme. Auction: 12.30 pm. Booking in: 11 am-1 pm. (28p/entry). F.B.A.S. Standards.

Saturday 18 September

Plymouth A.S. — 2nd Open Show, University of Plymouth Main Hall. Booking in: 9-11.30 am. Information: **Dennis Hilton,** 5 Connaught Ave, Mutley Plain, Plymouth PL4 7BT.

Monday 20 September

Solway A.S. — David Sands of 'Aquarian' Advisory Service. Venue: Mount Sidney Inn, Dumfries, 7.15 pm. Details from **John Cowan.** Tel: 0387 75606.