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AQUARIST AND PONDKEEPER

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EDITORIAL

CRAZY . . . OR JUST ECCENTRIC?

I had the most incredible conversation with one of our readers the other day.

She was most concerned about her eight-inch Oscar. "He" — she was quite definite about this — spent all day hiding in his cave. However, come the night, she could hear him crashing about in the tank, obviously looking for the food that he had been refusing all day. As soon as she switched the tank lights on, off he would shoot, like streaked lightning, back into his cave. What was wrong?

I must admit that I felt totally stumped by this one. A nocturnal Oscar that spends all day hiding in a cave must surely be a very frightened Oscar indeed.

I don't know why (probably to fill a pregnant pause . . . or something), but I asked, "How big is the cave?"

"It's quite roomy", came the reply. "About a foot long, six inches deep and four inches high."

Things were getting curiousest and curiousest! The poor Oscar would have to lie on its side just to fit into the cave, and if "he" was being forced to do this just to hide, there surely must be something very badly wrong somewhere.

Confused? Well, so was I . . . considerably so, in fact . . . until it turned out that "her Oscar" was nothing other than a 'Plecostomus' Catfish called Oscar!

There was, of course, nothing wrong with Oscar — he was just doing what many Plecos do — rest during the day and feed at twilight and during the hours of darkness.

As Jason Enfield so rightly and eloquently points out in his article this month, we aquarists have an eccentric tendency to christen our fish, particularly if they have some outstanding characteristic or other. Oscar obviously had some irresistible quality . . . but, alas, what this was, we'll never know.

Jason says we are eccentric — others call us crazy. But we know better, don't we? At least, Gertrude, my Bronze Corydoras, seems to think so. If she didn't, she wouldn't keep winking at me with that special look in her eye, now would she?

John Dawes
Editor

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HAVE YOU MET CICELY BORGSTROMM?

As Jason Endfield discovered, it's not just the scientific names of some fish that are unpronounceable.

Not content with complicated and unpronounceable Latin names, or even the sometimes equally tongue-twisting common names for fishes (Schwanenfeld's Barb?), aquarists — even the really 'serious' ones among us — always seem to make a special effort to think up their own pet titles for at least some of their charges.

The ingenuity and imagination that goes into this process is often quite startling, but I've learned not to enquire as to the origins of these creations, as the explanation is rarely a rewarding experience.

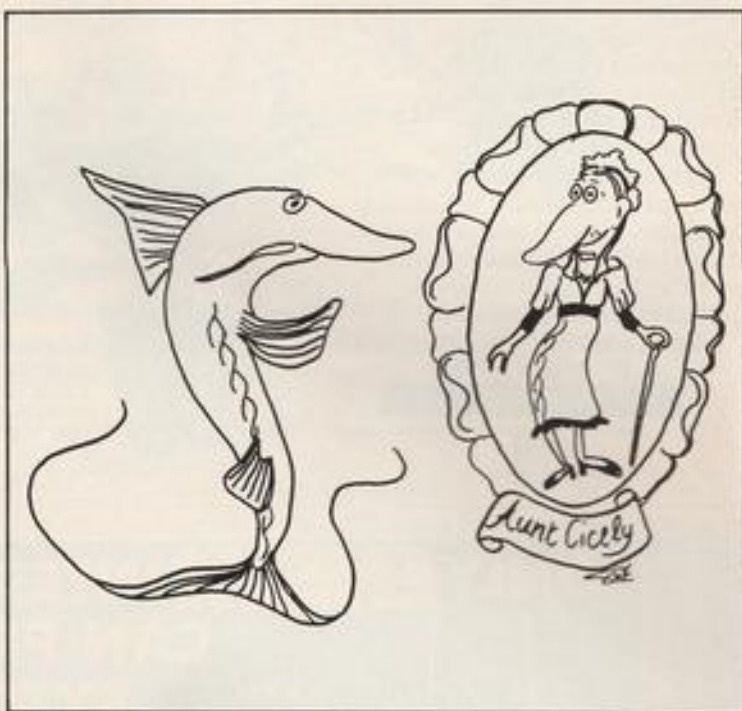
There are exceptions — but not many. I couldn't help, of course, but ask about one example — a Twig Catfish (*Parotocentrus acutirostris*) known affectionately as Cicely Borgstromm. I had to ask didn't I? Apparently the keeper of Cicely had a great uncle who was an immigrant from Scandinavia. He settled in Norwich (well, why not?) and married a local girl called — yes, you guessed it — Cicely. Half a dozen or so photographs exist of the said Cicely Borgstromm, and upon purchasing Cicely (the fish), it was unanimously agreed that it bore a striking resemblance to Cicely (the Great Aunt). So, Cicely Borgstromm it was; and is to this day. Well, it's one way to keep her memory alive, even if it isn't exactly flattering.

After the story was related to me (at greater length than is reproduced here), I was struck for the right words, though my albeit slightly delayed response of, "My goodness, how terribly fascinating", was, I think, quite appropriate and well-received at the time.

One's mind boggles at the thinking behind some pet fish names. I know of several perfectly ridiculous examples, which, however, seem entirely sensible to the devoted keepers: there is Roger the female Kribensis, Fiona the Siamese Fighting Fish (male), and even Caroline... who is a snail... I am tempted to ask that deceptively simple question: "Why...?" but I think, perhaps, it is more fun to leave it to one's imagination.

Together with most aquarists, I share this eccentricity for christening my fish, and I enjoy the puzzled looks I get from people asking questions like: "Tell me... why a tetra called... 'Nerys'...?" I answer in mock surprise, "Well, why not???" It's great fun, though over-liberal use of pet names does have its drawbacks, like the one time I went into a fish shop and calmly and politely asked the assistant for a pair of "Nerys — I mean Neon — Tetra..." I haven't been back there since. The embarrassment of it all...!

Believe you switch off, believe me there is



some point to all this nonsense. It's with reference to something I read recently in *AGP* by our editor, John Dawes, regarding the confusion surrounding the flexible and inaccurate use of common names. It is true that most dealers adhere to accepted names, but there are one or two who don't, and use, more often than not, some confusing variation of the officially recognised title.

But, worse still, is something I came across a while back when I purchased what has become one of my favourite fish — and I'm still trying to find out what it is. It was sold to me simply as a 'Goby'. I stupidly didn't enquire as to its correct name at the time, thinking that it would be a simple matter to thumb through a few books when I got home to establish precisely what species of Goby my fish was. A year later I'm still not sure, which is both annoying and frustrating. As for the Goby, well it is perhaps the perfect fish — small, thoroughly well-behaved, eats anything and is attractive, and so I'd love to recommend it — if only I knew what it was.

Certainly, there are a few well-known, and usually well-labelled, species of Goby offered for sale regularly for fresh or brackish water

tanks, the most common probably being the Bumblebee Goby (*Brachyogobius xanthocheilus*) and the species *Stigmatogobius sadanondio* (which, incidentally, I've also seen offered simply as 'Gobies'), but my little two-inch, brown-striped case-in-point, while having typically Goby-like features (two dorsal fins etc.), looks more like an over-developed Pencilfish.

Whatever my fish is, it's turned out to be something quite special, and although very timid to start with, 'Goby', as it is not so imaginatively called, is now virtually finger-tame. If anybody out there has a suggestion as to what Goby it is, I'd be very pleased to hear from them. Meanwhile, it all remains a bit of a mystery.

Which is just one reason to agree with John Dawes' sentiments regarding more accurate and uniform usage of common names. I mean, if every fishkeeper and dealer used his/her own system of nomenclature, it could be totally out of hand.

"I'll take one Goby, four Nerys Tetras, a pair of Rogers and a Cicely Borgstromm please..." "Eh?"

Tomorrow's Aquarist



By David Sands

T.A. Correspondence

Scott Fursedonn, twelve years old, wrote to me from Harrow in Middlesex. His first suggestion is that this column should be increased to two pages... (would the editor find the space???) Scott says *Tomorrow's Aquarist* is easy to digest and enjoyable to read. He would like to help me organise the column by bringing in a young person's thoughts on the matter.

The actual logistics of that idea would probably be a problem in that I live in Lancashire, the editor lives in Corsham, Wiltshire (wherever that may be) and Scott lives in Middlesex. I don't suppose the editor would give us much more space to play about with anyway!

I would like Scott to suggest a few ideas and if some of them prove interesting perhaps he can be involved in *Tomorrow's Aquarist* in that way.

Phil Hollings writes from Chester, the old Roman city of occupation, and tells me he is a junior member of the Ellesmere Port Aquarist Society. The club meets at the Labour Social Club at Ellesmere Port. Philip helps at a Chester Pet and Aquatic store and at Chester Zoo aquarium on a voluntary basis.

Are you a junior member of a fishkeeping club and would like to let us know if there is anything special going on to include you? Please drop me a line and let me know. Perhaps other local young aquarists would like to know about your club.

Phil has two lists for our Top Ten fishes, but I'll just give the top five from each:

Tropical

- (1) *Synodontis nigricentris* (Upside-down Catfish)
- (2) *Macropodus opercularis* (Bumblebee Catfish)
- (3) *Corydoras melanistius* (Spotted Catfish)
- (4) *Corydoras rubrae* (Rabout's Catfish)
- (5) Halfbeak

Coldwater

- (1) Moor
- (2) Shubunkin
- (3) Sarasa Comet
- (4) Lionhead
- (5) Weather Loach

Nice to see four catfishes dominating Phil's list!

Redtails and budgie cages

A young aquarist asked me at a show recently if he could keep a Redtail Catfish in a small tank. I thought for a moment and then explained that it would be like keeping a Golden Eagle in a budgie cage. I think he understood what I was trying to say.

Over the years I have often asked myself whether it is right to keep large fishes in aquaria. Some do seem to adapt to life in a tank but others look very uneasy....

Goldfish prizes

I've had a few letters about goldfish as prizes at fairs etc. Jenny Hadfield of Altrincham states they should be given room to swim around in. She saw goldfish at a fair in tiny plastic bags rotating on a wheel. Some were in containers hardly two inches square without shelter on a hot and very bright day.

Remember, if you see what you believe to be cruelty shown towards any animal, you are entitled to inform the respective authorities who can then determine the facts.

Hilda Allen, a contributor to *A & P*, pointed out to me and editor, John Dawes, that the goldfish is entitled to protection under the Protection of Animals Act, 1911 (see *Letters* page).

I am aware of this Act. Indeed, I was once asked by an RSPCA officer if I would help them in a prosecution of a drunken idiot who swallowed a

live goldfish for a bet....

Hilda believes the suffering goldfish are under — stress, shock, oxygen starvation, temperature fluctuations, etc — is totally unnecessary and I agree with her. Sadly, a lot of people begin fishkeeping by rescuing a fairground goldfish prize.

W Fowler of Stockport was concise, "giving animals as prizes belongs to yesterday's aquarist, certainly not today's or tomorrow's". Even some societies offer live fish as prizes and W Fowler believes some of these fish could suffer, in inexperienced hands, a premature end!

Dolphin-friendly tuna

After Sandown Park in June, I drove to Liverpool at high speed to attend a special meeting of the Whale and Dolphin Conservation Society. The speaker, an American called Sam, had posed as a cook on a trawler to obtain film proof that drift netting, a new method of tuna fishing which utilises miles of net, kills massive numbers of whales and dolphins.

In America, 'green' people (parents, school children and relatives) successfully campaigned against big companies such as the Heinz group, until they finally withdrew drift-net-caught tuna from the canning markets... In the UK, only Sainsbury's own brand guarantees that the tuna has been caught using traditional dolphin- and whale-friendly methods (see this month's

Seaview for further discussion of this topic).

Sam said that just a few people changed the way things were, not by legislation (that was in place and failing) or politics, but by consumer power. If people didn't buy drift-net-caught tuna then the companies are hit where it hurts most... in their pockets!

That made me think that we can help fish in the same way.

I wonder if any readers out there would like actively to help conservation when they have left school. I would have loved to have worked for Greenpeace or some similar organisation. Perhaps one day I will be working for a conservation group.

Common names

Has anybody ever wondered how a particular fish obtained its common name? Perhaps it's a community fish everybody knows like the Black Widow Tetra. Why should this Tetra be called the Black Widow? Maybe widows are supposed to dress in black...?

I have given several common names to catfishes purely for articles or books and then found that they've struck. If there are any fish names you would like to know more about, or have any special ideas about, please drop me a line.

I hope the World Cup football didn't detract too much from your fishkeeping (I'm a Blackburn Rovers supporter).

Until next time, happy fishkeeping!



This fish is widely known as the Black Widow Tetra... but does anyone know why?



Contrast among the plants, allied to generous planting, will produce attractive backdrops for the fish.

SETTING UP A SHOW AQUARIUM

(Or how to Create a Corner of Brazil in your Living Room)

Urged on by visions of a beautiful Brazilian underwater world, Andrew Grant set about changing his woefully depleted tank into a luxuriant masterpiece.

First
STEPS

I often spend my time looking through aquarium books, gasping at the beautiful underwater worlds populated by thoroughly contented fish darting through the foliage, probably fooled into thinking that they're actually in darkest Brazil!

Unfortunately, this has always made it all the more painful to put the book down and gaze at my own tank: a drab, sparse affair, with vast plains of gravel, interrupted only by the odd stem of *Cabomba* or *Bacopa*, struggling for their very existence under what could best be described as very dim lighting indeed.

It's always surprised me that my fish haven't died of boredom or depression in such an arid environment, as I'm sure I would. Apart from that, my tank hasn't looked very nice for ages. It would be so much more pleasant to come home to an underwater jungle, a slice of life from the other side of the world, a tank so full of plants that I'd have to prune them weekly to give all the cuttings away to friends!

Awaking from one of my many daydreams, however, I inevitably realised that this would be rather hard to do with a 40-watt pygmy bulb and an undergravel filter with half an inch of gravel on it! So, one day, when I had finally become fed up enough to do something about it, I decided to make a total change.

Theory into practice

Two weeks later, I made it to the aquarium shop with enough money to buy at least two pygmy bulbs! My first purchases were two sunlight-simulating fluorescent tubes and one pink one, an arrangement which I thought would bring out the colours of the fish and foliage, while not starving the plants of the essential range of wavelengths needed for growth. It was just as well that the shopkeeper reminded me that I needed a starter unit, or I might have been rather disappointed when I returned home.

Next, I decided that I would get a power filter. (This was after I had discovered that my wallet contained slightly more money than I thought it did). I decided that I would have a better chance of growing healthy plants with a power filter than with an undergravel one. This is not to say, however, that the undergravel necessarily impedes plant growth (there is enough debate about this subject anyway), but I just thought I would have something to blame if my attempt to grow healthy plants failed!

Anyway, it would provide a current into which the more energetic fish could swim,



A shoal of Cardinals will bring a splash of brilliant colour, even to the darkest of surroundings.

and it would mean that I could use sand as the substrate, as I think it looks so much better than gravel. I believe that any sand you put in a freshwater tank must be washed river sand. Sand from any other source may have salt or chemicals in it which may affect the fish and plants. Even if the sand you buy is washed, it is advisable to rinse it thoroughly when you get home.

To improve my chances of getting better plant growth, I decided to buy some peat. Again, you must make sure that the peat is suitable for use in the aquarium — make sure there are no added chemicals, as is the case in garden peat.

Now for the more interesting parts: the plants and fish. I really went to town with the plants, buying loads of different varieties, not really knowing what their requirements were. This was really a recipe for disaster — so it's just as well I never follow recipes too closely! In general, I got some 'fill-in' plants (eg. *Cabomba*, *Bacopa*, *Myriophyllum*), and a few 'show' plants (ie, plants which look best on their own, like *Cryptocoryne* and *Echinodorus*), as well as clumps of floating plants like *Riccia*.

I finally made it home after a hard day's shopping, and set the tank up. Luckily, I actually remembered to put the peat in before I put in all of the sand. I decided to make a sandwich of sand-peat-sand, the peat being buried deep enough so that it wouldn't be uprooted by the fish.

Furnishing the tank

Then came the part I really enjoyed: setting up the 'furniture'.

When I set up a tank, I try to think how it would look from the inside, as if I were a fish. I find that it is quite helpful to do this, as it often results in a better-planned layout. I often imagine I'm setting up furniture in a room, so that there are small corners where one could retreat if one is feeling anti-social, and other spaces where the kids could play, or where one could build a scale model of the Eiffel Tower out of matchsticks, on one's Sunday afternoons!

While fish don't lead such exciting lives, however, they do need a variety of different 'terrains' in their environment, such as an expanse of sand for digging about in, or a clump of plants to hide in or spend some time with their favourite Guppy.

Before I began planting, I decided to put in a couple of raised areas towards the back of the tank. I did this by building a wall with some ceramic rock to produce an 'enclosure'. I then poured in some sand to fill up the space up to the top. Once planted, this would give a most pleasing effect, giving the view a more three-dimensional feel. I also placed a couple of round, large stones in the sand, keeping in mind that the cichlids which I was going to buy were going to spawn successfully for the first time in captivity!

With the substrate ready, I began by planting the 'fill-in' plants, mostly along the back of the tank. One of my priorities is always to cover up the corners, as they tend to distract from the whole scene if they are left bare. I also planted a few bunches

elsewhere, rather randomly. This time, I set up a short wall of plants in front of the back wall of the tank, so that there was a little alleyway, where assorted fish could get up to whatever they do when out of sight.

Next, the show plants were put in. I placed a large Amazon Sword Plant, (*Echinodorus*), slightly left of centre at the front of the tank. It is usually a good idea to avoid symmetry, as it rarely works. I tried it once, and the results were abominable!

Along with a couple of other show plants, I planted quite a few dwarf *Cryptocoryne* specimens making a dense carpet of foliage, which not only looked good, but would also provide a medium in which to spawn, just in case some fish took it upon themselves to do so.

While arranging the plants, I tried to vary the colour from one plant to the next, so that I'd have some Red Milfoil next to some *Cabomba*, or some light-green *Bacopa* next to some dark-green *Elodea*.

Modesty prevents me from saying how wonderful it looked, so let's just say I was ready to get the insect repellent out for my next venture through the Brazilian jungle.



Hatchetfish are great — as long as the tank is well-covered.

the fish into their new environment.

A couple of hours later, when the fish had settled in, I turned off the room lights and sat back to behold the spectacle before me. I was finally satisfied! No longer would I be depressed by my drab-looking little tank — now I had created an underwater world of my own. I soon realised, however, that with my fishkeeping expertise, the plants would have withered and the fish died within a matter of days.



Plan view of my 'Brazilian' masterpiece.

Colourful fish selection

The next few days were rather painful, as I couldn't wait to get the fish, and see them darting contentedly through the plants, and saying to each other, "Ah, home at last!"

Finally, however, after two whole weeks of waiting, the tank was ready to receive its first piscine inhabitants. Because the main function of this particular tank would be decorative, I decided to get mainly brightly-coloured fish, which would provide the final splashes of colour on my underwater canvas.

My first choice were some Cardinal Tetras (*Parcherodon axelrodi*). I thought they'd be ideal candidates for my tank, with their lively temperament, shoaling behaviour and breathtaking colours. Bearing in mind that I had to restrict the numbers of fish I could put in the tank while it matured, I had to buy a small shoal of five fish.

To add balance to the whole scene as it would look once everything was set up, I purchased four Peppered *Corydoras*, and four Hatchetfish. My final purchase was a pair of Flag Cichlids, *Aequidens curviceps*. These were an ideal choice, as they are mild-mannered, beautifully coloured and relatively easy to breed.

I figured I had just about reached the stocking limit with these fish, with the tank just half-stocked. Once the bags had floated long enough in the tank, I slowly released

You can imagine my surprise, then, when after a couple of months, the aquarium looked as good as it did when I planted it. The Cardinals were swimming happily in a small, tight shoal, the Hatchets were doing their very best to escape through the lid, and the Catfish were busy grubbing about in the sand to their hearts' content.

And the Flag Cichlids? Well, they were last seen disappearing into the little avenue I had created. I guess they were just doing what they do when out of sight!



Many *Aequidens* species (this is *A. pulcher*) will spawn in a community aquarium, given half a chance.



A rich community of branching and tabulate *Acropora* corals growing on the reef crest of Heron Island on the Great Barrier Reef, Australia.

THE 'REAL' LIVING ROCK

Dr Lin Baldock takes a detailed look at the 'life' behind
'living rock'

*(Photographs — all taken underwater in the wild — by the
author)*



A species of Bubble Coral, *Pterogyra*, photographed in its natural habitat on a Red Sea reef.

Have you ever thought what those lumps of 'living rock' we see offered for sale might have looked like before they arrived in your marine aquarium? Many of them were once living coral, full of vibrant life and colour. Much of this coral is dead — or a pale shadow of what it once was — by the time it reaches us. By then the once-living coral skeleton has become a hiding place for many other delicate invertebrates which, admittedly, can add their own brand of attraction to the lumps of 'rock' we buy.

CORAL BUILDING BLOCKS

Living colonies of reef-building corals are made up of vast numbers of tiny polyps which are very simple animals related to sea anemones. Gradually, over thousands of years, these polyps lay down the stony, limestone skeletons which produce the structures we know as coral reefs and 'living rock'.

There are two types of coral: the *hermatypic*, or reef-building, corals dependent on light and confined to comparatively shallow seas; and the *ahermatypic* species, independent of light and often occurring in deep water away from reefs. The deep-water species include many of the precious corals, such as the Black and Pink Corals. We are only concerned here with hermatypic species.



A colony of *Diploastrea* photographed during the day. The polyps are withdrawn during the daylight hours.



A deep swathe cut by a dragging anchor on Gannet Cay on the Great Barrier Reef, Australia.



Coral interactions: a tabulate species of *Acropora* shading out a large Brain Coral.



Diploastrea photographed at night. The colony is now covered with delicate extended polyps quite invisible in the daytime photograph.

Reef building corals are widely distributed throughout the tropical oceans of the world, constructing reefs where water temperatures fall between about 18° and 30°C (64.5-86°F). The growth of reefs is affected by the amount of suspended silt in the water, salinity and the availability of a suitable surface in shallow water on which the corals may develop.

The greatest range of coral types in the world occurs in the Indo-Pacific Ocean around the Philippines, with coral diversity decreasing as we move away from this centre. On Australia's Great Barrier Reef for example, about 80 coral genera have been identified, comprising some 460 species and the list is continually growing as studies reveal previously undiscovered variety in this rich community.

COMPETITION FOR SPACE

Space on a coral reef is often limiting, although the intensity of competition varies from place to place. It has also been shown that occasional destruction of parts of reefs by natural phenomena, such as cyclones, plays an important role in creating space on a reef and in maintaining the species diversity of the site.

As a result of the competition for space, interactions between corals are numerous. One photograph shows a large Brain Coral resisting the strangle-hold of a species of tabulate *Acropora* or Staghorn Coral. In the

lower left of the photograph, the *Acropora* is beginning to shade the other coral. Towards the back of the Brain Coral colony dead areas are visible as grey patches.

CORAL FEEDING STRATEGIES

Hermatypic corals have two feeding strategies: one, using an association with an alga in their cells, and the other, the capture of microscopic zooplankton from the surrounding water.

Strangely, coral reefs typically occur in very nutrient poor waters. It is the efficient retention and recycling of nutrients within the system which allows for development of kaleidoscopic reef communities in what would otherwise be a marine desert.

The symbiotic algae (those that live in close association with corals) are known as zooxanthellae and are a species of photosynthetic dinoflagellate *Symbiodinium microadriaticum*. These useful partners allow the corals to grow and deposit the chalky skeleton which provides the basic reef structure. The numbers and distribution of algal cells are carefully regulated by the coral to provide oxygen and other nutrients. In return, the alga uses the waste products of metabolism produced by the coral.

It is the presence of these algae and their requirement for light for photosynthesis which restricts growth of reef-building corals to relatively shallow water. The zone suitable for growth of these corals may be restricted to the upper 2m (6.5ft) of water or

extend to depths of over 80m (c260ft). The distribution will depend largely on water clarity and light penetration.

During the day, most coral polyps are withdrawn, although there are several common exceptions which sometimes appear in marine aquaria, such as species of *Plerogyra* (illustrated). At night, a dramatic change in the corals' appearance takes place. (Compare the two photographs of the coral *Diplosaurea*). Polyps are extended and small beasts from the zooplankton may be captured. Some species of coral have, besides the normal short tentacles, highly flexible, elongate 'catch tentacles' which, it is thought, play a role in food capture and in warding off neighbouring coral colonies. Some species of coral are capable of capturing quite large prey items, for example the mushroom coral *Fungia*. This coral has only a single polyp, the largest species reaching a diameter of 50cm (19.5in) or so.

There is one further feeding method employed by corals — a bizarre technique which involves the spreading of a thin film of slime or mucus over the surface of the colony in which small organic particles and planktonic organisms are trapped. The mucus is then consumed by the coral polyps.

This mode of feeding is used particularly by species with small polyps. A reversal of this behaviour may also have a role in sediment removal, in that sediment, which would otherwise choke the coral colony, is trapped in the mucus film and is then sloughed off by the coral, like an old skin.

SOME THREATS TO CORAL REEFS

Coral reefs are under threat worldwide from a large number of man's activities. Serious, and often irreversible, damage has been shown to have resulted from, for example, trampling by visitors to the reef, destructive fishing methods such as dynamiting, various forms of pollution, increased sedimentation and anchor damage.

One of the illustrations shows the swathe cut by an anchor chain through a stand of a delicately branching Staghorn (*Acropora*) in the Swains Reef. This occurred in a relatively little used and isolated part of Australia's Great Barrier Reef. Imagine the likely impact on areas of reef more accessible from the mainland.

On the Great Barrier Reef, conservation interests are well co-ordinated by the Great Barrier Reef Marine Park Authority, but many other coral reef areas of the world are not yet so effectively protected.

FURTHER READING

A useful introduction to corals and their biology is provided by:—

A Natural History of the Coral Reef by Charles R.C. Sheppard (1983), published by Blandford Press.

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TWO-HEADED SNAKES

Two-headed snakes are more common than many people realise . . . and it's all got to do with good old British compost(!) as Dr. Andrew Allen explains.

Grass Snakes with two heads turn up surprisingly often. But while at least two hundred 'dicephalic' Grass Snakes are recorded in the literature, there is just the one record of a two-headed Adder (from Cornwall, back in 1853). The story of why this should be so is all to do with compost heaps and the British climate!

The northerly range of reptiles is limited by the availability of suitable conditions for egg incubation. The Sand Lizard (*Lacerta agilis*), for example, is confined to a handful of microclimatically-favourable heathland and dune sites in southern and western England, because at our northerly latitude its eggs will only hatch in warm, sandy soils well exposed to sun. Even in these favoured sites the hatching success rate is only 0-15% in a cold wet summer and 20-50% in a hot dry summer, against hatching rates of 60-90% for eggs laid in any and every kind of soil in central and southern Europe. No lizard or

snake can really afford to leave the hatching of its eggs to the tender mercies of the English weather.

The Grass Snake (*Natrix natrix*) gets round this problem by a neat trick: using the heat of compost heaps, manure heaps and hayricks, or more natural piles of rotting vegetation (drifts of rotting leaves, even cowpats), to incubate its eggs. The bacterial and fungal fermentations inside a manure heap generate enormous amounts of heat, and the temperature inside a really splendidly richly rotten manure heap rarely falls below 30°C (86°F).

Now, 30°C is just right for incubating eggs. Up to 80% of Grass Snake eggs hatch successfully. But life in a manure heap does have its drawbacks. First, bacteria and fungi are very partial to egg yolk and albumen, and gleefully switch from eating protein-poor grass cuttings to eating protein-rich eggs. As a protection against this soup of ravenous microbes, the Grass Snake doctors its eggs with a stiff dose of bacteriocidal antibiotics.

Secondly, the temperature inside a manure heap can fluctuate violently, sometimes reaching, if only transiently, levels more like an oven than an incubator (hayricks sometimes burst into flames of their own volition, as a result of internal combustion). These thermal fluctuations — of much greater amplitude than those recorded in ordinary soil, at the depths where other oviparous lizards and snakes lay their eggs — disrupt the development of the embryos, and are responsible for the abnormalities, such as double-heading, which plague the Grass Snake.

It is easy to reproduce this effect in the laboratory. If Grass Snake eggs are incubated at c30-33°C — 86-91°F (the average temperature inside a clump of eggs in a manure heap) the hatching rate is about 90% and no abnormalities. If the eggs are incubated at a fairly constant 30-33°C but with fluctuations up to 40-45°C (104-113°F), mirroring more closely the real environment as recorded by microthermometers inserted into a clump of Grass Snake eggs deep inside a compost heap, the hatching rate falls to about 80% and up to 1% of the new-born snakes are dicephalic (two-headed).

The remaining British reptiles cheat the British climate in a different way, giving birth to live young — we can ignore as relatively unimportant the distinction sometimes made between 'ovoviviparity' of the Slow Worm (*Anguis fragilis*), and Smooth Snake (*Coronella austriaca*), which lay thin-membraned eggs which hatch immediately on or soon after laying, and the full viviparity of the Common Lizard *Lacerta vivipera* and Adder (*Vipera berus* — viper, from Latin *virus*, living, *parere*, to give birth).

During the summer months the mother Adder converts herself into a mobile incubator. By basking, ribs flattened, in the sun or against sun-warmed soil or stones, and by shuttling back and forth repeatedly between sunshine and shade and in and out of piles of rotting vegetation, she is able to maintain the embryos growing inside her at a constant, thermostatically controlled, temperature: 29°C ± 2°C (around 84°F) on days when the sun shines even fitfully; rather lower at night and during periods of prolonged grey weather.

Because they develop at a controlled temperature and are never allowed to overheat, the embryos grow normally and do not turn into 'monsters' or 'sports' like the two-headed Grass Snakes.



A two-headed rattlesnake was born in captivity in 1974 — an uncommon, but not unique, event among snakes.



While one fish attends to the eggs (the male in this case), the other defends the spawning site against all comers.

KEEPING AND BREEDING THOMAS' DWARF CICHLID

Jiri Palicka introduces a peaceful, colourful — and breedable — cichlid from Sierra Leone, Liberia and Guinea.

(Translated by Mary Bailey — Photographs by the author)

The genus *Anomalochromis*, which was erected by Greenwood in 1985, contains only one species of this cichlid from Africa. This is *A. thomasi*, which is usually known as *Pelmatochromis thomasi* or Thomas' Dwarf Cichlid.

The systematic position of this fish was uncertain and in question for many years. Only after a detailed analysis of the morphological characters was Greenwood able to distinguish positive characters in the structure of the skull which separate *Anomalochromis* from *Hemichromis*. Previously, this fish was included in *Hemichromis*, to which it was transferred from *Haplochromis* by Wilson & Loiselle's 1980 revision. Thus, Thomas' Dwarf Cichlid was re-named *Anomalochromis thomasi* (Boulenger 1915) after the most recent revision.

This fish was first re-discovered in 1962 by the famous German aquarist E. Roloff during one of his journeys through Africa, when he caught it in Sierra Leone in West Africa. Current reports state that it is also found in neighbouring areas, i.e. the southern part of Guinea and the northern part of Liberia.

Distinguishing characteristics

Because of its colourful appearance, *A. thomasi* is rightly regarded as one of the most popular members of the cichlid family. Its coloration is very variable and practically identical in both sexes. The background colour is yellowish grey to grey-green. Each scale has an iridescent spot. The gill cover has a yellowish-golden iridescent spot, which is emphasised by the underlying dark background.

There are dark spots on the central flank and caudal peduncle, but these may sometimes disappear, depending on mood. Any of the six vertical dark stripes may become prominent. During display and spawning, a diagonal dark stripe appears, running through the eye to the chin. This stripe also appears during minor squabbles and may be a warning signal, intended to frighten the enemy. The dorsal fin is iridescent gold, edged with bright red. This red border extends onto the caudal fin.

Sexual differences are sometimes difficult to distinguish, especially in young adults. Only with advanced years do males develop the elongated dorsal and anal fins which are

usually used as one of the methods of distinguishing between the sexes. Females can also be easily recognised if they are ripe with eggs. But the sexes can be distinguished with absolute certainty only at spawning time by the genital papillae — shorter, more pointed, and conical in males. Males attain a length of up to 10cm (4in), while females are only 7cm (c 2.8in) long. These sizes are attained, in the case of both sexes, only in the second year of life.

Aquarium requirements

As well as its pleasing coloration, this fish has an additional attraction, that is, its peacefulness. It can be kept without worry with any non-predatory species from other families. But it is not frightened of larger opponents. It stands up to them and thereby teaches them the respect due. Except at spawning time, *A. thomasi* swims all over the tank.

This attractive species is very adaptable and, for this reason, its maintenance in captivity poses few problems. It is nevertheless advisable to maintain ideal conditions in the aquarium in order to produce well-

Continued on page 113



A spawning pair of *Corydoras nijsseni*

TWO NEW SPECIES OF *CORYDORAS*

David Sands introduces two new Corys from Brazil
(Photographs by the author — Drawings by Craig Greenwood)
(Terms marked * are defined in the Glossary at the end of the article)

The genus *Corydoras* is comprised of almost 120 species of small, plated, tropical catfishes from South America. This article deals largely with just two of them, both of which I have recently described and named.

Corydoras nijsseni

In a small white water tributary of the Rio Negro, Brazil, there are three sympatric * species, one of which, *Corydoras nijsseni*, I have only recently described. All three possess an almost identical colour pattern.

Morphologically, the three species can be separated, although the first two described to science were so similar that Dr Warren Burgess, who was the author of the original description of *Corydoras adolfoi*, failed to see a hidden 'mimic' among his paratypes*. (See *Aquarist & Pondkeeper: Colour pattern sharing in catfishes — Zoomimesis or mimicry?* November 1986 and *Zoomimesis Revisited*, August 1987).

Subsequent researchers, Nijssen and Isbrucker, used one of the paratypes to describe a second species, naming it *Corydoras imitator*.

Corydoras nijsseni, described in recent supplements to *Catfishes of the World*, is an 'upper water' swimming species similar in behavioural habits to *Corydoras elegans* and *Corydoras napoensis* (frequently referred to as *Corydoras nanus*, from Surinam, in the literature).

The colour pattern, morphological characters and locality (tributary of the Rio Negro) of *Corydoras nijsseni* distinguishes it from *Corydoras elegans* (Steindachner, 1877) which comes from Colombia, Peru and Brazil, and *Corydoras nanus*, Nijssen and Isbrucker, 1986 found in Ecuador and Peru.

Type specimens

The holotype* of *Corydoras nijsseni* measured 27mm (1.1in) SL* (paratypes 27-30mm — 1.1-1.2in SL) was deposited at the Rijksmuseum, Leiden. Other statistics are as

follows: body depth 11mm (0.4in) body width 8mm (0.3in), 21 dorso-lateral scutes*, 19 ventro-lateral scutes. (*C. elegans* has 20/22, respectively, and its pectoral spines are 'thorned' on the posterior edge, with the anterior edge being barely serrated).

The overall fin counts are standard for *Corydoras* (ie dorsal L7*) and although visually similar to *Corydoras elegans*, *Corydoras nijsseni* lacks the dorsal pigment displayed by *Corydoras elegans* males.

I originally ranked *Corydoras nijsseni* as a sub-species of *Corydoras elegans* but raised the species to full specific level after further research.

Colour pattern

In life, as per the colour photograph, *C. nijsseni* has a dark head (almost to the posterior edge of the eye), an orange band behind the eye but anterior to the dorsal fin, at which point, a dark, typical 'adolfoi/imitator' narrow black line arises and extends from the dorsal fin laterally to the caudal fin.

All the fins are clear of pigment.

Males display a marginally darker dorsal/lateral stripe than females. In fixative, the orange patch fades quickly and the dark line becomes a pale grey.

Origin of name

Corydoras nijsseni was named after Dr Han Nijssen, of the University of Amsterdam, who encouraged me in my early research and kindly wrote the foreword to my first book. Dr Nijssen, together with his colleague Dr Isbrucker, has reviewed the genus *Corydoras* and been the exclusive source of information relating to these catfish (along with so many other fishes) for over twenty years.

Aquarium behaviour

In aquaria, unless disturbed by external sound or movement or threat, *Corydoras nijsseni* show a preference for the upper water levels, whereas the majority of *Corydoras* species remain on the substrate. This behaviour, ie swimming and feeding among upper water level plants, leaves and aquarium wood/decoration, is characteristic of species within the Elegans Group (a grouping of small or dwarf species first proposed by Dr. Nijssen alongside other groupings in his revision of the Surinam species of *Corydoras* published in 1970).

When disturbed by sounds or vibrations, *Corydoras nijsseni* follow *Corydoras adolfoi* and *Corydoras imitator* into hiding. In aquaria, the shared colour pattern would appear to act as a shoaling 'flag' as the three species swim together. In nature, the shoals would possibly be able to orientate as a co-ordinated mass.

In one breeding success with *Corydoras nijsseni*, it became obvious that this species is an upper site egg scatterer, which incidentally, is the same reproductive mode as *Corydoras elegans*. I have observed a female spawning *Corydoras nijsseni* place her eggs in the upper plants and a number of other 'upper' sites. This is less specific behaviour than that observed in other species where a lower or more general area is chosen.

The specimens which I have kept were imported by Heiko Bleher in 1989. He provided me with the fish to allow a description to be made. I therefore gratefully acknowledge Heiko Bleher's assistance in this matter.

Corydoras araguaiaensis

The second species which I described in the supplements is *Corydoras araguaiaensis*. The holotype measured 35mm SL (1.4in) and was collected in the Araguaia River, Brazil.

Corydoras araguaiaensis has been known in the aquarium trade for years since it was imported into Europe by Heiko Bleher in 1983/1984 as *Corydoras 'araguaia'*.

Corydoras araguaiaensis was first pictured in a Tropical Fish Hobbyist magazine from specimens collected during Harald Schultz's Brazilian expeditions in 1960. I first encountered this previously undescribed



C. nijsseni's most similar lookalikes *C. imitator* (front fish) and *C. adolfoi*.



The new species *C. araguaiaensis*.



C. araguaiaensis can be confused with these two species: *C. haraldschultzi* (front fish) and *C. sterbai*.

species in the Sao Paulo Museum collections in 1979 during my expedition to collect *Corydoras barbatus* in Southern Brazil.

My losses from among the specimens I imported from Germany were forwarded to Dr Nijssen in 1984 who identified them as *Corydoras haraldschultzi*.

Quote from Dr Nijssen, 14/5/84: "They are certainly *Corydoras haraldschultzi*. A pity that the exact locality is unknown. However, I will deposit them in our collection because it is a well preserved, nice series."

Dr Nijssen's identification, as the world authority on the genus, was not questioned until the import of the true *Corydoras haraldschultzi* and *Corydoras sterbai* from the Mato Grosso was made by Heiko Bleher.

These latter two Mato Grosso species have always been inextricably intertwined, as they were collected together in 1960 by Harold Schultz and described in the same paper by Dr Knaack (published in 1962).

Corydoras sterbai (see TFH Looseleaf, bottom photograph F-224.00) is diagnostically **white-dotted** on the head, while *Corydoras haraldschultzi* (see TFH Looseleaf, upper photograph F-222.00) is **reticulated**. Both species have distinctive orange pectoral and ventral (pelvic) fins clearly visible in living specimens.

Corydoras araguaianensis which has for so long been confused with these two species of *Corydoras* is **black-dotted** on the head and much less robust.

Although often confused with *C. sterbai* (Rio Guapore) and *C. haraldschultzi* (Rio Guapore), *C. araguaianensis* is not closely related to either. Comparison with other Mato Grosso species, *C. polyzonus* Regan (Rio Paraguai) and *C. maculifer* Nijssen and Isbrucker (Rio das Mortes) — both long-snouted species — is more relevant.

Aquarium spawnings have been published under the name *Corydoras haraldschultzi*, by Scotland's Alan Pinkerton (TFH magazine and books), and new information has been provided by James Wyle (also from Scotland) which shows that aquarium hybridisation has occurred between *Corydoras araguaianensis* and *Corydoras axelrodi*.

I had raised some potential identification problems in conversations with Alan Pinkerton during the early imports of *Corydoras araguaianensis*. Alan obtained a copy of Knaack's original paper on *Corydoras haraldschultzi* and *Corydoras sterbai* and had it translated (I already had the paper in question, but it was published in German and I hadn't been to night school at that time!). The published descriptions did not match the catfish we knew. I had also (in articles) incorrectly captioned *Corydoras araguaianensis* as both *C. sterbai* and *C. haraldschultzi*, thus contributing even further to the confusion.

Dr Nijssen has referred to 68 specimens from the Rio Tocantins (Goias) collected by Harold Schultz in 1965 (see upper picture TFH 224.00) which may refer to *Corydoras araguaianensis* or a closely related form.

I have not had the opportunity of examining these specimens, but if they represent *Corydoras araguaianensis*, the species occurs in the Rio Araguaia and Rio Tocantins.

Yet another 'mimic' species is found among imports of *Corydoras araguaianensis* which is much longer in the snout and requires comparison with closely related species.

Type specimens

The holotype of *Corydoras araguaianensis* measured 35 mm SL (1.4in) and was deposited in Leiden Zoology Museum.

The specimens which I forwarded to Dr Nijssen have now been designated as paratypes. These measured between 25mm-35mm SL (1.0-1.4in) and were deposited at the Institute of Taxonomic Zoology, University of Amsterdam, in 1984. The details of this new species are: Dorsal fin 17, anal fin 16, dorso-lateral scutes 22, ventro-lateral scutes 20, five bars in the caudal fin, and the dorsal fin lightly spotted. The pectoral

spines are lightly serrated.

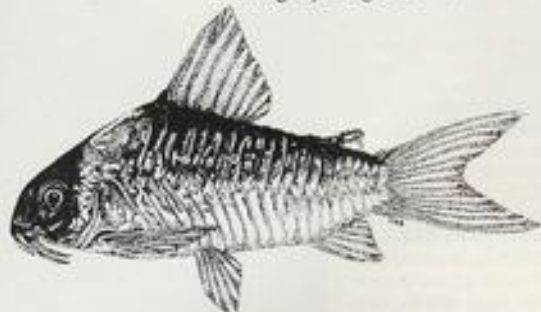
The colour in preservative is grey-white with spots merging into rows at either side in the meeting of the lateral scutes. The colour in life is a cream-beige background covered in black spots which are smaller in size than the eye.

Aquarium behaviour

In aquaria, *Corydoras araguaianensis* has proved fairly easy to keep, being undemanding of water conditions, providing filtration is good. It has also been spawned on a number of occasions. I currently keep a large group in with tank-raised Discus in a water temperature of 84°F (c29°C) with General Hardness of 6 degrees.

These attractive community catfishes feed and thrive on shredded Gamma shrimp, bloodworm and 'Aquarian' Carnivore Flake.

Drawings by Craig Greenwood



Corydoras nijsseni, Sands new species.



pectoral spine



Corydoras adolfi, Burgess



Corydoras imitator, Nijssen & Isbrucker,



pectoral spine

SOCIAL MIMICRY (ZOOMIMESIS)

'Social mimicry' of *Corydoras* species is probably best known through my articles relating to *Corydoras adolfoi*, Burgess, 1982 and *Corydoras imitator*, Nijssen and Isbrucker, 1983. The former has a blunt snout, the latter is larger-bodied and has a longer snout but, most importantly, they have more or less the same striking pattern.

Corydoras nijsseni Sands, 1989 is a new *adolfoi/imitator* pattern sharer, described in *Practical Fishkeeping* in September and October 1989 issues.

Editorial errors allowed a picture of *Corydoras darwini* to be illustrated instead of '*Corydoras elegans nijsseni*' — but this was corrected in the following issue.

A further intermediate *adolfoi/imitator* form now means there are possibly four species/forms living side by side sharing the same striking orange and black pattern.

It is my supposition that the four forms may be 'modern' and have evolved rapidly (in evolutionary terms), having adapted to subtle or even drastic changes in the environment.

The original division from one species into four morphological (rather than colour-pattern) phenotypes, is not unlikely to be the direct result of environmental demands. Perhaps rapid changes in the Amazonian Basin (the Amazon is said to have been raised up from the ocean in 'millions', rather than 'hundreds of millions' of years) has demanded changes (naturally selected variances in snout shape and body size) but allowed colour pattern changes to remain minimal.

The *Corydoras nijsseni* phenotype, similar to *Corydoras elegans* in morphology and behaviour, could be a modern step in the chain of adaptation/natural selection demands, directly related to the changing environment.

Corydoras elegans is thought to be a modern widespread species in evolutionary terms, (personal conversation, Dr Nijssen, Amsterdam University).

Fish species inhabiting the same waters, sharing a common colour pattern, probably increase the total shoal mass and, by distraction, make predation of individuals far more difficult for the predator. Mass shoaling of closely related species would increase the kill-failure percentage and, as such, would provide protection through increasing numbers.

More importantly, the same colour pattern, viz a distinctive black eye mask/dorsal lateral stripe (spaced by a gap without pigment) must act as a superb shoaling mark... as the shoaling catfish turn, so all the species groups within the shoal would turn... with the black markings acting as a common signal.

(My thanks go to Professor Malcolm Edmunds and Dr Han Nijssen for their suggestions and conversations, ranging from 1980-1990).

COMPARISONS BETWEEN *C. araguaiaensis*, *C. haraldschultzi*, and *C. sterbai*

	<i>C. araguaiaensis</i>	<i>C. haraldschultzi</i>	<i>C. sterbai</i>
Standard Length:	35mm	56.5mm	56.4mm
SL/Body Depth:	2.3	2.5	2.4
SL/Body Width:	3.5	4.0	4.2
SL/Head Length:	3.2	3.2	3.4
Dorsal Body Scutes:	22	24	23
Ventral Body Scutes:	20	22	21
Pectoral Spines:	thorned on both edges	moderately serrated	moderately serrated
Head Pattern:	black-spotted	reticulated	white-dotted

COMPARISONS BETWEEN *C. nijsseni* and *C. elegans*

	<i>Corydoras nijsseni</i>	<i>Corydoras elegans</i>
Standard Length:	27mm	29mm
SL/Body Depth:	2.5	2.4
SL/Body Width:	3.5	3.9
Dorsal Body Scutes:	21	22
Ventral Body Scutes:	19	24
Pectoral Spines:	thorned, greatly serrated	moderately serrated
Male Dorsal Fin:	unpigmented	pigmented



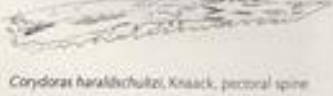
Corydoras araguaiaensis, Sands new species



Corydoras sterbai, Knaack, pectoral spine



Corydoras araguaiaensis, Sands new species, pectoral spine



Corydoras haraldschultzi, Knaack, pectoral spine

Drawings by Craig Greenwood

GLOSSARY

Sympatric species: species having the same, or overlapping areas of geographical distribution.

SL: Standard length; the length of a fish measured from the tip of the snout to the base of the caudal fin.

Scutes: strong, 'bony' protruding scales, sometimes carrying sharp edges or spines.

Dorsal I, 7: fin spine and ray counts often carry two types of numerals. The first one (Roman) indicates the number of unbranched, spinous (hard) rays; the second indicates the number of soft, branched rays. Therefore **Dorsal I, 7** means that the dorsal fin of this species has one spine and seven branched rays.

Holotype: the single specimen on which the description of a species is based.

Paratype: a specimen described at the same time as the holotype. There can be more than one paratype but only one holotype.

NOTES

The proofs relating to these two new species were forwarded to Dr Nijssen prior to publication. Dr Nijssen had only a few comments/corrections to make, one of which was related to Craig Greenwood's excellent drawings, which he described as splendid!

Dr Nijssen has written that he will comment on several new species described in aquarium literature in his continuing reviews to come.

I wish to thank Dr Hans Nijssen, Dr Gerlof Mees, Heiko Bleher, Bruce Clarke and Craig Greenwood for assistance in this work.

TANGANYIKAN PEARL

In his latest 'occasional' introduction Bill Tomey concentrates on a beautiful, lively killifish from Lake

Tanganyika.

(Photograph by the author)

Family: Cyprinodontidae (Tooth carps).
Derived from Kuprinis (= Gr. Carp) and (odoom = tooth).

Sub-family: Procatoponidae (= Lamp-eyes).

Scientific name: *Lamprichthys tanganicus* Boulenger 1898.

Common name: Tanganyika Pearl Killifish.

Origin: *Lamprichthys tanganicus* finds its origin in Africa — Lake Tanganyika — where it is known to be exported via Tanzania, Zambia, Zaire and Burundi, bordering the lake. Being the biggest known Killifish in Africa, this beautiful elegant species has attracted a lot of interest from hobbyists. When it comes to breeding though, only specialist aquarists are likely to meet with success. *Lamprichthys tanganicus* lives a pelagic life, i.e. in the middle or surface levels of the lake, where it hunts in a shoal for small fish and also preys on insects and their larvae. After sunset they seem to come nearer to the steep rocky shores, hunting small shrimps for food.

Sex differences: Males are more robust and sturdy than females and more brightly coloured in shining cobalt-blue and bright yellow. Females show about the same coloration, but the rows of fine spots are more silvery tinted.

Behaviour in the aquarium: Being a lively swimmer, the behaviour of *Lamprichthys tanganicus* largely depends on the size and arrangements made in the aquarium. First and foremost, they easily reach a size of nearly 12cm (4.7in); in nature 14cm (5.5in) has been reported. Because of their pelagic lifestyle, they require a spacious aquarium decorated with aquatic plants, but mainly planted along the sides in order to leave as much swimming room in the centre as possible. The plants serve as a functional background, being decorative as well as of biological use, enhancing the very beauty of this fish. If the arrangements don't meet their needs, *L. tanganicus* become very shy and are then never to be seen or, worse still, will become stressed, showing this with continuous up and down swimming in a corner of the aquarium, this even resulting in aggressive behaviour from time to time. Another sign of distress in this usually very active swimmer, is rejection of food,

which, in turn, rapidly results in a deterioration in overall condition, followed by reduction in vivacity and, finally, listlessness and death!

Water conditions in nature and in the aquarium:

The chemical composition of lake Tanganyika is largely affected by the composition of the surrounding soils, which contain very large quantities of limestone. This results in middle-hard to hard water with a minimum of 12° dH and pH 8.7 (locally, even up to 9.2 pH!). The pH, in particular seems to be a very important factor for the health of this species, largely influencing its vivacity, colour and pigment production, along with its reproduction capacity.

For best results, the pH should be stabilised at a level of pH 9. My own experience points in the direction of an extra sensitivity to various fish diseases if the pH is allowed to drop to levels below pH 8.5. A temperature between 23-25°C (73-77°F) seems to stimulate *L. tanganicus* to show off its rich colour.

Food: Of course, food will contribute substantially to overall health and condition, and *L. tanganicus* will feed on *Daphnia* and *Cyclops*, white worms and, preferably, *Mysis*. This small bait-shrimp seems to be nearest to their natural diet. Furthermore, they hunt for midge fly larvae, and black, white and glass larvae from different species of mosquitoes. Minced mussel-meat and beef heart mix will also contribute to their condition.

Breeding behaviour and habits:

Although the shape of this beautiful shoaling fish seems to point in the direction of

mass-mating (for they resemble Danios) there is not a bit of truth in this.

Due to shortage of the right substrate, my fish first mated among artificial fibres, but the eggs didn't hatch. Probably this was a case of the females just getting rid of their ripe eggs, with the males failing to follow them. To my surprise, they spawned again in a slightly larger tank, actually 'shooting' the eggs (c 2mm) in to the slits between the large stones on the base of the aquarium. This time the male followed the females closely, fertilising the eggs successfully.

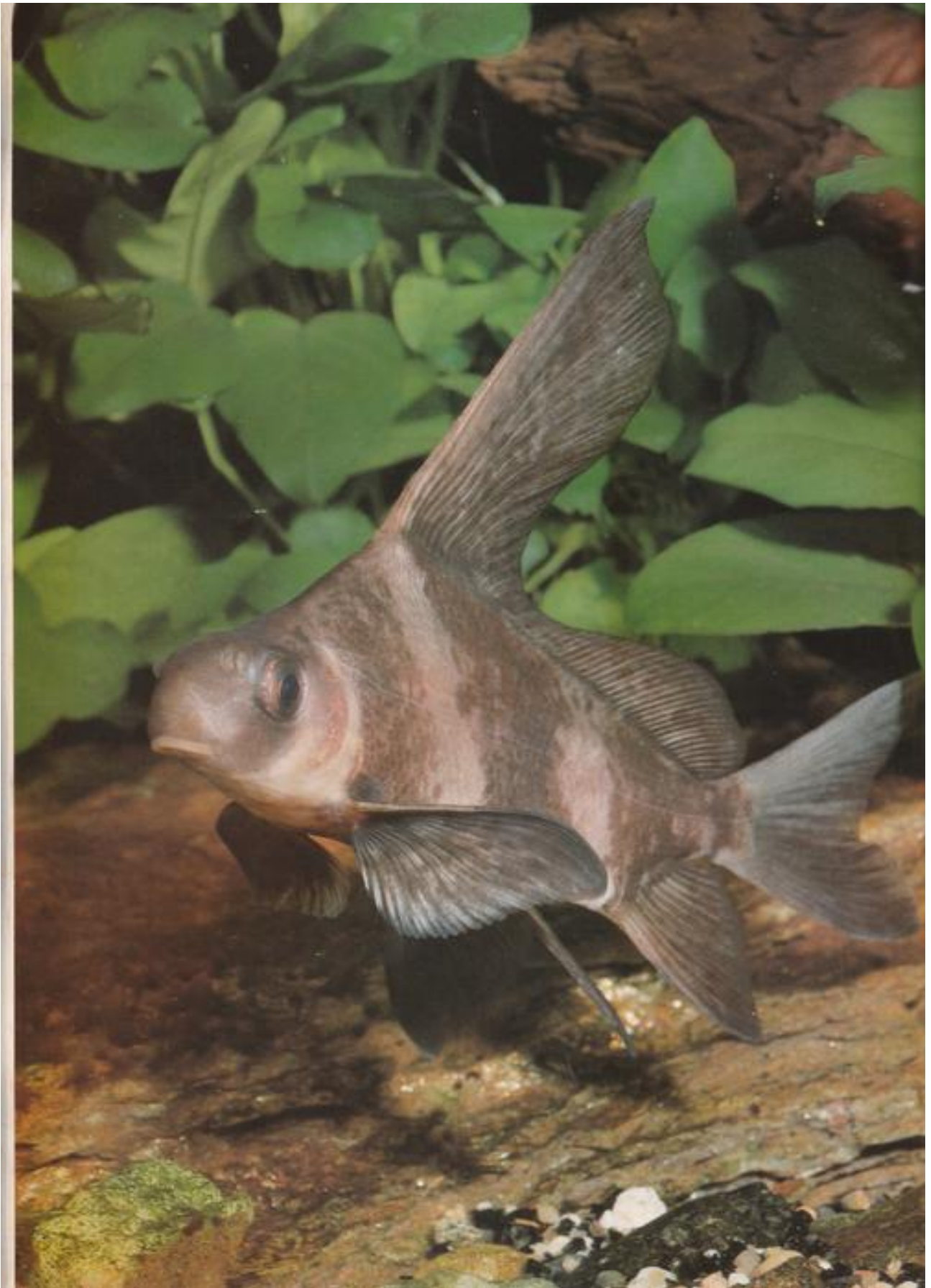
However, my fish never produced hundreds of eggs, as often reported. Instead, they mated continuously (preferably during the morning), never producing more than 8-10 eggs. As far as I could observe, they never took any notice of their eggs, but, directly after hatching (which took 5 days) they would eat the moving fry.

The only way to save the vulnerable fry seems to be to transfer the parents to another tank. In this way, I successfully raised a number of this beautiful fish to maturity on many occasions.

Social behaviour: As long as these fish are kept together with other fishes (for instance, other Tanganyika species about the same size), there will be no problems. Conclusion: *Lamprichthys tanganicus* may be a bit demanding on water quality, especially with regard to the pH, but, in my opinion, it is hard to find an African fish of the same beauty and strength. I can therefore recommend it to any aquarist who is prepared to put in the time and extra bit of effort required to bring the best out of this Tanganyikan pearl.



The lively *Lamprichthys tanganicus* from Lake Tanganyika.



Spotlight

TOP SAIL SUCKER

(*Myxocyprinus asiaticus*)

Arend van den Nieuwenhuizen introduces a large, spectacular, expensive* fish from China which has recently begun to make an occasional appearance in the UK

(Photograph by the author — translated by Mary Bailey)

During the first large aquatic trade show, Aquarama, held in Singapore in 1989, a number of exporters displayed their stocks of ornamental fishes in numerous aquaria. As was to be expected, among the species on display there were, as well as the common and well-known fishes, a number of rarities which are little-known, or quite new, to the hobby.

These included, for example, the so-called Suckerfishes (Castostomidae); these fish generally live in cold or temperate zones, attain an adult length of 60-100cm (24-40in) and are better known as food fishes than as aquarium dwellers. Some species, however, are even of little worth as food fishes as they are too full of bones.

This little-known group of fishes comprises some 100 species, which are, in the main, distributed in the region bounded by the Arctic to the north and Guatemala to the south, ie North America, Canada, and part of Central America. It is interesting that the number of species present diminishes steadily from the north to the south of their range. A few species are also found in Siberia (*Catostomus commersoni*) and in China (*Myxocyprinus asiaticus*). The latter was exhibited in Singapore and was, shortly afterwards, imported into Europe, including the UK. As there is little to be found about these fishes in the literature, I have assembled a few details about the family Castostomidae.

DISTINGUISHING CHARACTERISTICS

At first glance, Suckers are often difficult to distinguish from Carp; so in order to detect the difference, one must know what to look for. Carp have 1 or 2 pairs of barbels on the upper lip, these are absent in Suckers. Moreover, one can observe that Carp have a terminal mouth, while the mouth of the Suckers is underslung and highly extensible.

Suckers also have larger, fleshier lips, which are usually surrounded by papillae. But there are exceptions: the so-called Buffalo Fishes (genus *Ictiobus*) have a terminal, rather than an underslung mouth; this is best seen in the Large-mouthed Buffalo

Fish, *Ictiobus cyprinella*, which grows to 90cm (36in) and which is common in central USA.

A further characteristic of the Suckers is the interrupted lower lip. Exceptions to this are the *Moxostoma* species. In these, the lower lip is not interrupted and the upper lip is strongly developed. In the USA, the *Moxostoma* species are known as 'Red Horses'.

In preserved Suckers and Carp a further distinguishing feature can be examined — the arrangement of the pharyngeal teeth. Suckers have numerous small pharyngeal teeth which are always arranged in a single row, while Carp have 2 or 3 rows containing fewer teeth.

Hubbs and Legler give a key to distinguishing the North American Suckers and Carp. In the Suckers the distance between the anterior edge of the mouth and the anterior edge of the anal fin is 2.5 times the distance between the anterior edge of the anal and that of the caudal. In the Carp, this ratio is usually 2 to 1. An exception is provided by the 'prototype' itself, the Common Carp *Cyprinus carpio*, but this can nevertheless be distinguished by the presence of the first hard dorsal spine, which is always absent in Suckers.

SUBGROUPS

The fact that the mouth in Suckers is not terminal but underslung is connected with their way of life. They live among the plants in rivers and lakes, where they forage in the mud for food. From this type of feeding one might conclude that Suckers are inhabitants of muddy and still waters. But that is not the case, as the approximately 100 species, which are divided among 12 genera, can, according to Nikolski, be divided into 2 groups.

The species of the first group are high-backed, have small, close-packed pharyngeal teeth, and a relatively long slender intestine. They inhabit lakes and large rivers. To this group belong, for example, the above-mentioned Buffalo Fish and the Spiny-Backed Sucker, *Carpoides cyprinus*, which attains a length of some 60-65cm (24-26in) and a weight of 5-5.5kg (11-12lb). The latter species can easily be recognised by

the elongated second dorsal ray, which is about twice as long as the remaining dorsal rays. It is a fairly important food-fish.

The second group includes typical inhabitants of fast-flowing waters. These are generally smaller and spindle-shaped, with stouter pharyngeal teeth and a shorter narrow gut. To this group belong, for example, the *Catostomus* species, such as *C. commersoni*, in which females may attain a length of up to 45cm (18in), or *Erimyzon sucetta*, a peaceful shoaling fish of up to 25cm (10in) length, which can be kept in a large coldwater aquarium together with *Catostomus* or *Notropis* species. Adult males of *C. commersoni* remain smaller than females with a length of up to 30cm (12in).

A further member of the group inhabiting fast-flowing waters in N America is the Humped Sucker, *Xyrauchen texanus*, and in China, among others, the species described herein, *M. asiaticus*. Both species are, however, unusual in their body form; instead of being spindle-shaped, they are high-backed.

Fish from strong currents often possess a more or less complex sucking mechanism, as seen in the various Catfishes of South America, or, even more markedly, in the Finned Suckers from the Far East (eg Homalopterinae and Gastromyzinae). A very fine example is *Gastromyzon punctulatus*, which is often sold as *G. bornensis*. These fishes have a large sucker on the underside of the head, bordered by the pectoral and pelvic fins. A vacuum is created between the underside of the fish and the substrate to which it clings, as the pectorals divert the water from under the body. The Humped Sucker, *Xyrauchen texanus*, and the asiatic Top Sail, *M. asiaticus*, have adapted to fast-flowing waters in a different way. If one examines the photo closely, then one will see that the profile rises steeply behind the head and produces an 'inverted keel', the so-called 'Dorsal Keel', which has the effect of pressing the fish against the substrate, thus allowing it to withstand the current.

PERSONAL EXPERIENCES

The following are my experiences with these expensive fish during the short period

of time for which I was able to maintain them. The fish were placed in a spacious aquarium, whose substrate was partly covered with smooth, partially algae-covered, stones. The tank also contained several small pieces of wood, and these, together with the sides, were overgrown with *Anubias barteri* var. *nana*. The tank was moderately brightly lit with a few relatively strongly shaded areas.

At the importer's premises I had seen two specimens in a newly set up aquarium. The water surface was, in the main, bare of plants, so that the tank was brightly lit. The two fish spent all their time motionless on the bottom in one of the front corners.

In my aquarium, their behaviour was quite different. I must mention, however, that there was a gentle current, and strong aeration meant that, even in the corners, the water was circulating. The Suckers stayed in the diffusely lighted areas, were active, but never boisterous or shy, and grazed on the stones. Seeing this, I reduced the water circulation and fed them *Tabifex*, but the worms were clearly of no interest to the fishes (see editor's footnote). By contrast, they took bloodworms immediately. Later, I tried them on large flake, but this was ignored, although they constantly vacuumed the substrate.

Then I gave them a little chopped spinach from a frozen pack and waited to see what would happen. After a while, this food was discovered and eaten. This had the serious disadvantage, however, of easily spreading

out in the water so that both water and filter became dirty more quickly, making constant cleaning necessary.

As I kept *M. ananicus* for only a short while, I cannot judge if, after a longer period of acclimatisation, these fish would also take worms, as Suckers are noted for enjoying invertebrates, with the high-backed species also consuming vegetable matter.

I often observe new fish with which I am unfamiliar, during the twilight in the evening, and also occasionally look in on them at night to see what they are doing. So it was that I noticed that *M. ananicus* is very active during the hours of darkness. My fish no longer remained close to the substrate, but instead, explored the entire aquarium almost up to the surface (water depth was 45cm - c18in). At the same time, they swam more rapidly, as I expected. At any hint of danger, they shot like an arrow through the water.

I also noted that these fishes are apparently readily able to adapt to different water chemistry. In my aquarium, the water had a hardness of about 5 dGH with a neutral pH (7) and a temperature of 24°C (75°F). They obviously found this greatly to their liking, as after a very short time, they showed full colour and carried their dorsal fins like outspread sails.

There are three subspecies of *M. ananicus*: as well as the nominate form, *M. ananicus ananicus*, there are *M. ananicus chinensis* and *M. ananicus fukiensis*. I do not know to which of the three the fish here belongs. I only know that they originated in the basin

of the Yang-Tse in central northern China.

In conclusion, it should be said that aquarists who can afford to buy these fishes should, ideally, place them in a large sparsely planted aquarium where there are open spaces between the plants for the fish to occupy. It is essential to provide a diffuse light, by using either floating plants or tall species that float along the surface, eg *Vallisneria spiralis*. I also think it important to regulate the diet of these largely nocturnal fishes, though, with subdued lighting, they will be active during the daytime too. A further prerequisite is well maintained, crystal-clear water with a gentle current.

Editor's Footnote

I first came across this impressive, large species at an importer's premises in Singapore in 1988. The fish were in a large tank with gravel on the bottom and an aquarium background stuck on the outside. There were some small (c2.5cm - 1in) cichlids in with the Top Sail Suckers, and these were totally ignored. However, the *M. ananicus* were feeding on live *Tabifex* which had been placed on a saucer on the bottom of the aquarium, indicating that at least some specimens will take this food.

*A small (7.5cm - c3in) specimen costs about £250 retail, while a 15-20cm (6-8in) specimen will attract a price of around £400-450!

John Dawes

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Tahiti Aquariums

Seaview

By Gordon Kay



Following on from last month here are my continuing dietary tips for the main groups of tropical marines we meet in our hobby.

LIONFISHES

What to feed these beasts is easy, how to feed them can do your head in. It should be remembered that lionfishes are predators, which means that a) they take their food on the hoof (or should I say fin); and b) they eat one big meal every other day or so.

In this respect, it's daft to feed them Brine Shrimps every day as you would other species. They need cockles, mussels, lancefish and stuff like that. The problem can be getting them to eat dead food. If, as you should, you bought your lionfish from a dealer who sells well quarantined stock then this will have been done for you (although the trauma of being caught and taken home in a plastic bag could well undo all of that) but if you have a fish that has only recently come into the country, then you will have to do it all yourself. This involves weaning the fish off live fishes. This can be done by, say, feeding live goldfishes — or similar — every other day and gradually introducing frozen lancefish.

This may sound easy enough but, although fish are pretty stupid, they aren't THAT stupid. Happily, however, you can 'con' your lionfish into thinking the dead fish is alive by suspending it in the aquar-

ium by a piece of thread and jiggling it about. You see, it is movement which triggers off the feeding response (maybe fish are that stupid after all!). This will all take a few weeks but, at least, it will teach you to buy your fish from a good dealer in future.

PUFFERS

Most puffers, in my experience, will eat anything — including algae — but large chunks of meaty foods are preferred. Things like cockle and lancefish are relished, along with prawns — if you can afford them — and earthworms. However, they do need the odd 'crunchy' item in their diet to help keep their four 'teeth' down to manageable proportions. Small crabs are best if you can get them, but shrimps and prawns with their shells on work just as well. If you neglect this aspect of their care, your puffer's teeth will grow to such an extent that the poor fish won't be able to eat at all.

SEAHORSES and PIPEFISHES

I'm still of the opinion that seahorses should be left in the sea but, no doubt, with all the strides that some aquarists are making of late, someone will prove me wrong soon. Anyway, seahorses need plenty of calcium in their diet to keep their exoskeletons hard. Brine Shrimps provide absolutely no calcium and so (despite what



Seahorses need a carefully planned diet for long-term health.

everyone says) feeding them is, in my opinion, a waste of time and energy. Baby guppies are the things to feed your seahorses! (I'll just sit back now and wait for the flack...)

I've tried to cover all the popular families here but, no doubt, somebody will say "but how about my...". Well, if I've missed your favourite, then forgive me. Anyway, all of the foregoing bludge should have made one thing very clear, and that is that — with the exception of a few awkward cusses, coralfishes are extremely easy to feed.

Thank you for the idea, Carol. I'm just waiting for all the letters...

TOUGH NEWS FOR MINKES

The end of April saw Norway filing a request to the International Whaling Commission that she be allowed exemption from the IWC's moratorium on whaling for profit. Of course, Norway — along with other countries — have been catching whales under the condition in the moratorium that allows whaling for 'scientific research'.

There have been reports that the hapless creatures find their way mysteriously onto the dinner tables of Japan and others but I, for one, wouldn't like to take on the job of proving it.

However, Norway want to take Minkes commercially and justify their request by saying that the Minkes are now so numerous — following the ban on whaling — that they are eating all the fish. Unbelievable!

Most of you are probably aware by now that I feel that humankind should rid itself of the view that we are the only species on God's earth which matters, before we wipe out everything (including, ultimately, ourselves) and so it should come as no surprise to you that I say: TOUGH!

ENOUGH IS ENOUGH

You will also be aware of my feelings on the oil companies' use of bigger and bigger tanker ships for carting oil around the world in order that they can

make bigger and bigger profits. Well, we had another disastrous oil discharge in May, which found its way onto the coast of Devon and — more importantly — onto Wembury Bay.

This was particularly devastating to me, for two reasons. Firstly, Wembury Bay has some wonderful marine life there. In fact, the area is now a conservation area and is a Site of Special Scientific Interest (S.S.S.I). Secondly, it is a favourite holiday spot of mine. I have spent goodness knows how many hours of total wonderment on that beach, completely absorbed in the rock pools. Many, many others have done the same, not to mention the divers just around the headland at Fort Bovissand Diving Centre.

I find all oil spillages at sea abhorrent, but this particular incident made me very sad. It felt almost like an old friend had been harmed. Surely, it's time for governments all over the world to say enough is enough and restrict the size of oil tankers once and for all.

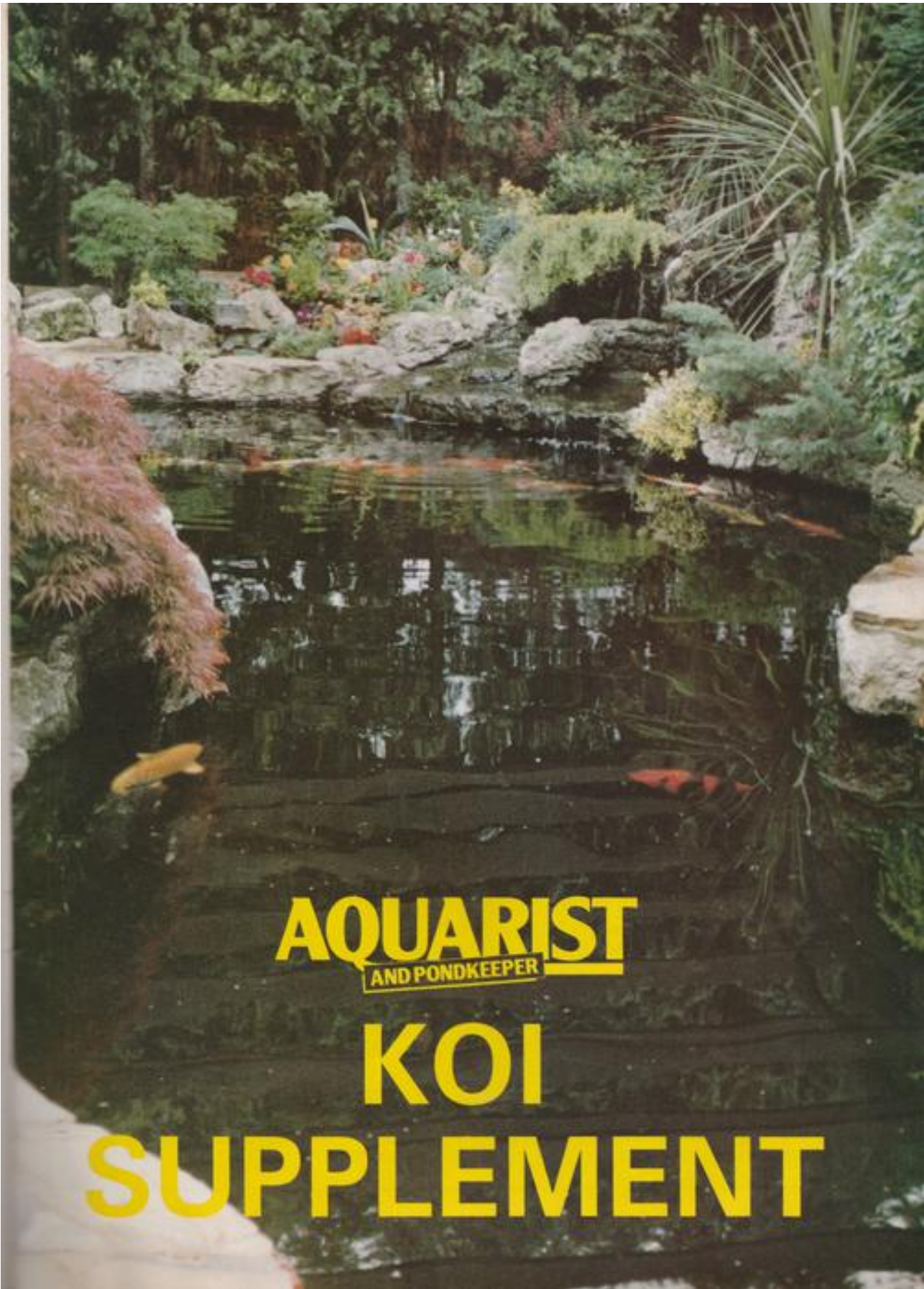
DOLPHIN-FREE TUNA

There was more good news to come out of the States in April. NBC announced on 11 April that STARKIST TUNA — who take 35% of the American tuna market — are to stop canning tuna which has been caught in 'Dolphin Nets'.

For the benefit of those who haven't a clue what I'm talking about, tuna — with the exception of Skipjack — very often swim with dolphins (or, more correctly, the dolphins swim with the tuna).

This results in thousands of dolphins being caught up and killed in the nets used to catch tuna. Anyway, it is thought that the announcement by Starkist will lead to other companies following suit. Amen to that!

Since learning of the above news, I have been trying desperately to obtain more information. I have also been trying to get more info on the spawning lionfishes I mentioned earlier in the year. I have failed on both counts. However, I am nothing if not persistent, so keep reading *Seaview*.



AQUARIST
AND PONDKEEPER

**KOI
SUPPLEMENT**

KOI SUPPLEMENT

(Questions & Answers)

PUBLISHED BY
AQUARIST
AND PONDKEEPER

CONTENTS

(Cover Photograph: Courtesy of Nishikigoi International)
Here it is! Our long-awaited Koi Question/Answer Supplement. Ever since we kicked off in February with our Tropical Freshwater Supplement, readers have been asking about this one — such is the enthusiastic following that Koi enjoy these days.

Of course, it also goes to prove just how popular and sought-after our bi-monthly Supplements have become. We've even been asked on more than one occasion about our plans for next year's Supplements, but that — as they say — is a secret for the time being.

Right now, it's down to all those vitally important questions that all budding (and 'fully budded') Koi-keepers should be giving serious thought to.

From selecting Koi, to feeding and treating them — it's all here in a packed editorial package put together by our intrepid team of Koi fanatics.

So, sit back and enjoy our Koi Question/Answer Supplement, and if you still have some questions at the end of it all, don't hesitate to drop us a line. We'll do our utmost to help in any way we can.

Happy Koi-keeping.



John Dawes
Editor

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DISEASES, NUTRITION

Dr David Ford — Head of the 'Aquarian' Advisory Service

DISEASES

Q What diseases are most commonly encountered in a Koi pond?

A A well-regulated pond with quarantined fish shouldn't develop any diseases. The main source of trouble is poor quality water stressing the fish which, in turn, allows ubiquitous diseases and parasites to get a hold on the fish.

Fungus spores, for example, are always present in the water. So, too, are White Spot parasites. No outdoor water can be sterile, so a colony of bacteria must always be present, not only the good nitrifying bacteria, but also the problem *Aeromonas* and *Pseudomonas* species.

Healthy (i.e. happy) fish have a mucus layer with antibiotic properties that protect the fish from the attention of these bacteria and parasites.

If the layer is broken by some form of damage, the area often becomes covered in Fungus or Cotton Wool disease. This is a vegetable parasite (family: Saprolegniaceae; genus *Saprolegnia*). It is easily removed by dipping the fish in a proprietary Fungus Remedy.

If the fish is large, the area affected can be treated locally with a cotton-wool bud dipped in solutions of medical quality methylene blue, malachite green or mercurochrome.

If the fish is affected by poor quality water, be it ammonia from the fish's own excreta, or toxins such as pesticides from the garden, the fish will form extra mucus to protect itself. The excess mucus can then be a source of trouble. Gill parasites (*Dactylogyrus*) that may be present in non-significant numbers, will proliferate and the Koi will be seen to be irritated (yawning) and develop red (instead of a healthy pink) gills. Body mucus may trigger Skin Flukes (*Gyrodactylus*) which will also irritate the fish, seen by scratching or flashing.

Obviously, just treating the fish with pond remedies for flukes is only part of the answer ... the water quality must be improved or the toxins, plus the chemicals, will stress the fish more than the parasites did.

The diseases that are not normally present in pond water include *Chondrococcus columbianus* that gives Mouth Fungus. Certain *Aeromonas* species, possibly in combination with a virus, will give body ulcers and Fin Rot. These diseases are introduced by infected new fish (buyer beware!) and cannot be cured by treating the pond water. Antibiotics are necessary, which require a prescription from a vet, and so are not on general sale. For the larger Koi, injections are best, but some good results have been obtained by feeding antibiotics in food.



Irrespective of their size, Carp and Koi (the photograph shows a Mirror Carp and a Ghost Koi) will feed on flakes, hoovering them up both from the surface of the water and from the bottom.



Regular vacuuming of the pond bottom to remove uneaten food and solid wastes will help maintain good water conditions — essential for the health of fish.

Introduced parasites include leeches (*Piscicola* spp), Lice (*Argulus* spp) and tapeworms (*Botriocephalus* spp, sometimes *Ligula* spp). It is hard work removing these parasites. Leeches have to be manually removed by catching the fish and stunning the leeches by immersing the fish in 3% salt for a few minutes, then gently removing the parasite, followed by not-so-gently destroying the leech! Lice can be removed manually too, but pond treatment is also required with proprietary compounds such as Dipterex or Masoten (but not if Orfe are present — it badly affects them). Tapeworms are treated with the same worming powders used for cats and dogs called anthelmintic compounds (these are best obtained from the vet).

Q What is Carp Pox? Can it be cured?

A Carp Pox is a viral disease caused by a herpes virus that produces proliferation of the epithelium (the fish's skin). The lesions are wax-like and easily identified as 'drops of candle fat'.

Being viral, there is no cure at the moment, but most fish develop self-immunity and the problem only then appears in new fish added to the pool. Further, Carp Pox is not regarded as a 'killer disease', and most affected fish often recover of their own accord after a shorter or longer period of time.

If the lesions spread and the fish becomes lethargic, the healing process can be helped by flicking one of the lumps with your thumb nail so that it (the lump) is damaged or even knocked from the fish. Only then does the fish's immune system recognise that there is a problem and immunity builds up, often leading to a complete recovery.

Large fish are best anaesthetised to Stage 1 or 2 (see chart) before the above is attempted. Wash your own hands well after treatment.

Q Will a vet know about Koi treatments?

A Some will... many vets are now taking post-graduate courses in fish diseases to help the many fish farmers in the UK. The problems of trout, salmon and, especially, carp farmers, are similar to the pond-keepers'. All vets can inject the fish with antibiotics and supply prescriptions for antibiotic feeds.

If specialist knowledge is required, ask the local vet (see Yellow Pages) to contact the British Veterinary Headquarters in London (071 636 6541) because they have a list of 'fish vets' and can quote the nearest to your home.

If necessary, you can ring yourself, but remember that the BVA is a professional body with its HQ staffed by accountants and secretaries, not vets. Do not expect a telephone consultation. They can only refer you to a practice near you.

If you own large, valuable Koi, it is well worth the cost of bringing the vet to your pond because s/he can anaesthetise the fish and treat it individually with little or no stress to the fish, which is far better than you catching the struggling fish or dosing the whole pond with chemicals.

DISEASES/SYMPTOMS/TREATMENTS CHART

Many proprietary cures are available at good aquarium stores; where unsuitable, try simple DIY treatment... if ineffective, contact a fish vet.

(A) Microparasites: (e.g. *Costia*, *Chilodonella*, *Trichodina*, *Ichthyophthirius*, *Gyrodactylus*, etc).

Signs: Excess body slime, tattered fins, poor colour.

Simple Cure: Salt bath, try (i) 3% sea-salt for 2 minutes; if not effective try (ii) 1% sea-salt up to 1 hour; or (iii) 1/2% permanent bath built up over 3 days.

Veterinary Cure: Letaux Meyer mixture: 3.3g Malachite Green in 1 litre formalin to give stock solution; use 1ml per 68 litres in 30 minute bath.

(B) Macroparasites (e.g. *Argulus*, *Lernaea*, Leeches).

Signs: Parasites can be seen on irritated fish.

Simple Cure: Pick parasites off fish after stunning parasite with paraffin bud; clean pond and filter.

Veterinary Cure: Trichlorphon (E.g. Dipterex, Masoten) at 0.2ppm in pond.

(C) Ulcers

Signs: Inflamed area, followed by erosion.

Simple Cure: Paint area with Methylene Blue solution; if eroded, fill with waterproof antiseptic cream (ask pharmacist for proprietary brand), plus antibiotic feed for 7 days (King British or Petar Hand Aquahealth).

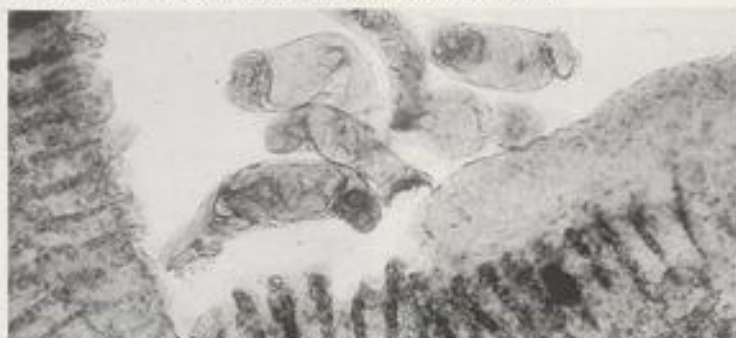
Veterinary Cure: Injection of Tetracyclines or Chloramphenicol at 25mg/kg body weight or Gentamicin at 2mg/kg.

PLANES OF ANAESTHESIA IN KOI

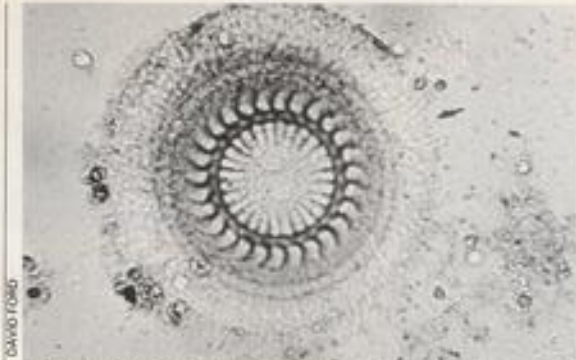
Stage 1	light sedation	slight loss of reactivity;
Stage 2	deep sedation	loss of reactivity, except deep pressure; normal equilibrium;
Stage 3	partial loss of equilibrium	erratic swimming; increased gill rate;
Stage 4	total loss of equilibrium	fish falls to one side; reacts only to strong pressure;
Stage 5	loss of reflex action	no reaction to pressure; gill rate slow;
Stage 6	medullary collapse	gasping, followed by total loss of gill movement.
Cheap anaesthetic		
40g benzocaine per litre acetone; store in the dark up to 3 months. Use up to 50ppm, best for Stage 4 or 5 only.		
Dearer anaesthetic		
MS222 (Sandoz); direct water soluble		
Up to 42ppm in water at pH7 for transporting at Stage 2		
Rapid knock down: up to 200ppm, but remove from solution at Stage 4		



Hyphae ('roots') of *Saprolegnia*, the most common form of Fungus.



Gyrodactylus — a fluke that affects both skin and gill tissues — may be triggered into explosive action by the excessive mucus produced as a result of poor water conditions.



This deceptively beautiful parasite is *Trichodina* which can cause serious irritation.



Injection of large Koi should not be attempted by inexperienced fishkeepers — better to leave this to the experts, like an appropriately experienced vet.

NUTRITION

Q Can I feed a healthy diet to my Koi?

A Yes, David Twigg gives some good advice on feeding Koi properly in his article in this Supplement. An additional point to make is what *not* to feed. Processed meats should not be fed. Fat-containing foods such as hams, burgers, sausages and formed-meat chunks can actually block the gut of fish with solid fat. Meat-based pet foods are unsuitable for the same reason. Human or pet foods based on fish are obviously better, but the vitamin content will be low after processing, compared with the live fish diet obtained by predation.

Koi are carp and so are mainly (but not exclusively) herbivorous fish. In the wild, they eat algae, which are very different plants to the land-based vegetables that humans eat. Garden vegetables have a high cellulose content which helps them fight gravity (which the water plants do not need), so items like lettuce leaves and spinach, although taken by the fish, just pass through without full digestion.

If you want to feed raw plant food such as lettuce, it must be scalded first to dissolve the cellulose. Cooked vegetables are digested better. Frozen peas and spinach are par-boiled before freezing and so make a better diet for carps than the raw form.

Logically, the best choice of feed for the fish will be the diet they have in the wild. This diet is mainly living animals or plants. The problem with reproducing this living diet in the pond is that of parasites. Over millions of years, parasites have used the food chain to infest fish in a balanced way that ensures survival of both parasite and carrier. In the confines of the pond, however, the balance is tipped towards the parasite and infestations will occur where they multiply until the fish dies. Therefore, the common source of these parasites, live aquatic foods, must not, in my opinion, be added to the pond.

Aquatic animals, such as *Tubifex*, Blood Worm and other larvae are sold as the ideal livefood, but microscopic examination of these foods will often reveal parasites, either within the bodies of the animals, or swimming with them, 'waiting' to infect a fish. Use of such livefoods becomes a gamble with the lives of your pet fish.

It is best to use non-aquatic livefood: the red garden earthworm, aphids, small land snails, slugs and flies. Cultured livefoods are also available in the trade, for example, White Worms, Micro Worms and Fruit Flies. Flower beds, marginals and pre-potted aquatic plants, are useful additions to any pond or surrounding area. They bring airborne insects during the summer that are useful parasite-free foods.

The larger fish will find most of these

livefoods too small, so owners can use chunky food such as lumps of fish fillet, shellfish or lean meat like beef heart and liver. However, the fish still need the necessary vitamins and minerals that commercial foods contain, so the best feeding plan is to take the chunky food and make a small cut in the flesh, then insert a flake or two of a proprietary fish food immediately before feeding to the fish. Note that even large Koi can be fed aquarium flaked food; the fish just 'hoover' up the flakes from the surface.

As with humans, variety is the best healthy diet, but to make sure the fish are receiving the proper levels of vitamins and minerals, do include a good quality commercial feed, whether flake, granule or pellet.

Bibliography for the Koi pond

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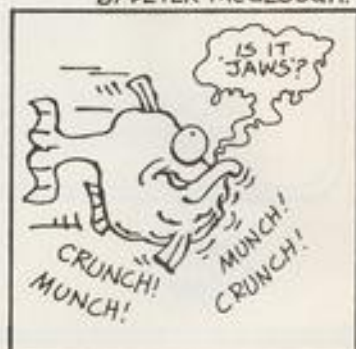
Manual of Nishikigi by Takeo Kuroki, Shin-Nippon Kyoiku-Tosho Co Ltd. (1985 edition).

Goldfish & Koi in your Home by Dr H R Axelrod and W Vorderwinkler, TFH Publications, Inc. (1984) H-909.

TFH have several books on Koi such as the new TS-132 *Cult of the Koi* (reviewed in the June 1990 issue of *Aquarist & Pondkeeper*) and earlier titles: C0040 *A Complete Guide to Koi Ponds*, H947 *Koi of the World* and PS730 *Koi Varieties*.

FRED THE PIRANHA

BY PETER Mc GEOUGH.





MISHIGOSHI INTERNATIONAL

Raised or sunken, formal or informal, few things can better the spectacle provided by a good Koi pool.

FIRST STEPS, POOL TYPES AND CONSTRUCTION, FILTERS, DRAINS AND PLUMBING

John Cuvelier

FIRST STEPS

Q As a complete novice Koi-keeper wishing to have a pool, what steps should I take in order to get things right first time?

A It is a rare bird indeed who manages to get everything right at the first attempt! However, the way to reduce the risk of major blunders to a minimum is to follow this simple check list:

- Read as many books on the subject as possible. Money spent on GOOD and APPROPRIATE books is money well spent.
- ASK and ENQUIRE at as many retail trade outlets specialising in Koi within your area as possible. Don't be dismayed if you appear to receive conflicting advice, as you most certainly will.
- Try to find some local hobbyists and pick THEIR brains as well. You will be very unlikely to find an unwilling adviser!
- Do accept that it is quite beyond the scope

of an article such as this to provide comprehensive instructions for building a pool, but view it as a signpost to better things.

● Should you be one of those fortunate people who can call in a contractor to build your pool from scratch, do remember that the professional pool constructor is a relatively new breed, so insist upon seeing some examples of their work before committing yourself to an outlay which could easily reach four figures or beyond.

Finally, refer to the list of recommended reading elsewhere in this article and get cracking!

POOL SIZE

Q Is there a recommended size for a Koi pool?

A Yes:

- (a) As large as your garden will allow;
- (b) As large as your pocket will allow!

Generally speaking, the bigger the better, for the following reasons:

- A large SURFACE AREA of water is able to absorb more life-giving oxygen naturally at the air/water interface.
- A DEEP pool will maintain more stable temperature throughout the whole year.
- A large deep pool responds more slowly to any fluctuations, not just temperature, but pH and pollution as well, than smaller pools.

These parameters are of vital importance when designing a successful Koi pool. If you wish your Koi to grow to the large size they're capable of, you should aim for a MINIMUM surface area of 200 square feet, with a minimum depth of 5 feet (18 sq m and 1.5m, respectively). Remember also when calculating pool size to allow plenty of room for a filter system: approximately one-third the surface area of the pool. It is impossible to have a filter which is too large, irrespective of what you might be told when shopping around.

POOL TYPES

Q *Is there a recommended basic shape for a Koi pool?*

A No, provided that the shape does not allow areas of static water and dirt to gather. The decision to opt for the formal or informal style of pool is dependent upon the type and style of the garden and, of course, the desires of the builder. Both styles can look superb in the proper setting.

Q *Is it better to have a raised pool or one at ground level?*

A This, again, is a matter of personal preference, although a raised pool is difficult to blend into a garden in a natural-looking way. However, there is some advantage with a raised pool in that its wall can provide a convenient sitting area from which to hand-feed your Koi. Also, from a safety aspect where young children are concerned, the raised pool has definite advantages.

POOL CONSTRUCTION

Q *The two principal methods of construction are liner and concrete. What are the advantages and disadvantages of each?*

A Difficult to answer in the space available but, a brief comparison is as follows:

Only butyl rubber (or rubber-modified polyethylene) liners are considered to give very long and reliable life. A lined pool is quicker to build but some limitations on the shape of pool are inherent in their use. A very informal and irregular shape is usually impossible to achieve without having very unsightly pleats and folds which cannot be hidden.

When a high water table exists there can be a risk of 'billowing' caused by water gathering between the liner and the excavation, particularly if the pool should require emptying at some time, although this risk can be catered for by installing a permanent suction pipe between the liner and excavation during construction, to which a pump can be connected if required. The inevitable growth of algae is difficult to remove mechanically from a liner owing to the risk of tearing. Filter and drain connections must be highly accurate to avoid undue strain being placed on the liner which will carry several tonnes of weight in water.

The concrete pool suffers none of these drawbacks, but is more difficult to build and takes longer. There are no limitations as to shape and, once built, such a pond is there forever. The old bugbear of concrete pools, that of cracking, has been eliminated since the advent of Fibromix, described many times before in *A & P*. Cleaning the concrete pool is child's play using a scraper and vacuum pump.

The best method of construction is to use concrete blocks for the walls and ready-mixed concrete for the base, the whole thing then being skimmed with a thin layer of Fibromix, further details of which can be

obtained by telephoning the manufacturers on 0355 42265.

The DIY addict will find no difficulty in building his/her own pool at a fraction of the cost of a professionally-built system, with the added bonus of the great satisfaction gained from being able to say, "I built it myself!"

Q *Are there any pitfalls ready to catch the untutored newcomer to Koi pool building?*

A All too many, I'm afraid! Some of the more important ones being:

- Build the pool as close to the house as possible, thus ensuring maximum viewing of your fish and better security, sadly, a necessity in these days of increasing Koi theft.
- Do ensure you leave sufficient 'walk round' room for pool maintenance purposes.
- Don't forget in the early stages to allow for electrical, fresh water and drainage services.



The pool surrounds are every bit as important as the pool itself when it comes to deriving maximum enjoyment.

TO FILTER . . . OR NOT

Q *Is it possible to keep Koi without recourse to filtration?*

A The short answer is, yes, provided you are prepared only to see your fish when they come up to feed and are willing to limit the number of fish you can keep in a given volume of water. All fish have a built-in growth limiting system which prevents growth beyond the point at which their environment is capable of supporting them.



A smallish, but highly efficient multi-chamber commercial G.R.P. filter.

In addition to providing clear water in which your fish are easily seen at their best, filtration serves to remove the chemical build-up in the pool water which triggers growth inhibition, thereby permitting a larger number of fish to be kept.

The chemicals referred to are: ammonia and nitrite, both of which are highly toxic to fish and are converted into the relatively harmless nitrate during the filtration process (commonly called Nitrification).

Another drawback with the unfiltered pool is that health problems which may arise with your fish are not usually noticeable until they have advanced beyond treatable limits.

Q *Is it better to build my own filter or buy one of the many prefabricated systems available?*

A The cost of a large prefab system can easily exceed the cost of your pool, so careful

consideration must be given to this question. (We are not talking here about 'watertank' models filled with medium — these are quite economically priced.)

A large multi-chamber job made from G.R.P. obtained from many of the major dealers will undoubtedly do a first-class job of filtering and cleaning the water, but they are quite pricey.

Personally, if at all possible, I would be inclined to have a go at a self-built filter but this, of course, may be neither convenient nor desirable, where others are concerned. The same building methods are used as in concrete pool construction: blocks and Fibromix, the partitions also being home-made from Fibromix and cast in a mould. The method has been previously described in earlier copies of *A & P*, but are amply covered in the 'Encyclopedia' (see Recommended Reading).

SETTLEMENT OF SOLID WASTES

Q *In any discussion on filtration, much emphasis seems to be placed upon the necessity of providing settling chambers in the filter chain. Why is this considered so important?*

A A biological filter works by means of

bacteria within the media converting the liquid waste products of the fishes' digestive systems. In an ideal filter, all the bacteria will have to work with is water saturated with ammonia and other chemicals. The bacteria are unable to break down large quantities of solid waste matter, with the result that filter media soon becomes blocked and polluted. Settlement chambers are intended to prevent solid matter from entering the biological stages of the filter by allowing it to settle out and be manually removed.

The most efficient (and cheapest) method of trapping solids is to install several rows of filter brushes in the first chamber of a filter chain. These brushes have proved to be extremely successful in trapping even very fine solids which are in suspension in the water. All that is required by way of maintenance is the regular removal and washing of the brushes, one row at a time.

For larger pools, consideration should be given to the purchase of one of the commercially available centripetal solids removal chambers which 'spin' the solids in a vortex, causing them to fall to the bottom where they are then removed.

Provided that efficient removal of solids takes place, then theoretically, there should never be any necessity completely to remove and clean the media within the bio-filter itself, particularly if plastic ring media are used.

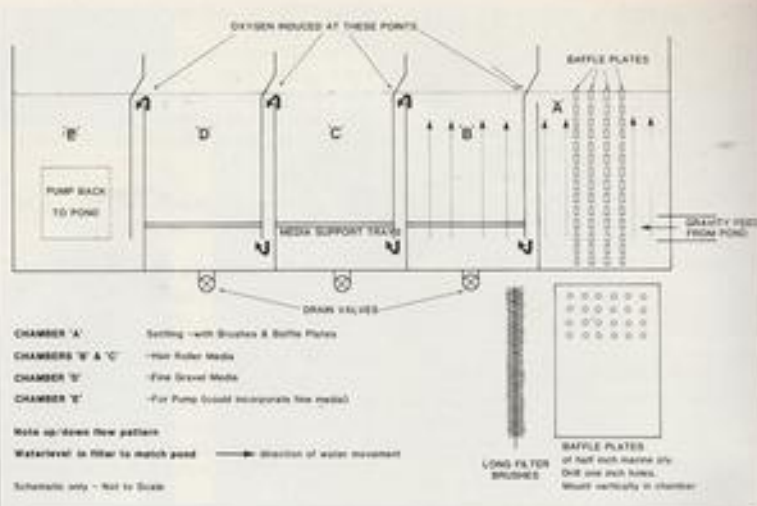
FILTER MEDIA

Q Speaking of media, which is the best type to use?

A That's the question which probably causes more argument than any other one among Koi-keepers, each of whom has his or her pet theory.



A sunken home-built concrete/Fibromix multi-chamber filter.



Schematic view of a multi-chamber Koi pool filter.

In fact, almost anything can be used, the criteria being: it must be inert, easy to handle, easily obtainable, allow free passage for the water being filtered, present a large surface area for bacterial colonisation and be reasonably cheap (for the DIY types).

Examples which spring to mind are: coke, granite road chippings (unused), sawn up lengths of land drain, waste turnings and swarf from a plastics factory, scrunched up lengths of garden netting, nylon pan scrubbers, expanded clay pellets (litag), hair rollers, commercial ring media (Flocoor, Siporax) and so on.

Speaking personally, I'm a firm believer in hair rollers, having used them ever since the idea hit me. They are light, have a colossal surface area and never seem to block with detritus. One slight disadvantage with them is the fact that they float, which can cause problems with retention in the filter chambers. Flocoor, the other most well-known plastic medium is almost as effective, does not float but, being larger, requires larger chambers to accommodate it. Siporax, on the other hand, is required in smaller amounts and therefore does not cause space problems.

Q How much depth of medium is required in filter chambers?

A As most of the bacteriological action takes place in about the first 2-3 inches (5-7.5cm) of depth, there seems little point in having a depth of more than about 15 inches (45cm) of medium. Having said that, it does no harm to have a greater depth of medium as the extra depth will provide mechanical filtration to trap any fine solid matter which escapes the settling process.

What is more important is the time the water being filtered is in contact with the bacteria-supporting medium. This 'dwell time' allows the bacteria to do their work properly. It is quite useless to race your pool water through your filter at a speed greater than, say, the volume of your pool every two

to four hours, depending upon conditions such as stocking rate, etc. The correct formula can be found only through trial and error, but it's better to be too slow than too fast.

WATER CHANGES

Q How often should water changes be carried out?

A This, again, depends upon individual circumstances. All pools will benefit from the addition of some fresh water occasionally, provided precautions are taken with regard to the removal of all the 'nasties' which tapwater seems to contain these days.

If your pool embodies an overflow pipe, it is worth considering having a constant trickle of fresh water running in, rather than doing, say, a weekly 10% change. If you permanently plumb in a water supply, preferably using half-inch Alkathene pipe with, perhaps, a ballcock to control it, you will not run foul of any hosepipe ban should one occur.

Such a supply should be piped downstream of the filter and should, ideally, pass through one of the commercially available tapwater filters which remove any residual chlorine or chloramines. Needless to say, regular monitoring of this fresh water supply is essential.

ALGAL CONTROL

Q Many Koi-keepers with properly filtered pools still appear to have pools with pea green water. Why is this, and can anything be done to relieve the problem?

A Koi pools, by their very nature, are usually bare of plant life, a mistake in itself. Green water is caused by a combination of sunlight, temperature, lack of shading provided by plants such as water lilies, and the



A venturi will significantly improve water oxygenation.

high levels of nitrate resulting from the nitrification process within the filter system.

The single-cell algae responsible for greening the water thrive happily on a diet of nitrate combined with bright sunlight. Changing large quantities of water is NOT the answer; indeed it could well worsen the problem, as present-day tapwater is rich in nitrate itself.

If you cannot bear the idea of planting your pool with water lilies, then be prepared to install some form of removable shading made from garden centre netting, rather unsightly and a nuisance, or, better still, erect a pergola over the pool which will provide some cover and enhance the appearance.

A very popular method today is to install an ultra-violet steriliser or, as some prefer to call them, clarifiers. These are highly effective and have negligible running costs.

Notwithstanding your desire to have crystal clear water for your Koi, do remember that some part of the pool should contain an area where the fish can be under cover when they so desire. Incidentally, green water does not harm Koi; in fact, they love it!

Q And now for the 'golden oldie'! What can I do about Blanket Weed?

A Some parts of the country appear to suffer much more than others from this pest, possibly because the source water used in pools contains a higher percentage of the dissolved salts largely responsible for the growth. Hard water areas seem to be particularly affected.

Provided it doesn't completely take over your pool, even to the stage of preventing your fish from free swimming, regular mechanical removal is the simplest way of coping. Chemicals, such as Clarosan, are available, but care should be taken with their use as all chemicals — when improperly used — will cause problems to the fish. Of course, once

the chemical has done its work, dead material must be removed before it decays and adds to your problems.

A garden cane simply twirled around in the growth will remove large quantities of Blanket Weed and provide endless amusement trying to get it off the cane afterwards! There is a lot to be said for leaving a growth intact on the walls of the pool as it really does impart a delightfully natural look to the pool, as well as provide a splendid grazing area for your Koi to enjoy as they search for those tasty 'bugs' lurking within.

Q Is it true that a couple of Grass Carp in a pool will help to keep unwanted green growth down?

A Unfortunately, this is yet another fallacy. In the wild, no doubt, these fish will eat a prodigious amount of green stuff, but once in a Koi pool, they very quickly find it more profitable to eat Koi sticks, etc. If you should happen across an albino Grass Carp for sale, they are quite attractive in appearance and make a good talking point when compared with Koi.

VEGETABLE FILTERS AND PLANTS

Q Is there any advantage in incorporating some form of vegetable filtration?

A Undoubtedly yes, because the water following filtration is rich in nitrates (the major cause of green water), and watercress, or similar plants, even common Iris, will consume a large part of these in addition to housing a great population of 'bugs' which are constantly being washed into the pool to the delight of the inhabitants.

I have always advocated a stream for returning water to the pool if space permits, this being filled with gravel and planted out. Should space not permit the building of a stream, then watercress can be planted in the final filter chamber, even a little being better than none.

Q What about plants in the pool?

A Unfortunately, it has become the norm among the more dedicated Koi pundit, to banish plants entirely from the pool. In my opinion, and that of many others, this verges upon cruelty to the Koi who spend their day swimming about in a large area of crystal clear water devoid of any shade or shelter.

Admittedly, Koi will demolish most

Continued on page 69



Concrete 'tables' will provide both hiding places for the fish and a suitable base for lily baskets.



DAVID TWIGG

Overcrowding will inevitably lead to problems, unless excellent water management techniques are practised.

CHOOSING AND TRANSPORTING KOI, STOCKING, BREEDING, LIFESPAN, SOCIETIES

Roger Cleaver

CHOOSING AND TRANSPORTING

Q What do I look for when choosing a Koi?

A The actual colour or variety of Koi to look for is a matter of personal choice. I would say, however, that the prime objective is to choose a fish that appeals to you. If a Koi appeals to you, even if it technically has faults, you will probably receive greater pleasure from that fish than from a similar Koi which is technically superior. All Koi are good Koi if they give you, the owner, pleasure.

What should be looked at, though, is whether the fish is healthy or not. A Koi in good condition will look alert and should be swimming around with all its fins erect. There should be no sign of any physical damage to the fish and most good dealers will allow serious purchasers to examine the fish in a bag before taking it away. (See David Twigg's article elsewhere in this Supplement for further discussion of this subject.)

Koi to be avoided are those that sulk about the pool or are hanging around at the surface gasping. Those that are showing damage to the body or have badly damaged finnage should also be avoided.

Another sign of possible problems is if the Koi are rubbing themselves or flicking off the sides of the pool. If this is happening continuously then there is probably a parasitic problem on the fish, as is the likely case

if the Koi have a greyish or white film across their bodies.

Q How do I transport my Koi home once I have purchased them?

A Once you have made your choice of Koi, they will be placed into polythene bags and the bags will usually be inflated with oxygen.



Oxygen is being pumped into the polythene bag which is placed in a polystyrene box for transportation.

The best way to transport the bag with your Koi in it home, is to place the bag in a sturdy cardboard box or, if possible, a polystyrene box, and place it in the boot of your car.

To give your fish the easiest journey home, then place the box so that the longest axis of the polythene bag lays parallel to the axle of the vehicle. This will ensure that the fish receive the least disturbance due to the motion of the car. The reason that the boot is used is that Koi travel best in darkness, so if an estate car is being used, ensure that you take along a blanket, or the like, in order to cover the box so that the fish are in darkness.

STOCKING AND POOL SIZE

Q How many Koi can I keep in my pool?

A Many factors will affect the stocking rate of your pond, but a useful guide line given by Mr Tamiki of Hiroshima is useful to follow:

Number of Koi per pond area

Age of Koi	Approx size	Min depth	No per 36 sq ft
1 year	6in (15cm)	8-12in (20-30cm)	40
2 years	12in (30cm)	12in (30cm)	10
3-5 years	16in (40cm)	12-18in (30-45cm)	2-5

Q Is there a minimum size that I need to have for a Koi pond?

A Koi can be kept in almost any size of pond if you know what you are doing. I have

LONGEVITY

Q How long can I expect my Koi to live?

A Tales have been told of Koi reaching 200 years or more of age but, unfortunately, the assumptions made to reach this figure were proved to be inaccurate.

Given ideal conditions, it is still believed that Koi could live for 80 to 100 years, but this would be the exception rather than the rule. Comparing lifespans of similar carp, and talking to experienced Koi-keepers, I should think that Koi should live to be between 25 and 40 years if they are given the best conditions possible.

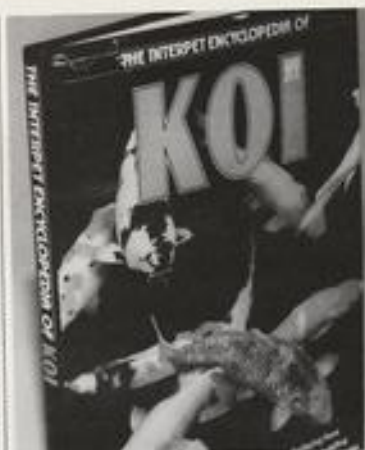
Whether the British weather will adversely affect the lifespan or not, is difficult to know, as Koi did not arrive in Britain until the late 1950s. I do know of a gentleman who has had the same fish in his pool for a little over 20 years, but I do not know of anyone who has had one longer. Time will tell us exactly how long we can expect our pets to survive.

BOOKS AND SOCIETIES

Q Are there any books you can recommend on Koi-keeping?

A There are three books that I would recommend.

The first is Interpet's *Encyclopedia of Koi*.



The *Interpet Encyclopedia of Koi* is an excellent choice for both beginners and established Koi-keepers.

This book, written and produced in Britain by British Koi-keepers, covers all aspects of Koi-keeping, from how to start your pool, to how to show your Koi. It also has excellent sections on diseases of Koi and on Koi varieties.

The other two books are written by Japan's leading Koi-keeper Dr Takeo Kuroki and are called: *Manual to Nishikigoi* and *Modern Nishikigoi*. The first deals with all aspects of the Koi-keeping hobby, while

the second is specifically on the differences of the various Koi varieties.

Q Are there any clubs or societies that I can join to obtain more information on Koi?

A Three main clubs exist in the UK which deal specifically with Koi-keeping.

The largest is the **British Koi Keepers Society**. The BKKS produces a monthly magazine and various sections exist around the country which hold regular meetings monthly.

The membership secretary is Mrs Bobby Barton, 316 Bournemouth Park Road, Southend on Sea, Essex, SS2 5LY.

The other two societies are the **Midland Koi Association** and the **Yorkshire Koi Society**. Again, both hold regular monthly meetings in their respective areas and also produce a newsletter for their members. Their secretaries are:

for the Midland Koi Association, Mrs Joyce Hewitt, 1 Durham Crescent, Allesley Village, Coventry;

and for the Yorkshire Koi Society, Mrs Rita Thompson, 132 Slaithwaite Road, Meltham, Huddersfield, HD4 3PW.

While a great deal of knowledge can be obtained from books, nothing can really beat talking directly to people who have the same interests as you. A great many problems can be avoided by talking with people who have experience of the challenges associated with Koi-keeping and membership of a society is of great value.

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Two photographs of the same fish, showing what we mean by Tategoi ('unfinished' Koi). In June 1989 (left photo) this Tategoi Sanke was 7 inches long and showed some potential Sumi (black markings), mainly underlying the white areas. By June 1990, the fish had grown to 12 inches — some of this Sumi had come through, especially on the white skin between the first two Hi (red) areas.

KOI CLASSIFICATION

Nigel Caddock (Nishikigoi International)

(Photographs: Nishikigoi International)



The black edges on the golden reflective scales of this specimen (owned by Gregory Peck) identifies it as a Kin Matsuba.

CLASSIFYING KOI

Q *What is a Koi?*

A Koi is an abbreviated term for Nishikigoi. Nishikigoi is the Japanese term which, when literally translated, means 'brocaded carp'. For the purposes of clarity, this means 'coloured carp'. Although Koi have their genetic roots within the carp family, almost a century of inter-breeding and production technique development render the Koi we see today totally different from the original carp (*Cyprinus carpio*) from which they have evolved. So, the much used term 'Koi Carp' is a little like referring to Desert Orchid as a cart horse!

The correct term to describe these genetic miracles is Nishikigoi (this is pronounced Nish-Key-Goy) but, if this is too much of a mouthful, then Koi is fine, but please NOT Koi Carp!



Shusui are characterised by a predominance of blue and red on a Doitsu (unscaled) body.

Q How many varieties of Koi are there?

A Koi have a snowflake quality and every single Koi ever produced is totally unique. This may help to explain some of the mystique and charisma which induce people like me to spend most of our time in the pursuit of more knowledge about them.

Although each Koi is unique, a categorisation system exists which may help to simplify things a little. There are thirteen basic variety classifications which all known sub-varieties can be put into. Although there are thirteen varieties, some of the classes contain many sub-varieties, just to confuse things even more.

One basic factor which may help is that the classifications recognise groups of varieties, for example, metallic and non-metallic types.

For the purposes of clarity, I have prepared the table on page 68 (Table I) which details the main variety classifications and the sub-varieties.



Although the three colours — red, white and black — are the same in Sanke and Showa, the latter have a predominance of black overlain with white and red. This Showa is owned by Joe Wilmington.



In order to establish the size class of an individual Koi, it is floated in a Koi-measuring basket such as the one shown in this photograph. The Koi — a Kohaku — won the Grand Champion trophy at last year's BKKS South East Section. Seen receiving their award from David Brown (Section Chairman) are proud owners Albert and Cynthia Hutton.

SIZING AND ASSESSING KOI

Q How are Koi sized for shows?

A In the UK, most shows conform to the British Koi Keepers' Society standards relating to sizes. The Koi is measured from the tip of its nose to the farthest tip of its tail, and the system works on the basis of measuring each Koi entered into the show individually, using the same calibrated measures. The measuring vessels are usually floating Koi baskets with a calibrated scale on the side. The scale is used to size the Koi and great care is taken in ensuring that each Koi is placed in the correct size group.

As a guide, I have prepared a simple table identifying the current BKKS size qualifications (see Table II). You should note that not all Koi shows in the UK are BKKS shows, so these sizes may vary. If in doubt, always consult the show chairman.

TABLE II

	Koi Size Classifications	
	Ins	Cms (approx)
Baby Koi		
Size 1 =	1 to 8	2.5 to 20
Size 2 =	8 to 12	20 to 30
Adult Koi		
Size 3 =	12 to 16	30 to 40
Size 4 =	16 to 20	40 to 50
Mature Koi		
Size 5 =	20 to 24	50 to 60
Size 6 =	Over 24	Over 60

TABLE I

BKKS BENCHING VARIETIES

- 1 **Kohaku** — A white Koi with red markings.
- 2 **Sanke** — A white Koi with red and black markings.
- 3 **Showa** — A black Koi with white and red markings.
- 4 **Utsurimono** — A black Koi with one other non-metallic colour.
Shiro Utsuri — Black Koi with white markings.
Hi Utsuri — Black Koi with red markings.
Ki Utsuri — Black Koi with yellow markings.
- 5 **Bekko** — An all-white or yellow non-metallic Koi with black markings.
Shiro Bekko — White Koi with black markings.
Ki Bekko — Yellow Koi with black markings.
- 6 **Tancho** — Including Gin Rin Tancho.
Tancho Kohaku — White Koi with single red spot on head.
Tancho Sanke — A Shiro Bekko with a single red spot on head.
Tancho Showa — A Shiro Utsuri with a single red spot on head.

- 7 **Kin Gin Rin** — Koi with reflective gold (Kin Rin) or silver (Gin Rin) scales superimposed over their pattern. The only varieties that are usually placed in this category are **Gin/Kin Rin Kohaku, Sanke, Showa** and **Shiro Utsuri**. Note — all other Kin Gin Rin to be benching in variety classes, i.e. **Gin Rin Hariwake** = **Hikari-Moyo**.

NOTE — As a rule of thumb the decision as to when a Koi has enough scales to be deemed Gin/Kin Rin or not, is: if you are able to count the number of Gin/Kin Rin scales it should NOT be included, but if there are too many Gin/Kin Rin scales to count, it IS included.

- 8 **Koromo** — Koromo represents a scales pattern formation on the red pattern of the Koi which usually appears as a robed purple effect. The sub-varieties included here are **Ai Goromo, Sumi Goromo, Koromo Showa** and **Koromo Sanke**.
- 9 **Asagi/Shusui** — Blue Koi with red patterns: the scaled Koi is **Asagi** and the unscaled (Doitsu) Koi is the **Shusui**.
- 10 **Hikari-Utsuri** — Metallic versions of the Koi listed in Utsurimono, plus

all metallic Showa.

- 11 **Hikari-Muji** — This includes all single-coloured metallic Koi, i.e. **Yamabuki** (yellow) and **Purachina** (white) **Orenji** (orange) **Ogons**, plus those single-coloured Koi with black edges to their scales, i.e. **Gin** and **Kim Matsuba**.
- 12 **Hikari-Moyo** — All other metallic Koi not included previously — **Hariwake, Kujaku, Yamatonishiki** (metallic Sanke), **Sakura** (metallic Kohaku), **Kikusui, Gin Shiro Bekko** (metallic Shiro Bekko), **Shochicubai** (metallic Ai Goromo), **Shochicubai Goshiki** (metallic Goshiki).
- 13 **Kawari-Mono** — All other NON-metallic Koi not included previously — **Kumonryu, Hajiro, Hageshiro, Yotsushiro, Matsukawabake, Chagoi, Soragoi, Midorigoi, Shiro Muji, Nezugoi, Goshiki, Aka Matsuba, Ochibaishigure, Benigoi, Kanako Sanke, Kanako Showa, Kanako Kohaku, Kage Showa, Kage Utsuri, Kage Sanke, Shusui/Sanke, Shusui/Showa**.

NOTE — In addition, there are numerous other hybrid non-metallic Koi which are not included in the other 12 varieties.

Q What are the main factors when assessing a Koi?

A If you wish to buy or assess a Koi, the two most important considerations are: Do YOU like the Koi, and is it healthy?

However, there are many factors which must be considered when attempting to assess a Koi, and the overall impression the Koi gives is of paramount importance. It is also very important to look for the Koi's merits first and foremost and not be distracted by minor demerits. For the purposes of comparative assessment, the following are the key aspects one should consider, and the order of priority in which they should be addressed:

- Skin quality
- Body shape
- Pattern — consistency and formation
- Coloration — consistency
- Deportment — attitude in the water
- Quality of finnage

Fuller details about how to buy and transport Koi are given elsewhere in this Supplement.

KOI TERMINOLOGY

Q What do the various Koi terms mean?

A **Gin Rin** — Koi with reflective silver or gold scales; this can occur in all varieties.
Hi — Red markings.
Kiwa — The name given to the edges of the red pattern. This should ideally be blurred

on the leading edge and sharp on the following edge.

Motuguro — Sumi markings (see below) at the base of the pectoral fins on Showa and Utsuri varieties.

Menware — Sumi pattern on the head of Showa and Utsuri varieties.

Pectoral fins — The two front fins (a little like wings).

Shimmi — Little black spots of pigment which frequently occur on areas of the skin pigment of numerous varieties. This is not a disease and the definitive cause is not known; it is believed to be a combination of doubtful bloodline and water chemistry. Shimmi give a speckled appearance, often on the red pattern, and are a real pain in the neck!

Sumi — Black markings.

Tancho — Refers to Koi with a red spot on their heads and no red anywhere else. This can occur in numerous varieties but the main ones are **Tancho — Kohaku, Sanke, Showa**.

Tategoi — 'Unfinished' Koi with great potential.

STOCKING

Q How many Koi can I keep in my pond?

A This clearly depends on how large the pond is, but if you want your Koi to grow and develop and reach their true potential, you should aim to keep your stocking levels on the low side.

To give you an indication, we would offer a suggested range of stocking levels which

are based on the assumption that the pond has adequate filtration:

50 to 100 fish inches per every 1,000 gallons (c 130-260cm/4,500 litres).

This range suggests a stocking level (expressed in Koi per 1,000 gallons) of, either five 10in (25cm) Koi OR ten 5in (c 13cm) Koi, up to a maximum of ten 10in (25cm) Koi or twenty 5in (c 13 cm) Koi.

The realistic level depends on a variety of factors, the most important of which is how efficient your Koi pond system is, but the most important message is clearly DO NOT OVERSTOCK YOUR POND.

FURTHER READING

My favourite book, for beginners and established Koi-keepers alike, is: *Manual of Nishikigoi* by Takeo Kuroki, published by Z.N.A. (Zen Nippon Arinkai).

**FOR THE BEST
ADVICE ON ALL
AQUATIC
PROBLEMS, WRITE
TO OUR PANEL OF
EXPERTS**

FIRST STEPS

Continued from page 53

plants in a pool, but there is no reason why properly planted water lilies (of which there are many beautiful varieties and colours available) should not form an integral part of the Koi environment. In addition to looking really nice, they also provide shade for the fish, and reduce the amount of sunlight falling upon the water, thus helping to control algal growth.

Lilies can even be planted in deep water, as described before, by making a 'table' from concrete, which provides a 'hidey hole' for the Koi, as well as supporting a crate or two of lilies.

With Koi-keeping, a little ingenuity can transform a pool into a thing of lasting beauty which will give immense pleasure for many years.

WATERFALLS

Q Why is it considered desirable to have a waterfall, venturi, or both, in a Koi pool?

A Oxygen is essential for living creatures to survive. In a pool, oxygen is absorbed at the interface between the water and the air above it. However, when a pool is heavily stocked (and we're all guilty of that mistake!), there are certain times, such as during sultry weather and at dawn, when there is simply not enough oxygen being absorbed.

Agitating the water surface with a waterfall allows more oxygen into the water. This effect is enhanced by the use of a venturi which, in addition to agitating the water, actually injects a small amount of extra

oxygen entrained in the bubbles produced. In addition, the venturi provides a current of water which Koi really enjoy swimming against, with the added bonus of encouraging muscle growth and maintaining that elegant 'torpedo' shape.

Very heavily planted pools will, of course, have plenty of oxygen during daylight hours, but remember, this can be a two-edged sword, as during the hours of darkness, plants consume as much, if not more, oxygen than they produce during the day!

The first sentence in this paragraph applies equally well to the bacteria in our filters. The tiny organisms which clean the water are called aerobic bacteria, i.e. they depend upon oxygen to live and reproduce. It's therefore not a bad idea to install an airstone in each chamber as a back-up to natural absorption. Bacteria which do not require much, or any, oxygen are known as anaerobic bacteria. Those that denitrify water, i.e. convert nitrates to free nitrogen, can be encouraged, but those which require no oxygen at all and produce toxic substances like hydrogen sulphide, are best kept at bay if possible, as these thrive in polluted areas such as those hidden little corners within a filter where there will always be dirt.

DRAINS AND PLUMBING

Q Is it essential to incorporate a bottom drain in a Koi pool?

A There has long been a misconception regarding the effectiveness of the bottom

drain as a simple method of cleaning the Koi pool. When the bottom drain is opened up to waste, a suction is generated which draws any dirt in the vicinity and runs it to waste.

Unfortunately, this suction is only limited to quite a small area, perhaps a circle of a metre diameter. Therefore, to be effective in a large pool, several bottom drains would be required, a highly expensive exercise, what with the cost of the devices and all their associated plumbing.

What drains do do very effectively is remove any 'dead' water which tends to lie in the bottom of the pool. Regular cleaning by means of vacuum or siphon will both remove any dirt and 'dead' water simultaneously, so the answer to this question is, pay your money and take your choice!

Q As has just been stated, plumbing a Koi pool is highly expensive. Can you suggest alternative cheaper materials?

A Yes, use domestic plastic piping — it is a fraction of the cost and will give faultless service when properly installed, but you need to know what you are doing — and have the time and inclination to do it properly. Filter feeds and bottom drains can be served with either 4 or 6in (10 or 15cm) sewer piping and are watertight to much higher pressures than those found in a Koi pool. All joints must be installed in such a manner as to place no strain upon them, i.e. ensure joints are supported underneath before backfilling the trench.

Pumping runs can utilise domestic 1½in (3.8cm) drain pipe of the type used for sinks, etc. Even connections to pumps can be obtained by using 'tank connectors' from the same family of fittings. The DIY type can work minor miracles when odd sizes of pipe and fittings are needed, simply by judicious use of a junior hacksaw and a selection of pipe and fittings, together with a can of solvent cement and a tube of gap fill cement. Reducers/enlargers for jointing different sizes of piping are all easily constructed with a little thought. A selection of jubilee clips is also an essential part of the tool kit and will solve many a problem.

One golden rule applies with any plumbing, and that is, pressure test all connections before reinstating trenches, etc. This is easily done by temporarily connecting a vertical length of pipe at each end and filling the whole thing with water. Leave for a couple of hours at the end of which there should be no loss of water. (In very warm weather you might get the impression that water is being manufactured due to expansion causing overflow!)

JOHN CUVELIER

RECOMMENDED READING

John Davies's Book of Water Gardens.
Published by T.F.H. Publications Ltd.
The Practical Encyclopedia of Koi.
Published by Salamander Books.
The Cult of the Koi.
Published by T.F.H. Publications, Inc.
An Interpret Guide to Koi.
Published by Salamander Books.



Watercress is the ideal plant for a vegetable filter.

BUYING KOI, FEEDING, HEALTH FACTORS, WATER QUALITY, QUARANTINE, DIPS

David Twigg

BUYING KOI

Q How can I ensure that I purchase a fish in good health?

A In short, you can't. There are, however, many signs to look for when buying fish and ways of minimising the risk. Your eyes are your best friend on these occasions and you should watch the fish which takes your fancy for as long as possible. Do not worry that somebody else will buy it from under your nose (there are plenty more fish where this one came from) because it is better to be sure of your buy than have a disaster on your hands.

Watch the way it swims, breathes, eats and, most of all, how it mixes with the other fish in the pond. Inactivity is a sure sign of a problem, although fish are just as in need of rest, as we are, and do take 'time out' to relax. This is where the time spent watching pays dividends because you will be more able to differentiate between rest and illness.

Having decided that your choice is worthy of a closer look then ask the dealer to swim the fish in a suitable bowl or basket. Things to look for now are obvious signs of damage (liable to bacterial infection), mis-shapen body or damaged fins. Other signs of illness are raised scales, sunken or protruding eyes, or large heads and thin bodies (you can rarely 'fatten them up'). Some parasites are visible to the naked eye. The two most obvious to look for are *Argulus* (Fish Louse) and Anchor Worm.

If your fish passes this critical examination then there is really only one last thing to do before dipping into your pocket; ask to see the fish in a bag so that you may see the underside closely. Run your eyes along the body below the lateral line on both sides and then along the underside from mouth to tail, paying particular attention to the anal vent and fin. Any dealer worth his/her salt will willingly concede to these requests before asking you to part with your money.

Finally, remember not to let your enthusiasm for the beauty of the fish over-ride your need to be critical of health.

HEALTH FACTORS

Q What factors affect the health of fish (Goldfish, Orfe, Shubunkins, Koi, etc)?

A The factors affecting the health of your fish are many and varied. As Koi are highly in-bred (canalised), they tend to be less hardy than many other fish. I think it is true to say, therefore, that what is good for your Koi is good for the others.

If you have a healthy fish population at the moment, then your wish is to maintain it,

and if you haven't, then you must make sure that the conditions under which your fish live are as good as you can make them. This can be summed up in two words, GOOD HUSBANDRY.

A stressed fish is a fish that is more susceptible to attack from disease, bacteria and parasites. It is imperative, therefore, that we start with good water quality.

Water quality

Water quality is the most important of the factors affecting the health of fish. Clear water is not necessarily 'clean' water. If you have a large enough pond (several thousand gallons) and a small quantity of fish you may get away without filtration. If your pool is 'average' garden pool size of, say, 500-600 gallons (2,250-2,700 litres) then, in order to keep Koi successfully, you must have adequate filtration.

The filter converts the fish products, predominantly ammonia into nitrites and then nitrates. Nitrates are relatively harmless to fish, but if you have a planted pool, the lilies and other plants will thrive on these nitrates, thus helping to remove any possible problem.

Poor water quality can lead to the propagation of parasites and harmful bacteria. Under these conditions a fish weakened, say, by a long cold winter, will be prone to catching an infection much like you and I catch a common cold when we are run down, the big difference being that the fish could, and probably would, die if not spotted and treated in good time. It should be remembered that part of the treatment is to get the water quality right; it is no good putting the fish you have just spent many hours over, going back into the same water only to start the process over again.

(For fuller details of diseases and their

treatment, see Dr David Ford's article elsewhere in this Supplement.)

Feeding

Feeding is another important factor in fishkeeping. Here are a few rules of thumb for the Koi-keeper which may also be applicable to other coldwater fishkeepers:

DO feed your fish regularly. Three times a day in summer is a good starting point. Some would recommend hourly feeds during the warmer spells, provided sufficient aeration and filtration of the water is available.

DO only feed as much as the fish can consume while you watch them. When that has gone, try a little more. Your fish will soon tell you when they have had enough.

DO, by trial and error, adjust the amount of feed given until you find the optimum which your fish can consume at one feeding session. This not only helps keep water quality good, but also keeps wastage and, hence, cost of food down.

DO feed a varied diet. Try different types of pellets. Lettuces, boiled peas, sweetcorn (non-sweetened) and brown bread in moderation are also favourites with Koi.

DO ensure the food you feed is fresh. Rule of thumb for pellets is to regard them as suspect if over three months old.

DON'T feed in spring before water temperature has reached 50°F (10°C).

DON'T feed in the autumn or winter after the water temperature has dropped to below 43°F (7°C). Although this is a 'rule of thumb', certain foods can be fed if the temperature is below these levels. Your fish will tell you when they want food, but you must exercise caution. Check the weather forecast to see if the weather is moving into a cold spell. If so, don't feed. If it is likely to stay mild for the next couple of days, then OK. Your dealer will be able to supply pelleted food made



Koi are gregarious by nature and should not, therefore, be kept on their own, not even during quarantine.

predominantly of vegetable matter; these pellets are commonly known as 'wheatgerm' and are more easily digested by Koi when the water is cooler.

If all fish appear to be suffering from the same problem you may have a parasitic infestation or you may just have poor quality water as mentioned above. It is important to eliminate the second of these from your symptoms in order to diagnose and thence treat the problem properly. If in doubt, call in a specialist or, if in a club, approach the more knowledgeable members for advice and help which I am sure they will willingly give.

(See Dr David Ford's article elsewhere in this Supplement for fuller details on nutrition).

IMPROVING WATER QUALITY

Q Can you suggest ways of improving the quality of the water in my pool?

A First, and most importantly, you must carry out frequent tests on your water quality. Secondly, do keep your pond clean, i.e., siphon off the 'mud and muck' from the bottom at least once a week in the summer when feeding is at its height. Replacement of dirty water with fresh will ensure vital minerals used by the fish (and plants if you have them) are replaced.

In summer months, when sunshine falls directly onto the water surface, the water temperature of small-capacity pools can rise very markedly in a matter of minutes and, conversely, when the sun goes down, so does the water temperature, quite rapidly. Cold-water fish, and Koi in particular, do not like this phenomenon and they become stressed. Add to this the fluctuating quantity of oxygen in the water and your Koi are doubly troubled. Under these conditions (particularly on hot, humid nights) oxygen supply in the water is greatly reduced, thus adding to the problem.

It is wise, therefore, to have some form of additional aeration available for use under these circumstances. Pumping your water through some form of venturi is one way of doing this; another is to have an air pump feeding an airstone in the pond. Some form of shade is also useful during the height of the midday sun to reduce the temperature swing of the water.

If you have efficient filtration then you should be able to maintain 'clean and clear' water, but this situation may not hold up if you increase your fish stock. A filter takes time to adjust to the extra load placed upon it, and extra caution and observation should be exercised at this time.

Please also remember that there will be an optimum flow rate through your filter media. This rate is different for every installation and can only really be found by trial and error. If you are having trouble with 'green water' then you should give consideration to the purchase of a UV steriliser.

Q Would you recommend the use of a UV steriliser on my newly-constructed 3,000 gallon



A nicely balanced head/body configuration (in terms of relative sizes), plus a perfectly located red head patch, identifies this Tancho Kohaku as a healthy top-quality fish.

Koi pool? I am using a powerful pump to return water to the pond at approx 1,700 gallons per hour.

A UV steriliser units were originally designed to kill bacteria in drinking water supplies, but they have been used for some years now by Koi-keepers, not only for their ability to kill bacteria, but also because they will kill free-swimming algae and therefore clarify the water.

As is the case with filters, so it is with UV sterilisers: you must adjust the flow for optimum benefit. These units can only maintain bacteria-free (sterile) conditions in small volume pools, so assuming you work on the basis of a 30 watt unit for 3,000 gallons (15,500 litres) I do not think you will create a sterile pool.

I would suggest that you split the output from your pump (place a gate valve in each leg), so that you can experiment with the flow rate through your UV. This would have the added advantage that, should your UV fail for any reason, it could be easily removed without having to stop the pump or interfere with the overall pond turnover rate.

A couple of words of caution here:

1 Remember that the light given off by a UV (germicidal) tube is harmful to the eyes, so do observe the strictest of safety precautions when in use.

2 You have a new pond which may not yet have an established filtration system, so installation of a UV may lull you into a false sense of satisfaction with water quality. Keep doing checks and observe your fish as often as possible.

POOL HEATING

Q I am planning to heat my pool so as to minimise the risk of my Koi suffering from bacterial and parasitic infestation in the spring. What minimum temperature would you recommend I maintain?

A The immune system of Koi is temperature-related and is greatly reduced if the water temperature is below 12°C (54°F). Above this temperature, the metabolism is increased and the immune system starts to produce antibodies which can fight invading pathogens.

Below 12°C (54°F), while Koi will continue to eat, their metabolism is not so effective and care must be taken as to what sort of food is given. Vegetable matter and wheatgerm pellets are recommended (see earlier).

I now write from personal experience. During the winter of '88/'89 I maintained minimum water temperature at 11°C (52°F) for the period 21 November to 26 January, using Economy 7 electricity, plus day-time backup when required. My fish were active, but certainly not over so, during this period, and feeding was kept to a minimum diet of boiled wheat, sinking wheatgerm pellets and the occasional delicacy such as peas, brown bread and (unsweetened) sweetcorn.

Last winter, '89/'90, I decided to see what effect an extra degree would do and so set



A viewing basket will allow for close examination of fish on a regular basis, without causing undue stress.

my minimum temperature to 12°C (54°F). Certainly, my fish were a lot more active and I was happy to feed them with a mixture of wheatgerm and ordinary pellets, as well as the occasional delicacies. I must say that they have benefited from the extra food and warmth. I suggest, therefore, that you maintain your water at a minimum of 12°C (54°F), or higher if cost allows.

QUARANTINE

Q *Should I give my newly-purchased fish a period of quarantine?*

A Quarantine is most important, and it is generally accepted that the longer the period, the better, so as to avoid introducing problems into an otherwise healthy pool.

If you are planning to use existing quarantine facilities, then please ensure that they are suitable for the size of fish that you plan to buy. Remember that a healthy fish taken from a large dealer's pond and placed into a small, confined, and maybe dark tank which may have incorrectly or insufficiently filtered water, will rapidly become stressed and prone to problems it would normally avoid.

This is a chicken and egg situation because you then become tempted to treat a problem which doesn't exist, which stresses the fish further. You then think that it is even more ill than it really is, etc, etc.

Remember that, on your judgement, lies the life of your Koi.

Q *I would like to build myself quarantine quarters for housing my fish prior to transferring them to the pool. Could you suggest a suitable set-up?*

A Most people tend to think of quarantine as something to be tucked away in the corner of a shed or at the back of a garage. I have seen set-ups in both these locations and some tragic losses have resulted. An example of one in a garage was that every time the up and over door was lifted, it made such a lot of noise that the fish panicked, shot off at great speed in all directions, and ended up banging themselves very hard against the side walls of the tank. Repeated doses of this treatment over a matter of days resulted in two fish dying, literally, I think, of shock.

If a quarantine facility is to be successful, it will be home to your fish for at least a month, maybe longer if any problems show themselves. It is, therefore, necessary to take into consideration, before the design is finalised, the size and quantity of fish it will house at any one time.

As it is probable that this set-up will double as hospital quarters, I would recommend that you allow for 1in (2.5cm) of fish per square foot (900 sq cm) of surface area of water as your absolute minimum dimensions, e.g. if you wish to house two 10in (c 25cm) fish (being 20in — 50cm — total) you would require 20 sq ft (1.8 sq m) of surface area, say, 4ft x 5ft (1.2 x 1.5m). Depth should be as deep as you can make it and, of course, filtration is extra.

Please consider your location very carefully. A second pool in the garden would be a

far better option, but I know we do have limitations of space and family to take into account.

The actual design will, obviously, be decided by your budget. A simple frame made of 2in x 2in (5cm x 5cm) wood with a polythene liner dropped in place, would be the cheapest; a purpose-built fibreglass unit with integral filter system would be the ultimate.

Whatever you choose to build, some points to remember when designing are:

- no internal corners (bath shape with a greater angle of slope would be ideal);
- keep the circulating pump outside the pool;

- have a quiet spot for the fish to rest;
- have some means of reducing the flow (a sick fish will not want to use its energy to fight a strong current);
- have good drainage and cleaning facilities.

Having built your quarantine facility, don't forget that you should never leave a fish on its own. They, like humans, like company, and many people have found that an old large goldfish is an excellent companion for Koi. If you leave your system running all year round, complete with goldfish, then the filter will be well established and water quality good.

Q *I do not have a quarantine facility. Could you suggest what precautions I should take before placing a new fish in my pond?*

A Most specialist Koi dealers will have thoroughly checked over their fish and treated them, where necessary, before offering them for sale, but even if you buy one from these dealers, it is probably wise to use your own quarantine facilities if you have them.

It is well worth asking the dealer from whom you intend to buy how long he/she has had your selected fish in stock. If this is a month or more, then the chances are that the fish, judged by you as per my previous answer, is healthy, and therefore, following one of the recommended 'dips', could be put straight into your pool.

Dip selection

Given that you have done your best to select a clean and healthy fish, I would suggest that you do give the fish one of the recommended 'dips' to kill parasites before placing it in the pond. There are several that you can use, and the choice is really one of personal preference. Most specialist Koi books and magazines will give Salt, Malachite Green, Formalin and Potassium Permanganate as the most popular of these dips and suggest:

Salt: at the rate of 1oz per gallon (6.25gm per litre) for 10 minutes.

Malachite Green: at the rate of 1oz per 7 gallons (8.8gm per 10 litres) for 40 seconds.

Caution: Malachite Green is a carcinogen (cancer-forming agent). If you handle the powder form ensure you use plastic disposable gloves and a face mask for safety. A

better bet is to buy Malachite Green from your dealer in a ready-mixed solution form; following the instructions on the label to ensure the correct dosage.

Formalin: at the rate of 1ml per 10 gallons (45 litres) for 30 minutes. **Caution:** Formalin is an irritant and should only be used in a well-ventilated area. Avoid inhalation of the fumes. Always ensure that you use fresh formalin. If crystals are seen forming on bottom of bottle, please discard, as you could seriously harm your fish. Your chemist will supply fresh formalin in the exact quantity you require for only a few pence.

Potassium Permanganate: at the rate of 1gm per 1 gallon (4.5 litres) for 30 seconds. Potassium Permanganate is also sold by your chemist. Mine stocks it, very conveniently, in 25gm jars for 53p. It comes in crystalline form and must be thoroughly dissolved in boiling water before being added to your container.

Dip preparation

Preparation before dipping is very important and, ideally, I would suggest you have a vat capable of holding around 200 litres (45 gallons) into which you pump pond water, and a second smaller bowl or other container into which you place the actual dip solution of your choice.

If, like me, you have a polystyrene fish transportation box, then you can accurately measure the quantity of water into the box and mark the water level so that the box can be used again with minimum effort.

1 Float your new fish in its bag on the surface of the water in the vat for around half an hour to help equalise the temperature of the water in the bag with that of the pond. This also means that if you have contaminated water in, and on, the bag, you are not bringing it into your pond.

2 Undo the elastic bands around the bag and check the difference in water temperatures.

3 If it's within 1°C (1.8°F) you may then release your fish into the vat and, after a quick check to ensure that it is OK, lift it out and into the dip. Don't forget that before handling your fish you should thoroughly wet your hands and, if the fish is small, or you are happy to lift straight from the bag, then you may omit the release into the vat.

General points to remember when dipping fish are:

- (1) always regard chemicals used as dangerous to humans as well as your fish;
- (2) never leave your fish in a dip, as excessive time in what is a toxic environment may, at best, damage your new fish and, at worst, kill it;
- (3) for the stronger short-term dips, have your stopwatch ready and zeroed before placing the fish into the dip;
- (4) if the fish shows any signs of distress, remove it from the dip immediately and either place it into your pool or, better still, into the afore-mentioned vat for further observations;
- (5) Malachite Green and Potassium Permanganate are dyes, and splashes onto your body, clothes or patio could be very difficult to remove.

Letters

PRIZE GOLDFISH

IN these enlightened times, when people are far more aware of the needs of animals, it is to be hoped that the offer of goldfish as prizes at local fairs and fêtes will be seen as inexcusable.

It is not surprising that so many of these unfortunate fish die soon afterwards, considering the appalling treatment meted out during their short, miserable lives. The high death rate among such goldfish is the result of stress, shock, oxygen starvation, rapid fluctuations in water temperature, etc.

As a captive animal, the goldfish is entitled to protection from cruelty and neglect under the Protection of Animals Act 1911, and following public protest, many local Councils have banned stalls offering goldfish as prizes at



Goldfish prizes receive firm condemnation from A&P readers.

fairs, fêtes and bazaars.

I am sure the Authorities which still allow goldfish to be given away as prizes just need to be made aware of public concern for their welfare, and this can easily be achieved by a letter to the local press.

The RSPCA is totally opposed to the practice of giving any live animals as prizes, and nothing is more unnecessary than goldfish on hoop-la stalls.

Hilda Allen
Peterborough

Editor's note

Mrs Allen's letter is typical of the response which we have been receiving to our two recent items on this subject: Jason Endfield — *When the Prize is Fishy* (May '90), and David Sands — *Tomorrow's Aquarist* (June '90). No-one, I am delighted to report, has so far, written in support of goldfish as prizes. John Dawes

MONITORING AMBITION

It was with great interest that I read your article on Monitor Lizards in the June issue of *Aquarist & Pondkeeper*. I found the article to be a revelation in many respects, and was pleased to find some literature that actually deals with monitors in some detail.

I, myself, am an owner of a Water Monitor and am one of many, as described in the article, in being in possession of just one of these beasts. At the end of the article, Daniel Bennett placed good emphasis on breeding monitors in captivity, and I would very much like to attempt it, but their space requirements make it virtually improbable. I must point out that I found the section on their space requirements pleasing to read, but a nightmare to try and practically recreate.

I suppose I have had my Water Monitor for around two years and the animal must measure at least three feet long, but at the moment, it is being housed in a vivarium eight feet long by two feet wide by two feet high. After reading your piece on accommodation I am going to have to have a serious and quick re-think on what to do. To build something sixteen feet long by eight feet wide within the confines of a three-bedroom semi-detached house is out of the question; the only alternatives left to me are either to dispose of the animal, or consider outbuilding accommodation at great cost.

However, I am somewhat reluctant to be rid of the reptile as I have come to admire its seemingly intelligent behaviour and would feel great pride if I could grow it to full size and accommodate all its needs.

Also, if I could provide the right size housing for it, I could have a crack at breeding. I feel fairly confident in saying that, as far as diet is concerned, my monitor receives an excellent variation of whole food animals and not just the normal run-of-the-mill food. The lizard's environment is also well controlled and uses the latest technological benefits, such as 'black light' and a spotbulb for basking under.

It's not as if I'm new to reptiles as I have been keeping them for about five years and belong to an association, as well as being among a minority of people in possessing a 'Dangerous Wild Animals' licence for keeping two Mangrove Snakes (*Boiga dendrophila*). I, of course, keep other reptiles and have bred the Australian Bearded Dragon.

I would be grateful for any comments that Daniel Bennett may have.

Matthew Starkey
Tonbridge

Editor's note

Thank you for your letter, Matthew. I've passed it on to Daniel Bennett, the author of the article in question, and hope that both he, and any other A&P readers who keep monitors, will be able

to supply you with additional information and/or constructive comments. John Dawes

ABSAT UPDATE

With reference to your article in the June edition of the *Aquarist & Pondkeeper* on **Ponds: Choices, Sitings, Designs**, I would like to update you on the qualities of polyethylene liners, as I feel you have not treated them fairly.

The Absat liner, which is manufactured solely by Blagdon Water Garden Products and is rapidly becoming market leader, is a rubber-modified polyethylene. It is an extremely durable quality liner guaranteed for 20 years. It is U.V. stabilised, very supple and stretchable, and comparative tests show that, in most respects, it outperforms PVC and Buryl.

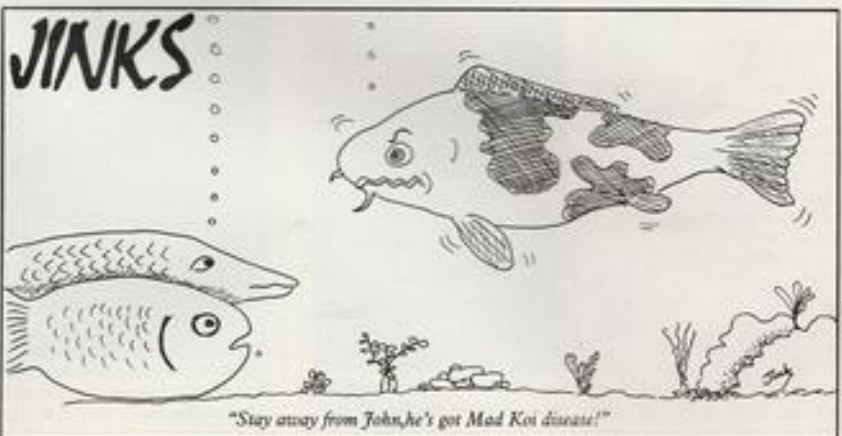
We would be obliged if you did not tar Absat with the same brush as you would polythene. Modern technology has made possible this high quality liner.

If you would put the record straight in a future issue we would be grateful.

P G Chivers (Mrs)
Publicity Director
Blagdon Water Garden
Products Ltd

Editor's note

Thank you for the update on the positive qualities of Absat. I am happy to redress the balance as you request and trust that our readers will take note of the points you raise. John Dawes



Your questions answered

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

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

**Your Questions Answered,
The Aquarist & Pondkeeper, 9 Tufton Street,
Ashford, Kent TN23 1QN**

**Herpetology, Julian Sims. Koi, Roger Cleaver.
Tropical, Dr. David Ford. Coldwater, Pauline
Hodkinson. Plants, Barry James. Discus,
Eberhard Schulze. Marine, Graham Cox.**

HERPETOLOGY

Newt breeding book

I would like to breed Smooth and Palmate Newts and would like to obtain a book on these species. Can you help?

With regard to breeding Smooth and Palmate Newts (*Triturus vulgaris* and *T. helveticus*), you could do no better than refer to the 1989 publication: *Newts of the British Isles* by Patrick J Wisniewski (ISBN 0 7478 0029 4).

Published in the Shire Natural History Series — Number 47, by:

**Shire Publications Ltd
Cromwell House
Church Street
Princes Risborough
Aylesbury
Bucks, HP17 9AJ**

This little book is profusely illustrated with colour photographs, and at only £1.95, represents outstanding value.

This publication gives detailed information about the habitats where newts live, their

courtship, egg laying, the food eaten by newts — in the gilled larval state and as adults after metamorphosis — and ends with the measures which need to be taken to conserve the three species which are indigenous to the British Isles.



Recently metamorphosed Smooth Newts bred in captivity.

TROPICAL

Fish on the move

I hope to move soon and am not sure how to transport my collection. I have three Oscars 6-9in (15-23cm), a Fire Eel 12in (30cm), an 8in (20cm) Black Shark, a large Firemouth and a number of small fish. Your advice would be appreciated.

Moving a small collection of fish is relatively simple; just bag them up in polybags (food grade, not refuse bags) with plenty of trapped air and place them in polystyrene fish boxes, picnic boxes or even cardboard boxes padded with shredded newspaper, to keep the temperature up. In the dark, the fish will become quiet and survive for many hours.

At the new home, set the tanks up first and add as much of the original water as you can transport. Top this up with heated, dechlorinated water and de-bag the fish promptly. You can sort out decor, etc, later.

The large fish may need tranquillising ... a low dose of MS222 or Benzocaine will do the trick, but you must see your local vet for prescribing and dosing. Addition of oxygen to the polybags also helps; again, the vet should be able to help. Your local shop may also have oxygen laid on, so it's worth asking them. When a polybag is oxygenated the survival time becomes days, rather than hours.

Never put the fish in a

bucket; the rigid sides cause bruising. It's OK to pre-bag them in polythene and then place the bag in a bucket (if temperature is not a problem).

Tanks should be drained, and can be moved (but kept level) complete with plants, gravel, fittings, etc, for easy re-setting at the other end. A short flush to waste is needed through any power filter, but retain the filter medium and its valuable bacterial culture intact.

Courting Balas?

I have two Silver or Bala Sharks (Balantiocheilus melanopterus) which appear to be showing courtship behaviour, with the male wrapping his body around the female. Both fish always swim together and feed together. Your comments would be most welcome.

Balantiocheilus melanopterus is variously known as the Silver Shark, Bala Shark or Tri-colour Shark, and comes from Thailand. It is not considered a good aquarium fish because it grows too large for the home aquarium (over 12in — 30cm) so few hobbyists' books include comprehensive details in their listed fish. In fact, there are no records of successful tank spawning by hobbyists (but see caption below) or, indeed, of any obvious sex differences in the fish.

You may well have a pair, so do record what is happening, including photos; let us know if breeding occurs, and how it happens.



The Bala Shark has now been bred commercially by Ekkwill Tropical Fish Farm in Florida. This fish won the second prize in the Breeders' Class at this year's F.T.F.F.A. show.

COLDWATER

Artificial advantages

What plants would you recommend for a coldwater aquarium? Would plastic plants be OK?

I see some advantages in having both real and artificial plants which, by the way, really have improved over the last few years; one or two manufacturers are now producing very realistic looking plastic plants which can be mixed very successfully with real ones.

The advantages of plastic plants are that, not only are they decorative, but their leaves soon become covered with beneficial nitrifying bacteria, all helping to reduce levels of ammonia and nitrites. These plants can be gently swished in cool water when they require cleaning so that the debris is removed but the bacteria remain to continue their good work.

However, artificial plants cannot promote a balanced aquarium by removing excess mineral salts and organic materials which real plants use as a fertiliser for their growth. Therefore, I would always recommend that real plants are used, not only for their beauty, but also because they play a



Egeria densa — a good plant for coldwater aquaria.

most important role in creating a healthy, balanced environment with the aquarium.

Choose plants such as *Egeria densa*, *Elodea canadensis*, *Ludwigia palustris*, *Sagittaria subulata* and *Vallisneria spiralis*. These are only a few of the plants suitable for the coldwater set-up.

A really comprehensive guide to aquarium plants for the coldwater aquarium is a book entitled *Coldwater Aquarium Plants* by Vivian de Thabrew, published by Thornhill Press.

I also suggest that the extra costs of buying plants already established in small plant plugs are well worthwhile since these plants generally appear to settle down better when planted in the aquarium. One point to take into consideration, of course, are the necessary requirements: light, temperature, etc, for each variety of plant to flourish in the aquarium because, if these requirements are overlooked, then you cannot hope to grow any plants successfully.

Confusing pumps

I've bought a ready-made fibreglass pond of approximately 130 gallons capacity. My problem is not what type of fish or plants to buy — but what pump! All I really want is one that operates a fountain, and was thinking of going for an Otter Fountain Kit. However, there are so many pumps available today that I'm finding things somewhat confusing.

I quite agree that there are so many similar, yet slightly different, pieces of aquatic equipment that, often, it is very bewildering as to which is the best for our own particular needs. However, I think that your choice of the Baby Otter Kit is probably one of the best products for your requirements.

I always suggest that, if it is at all possible, one should visit one of the water garden centres that actually has a selection of pumps in operation. Then, people are better able to make a final decision about which will suit their needs. Most of the larger and better centres do have several set-ups for their customers to gain ideas as to what they are actually buying.

PLANTS

Damaged Lilies

Whenever I lift any damaged lily leaves, there are tiny worm-like creatures on the underside. Could these be causing the extensive damage that the leaves exhibit, or could there be other factors involved?

The little worms are harmless organisms. They are feeding on the decaying leaves but are not the cause of your problem. There are three possible causes:

1) **Algicide damage.** Certain chemicals used to destroy algae can, if overdosed, lead to this problem.

2) **Remedy:** change the pond-water, remembering, of course, to add a dechlorinator to prevent 'fish' damage.

3) **Fungal infection.** This attacks water lilies, especially yellow and changeable varieties. It is very virulent.

Remedy: certain expensive commercial fungicides are effective but not economical for

home use. Other than that, remove the baskets, take the lilies out from the containers and wash off all the soil from the rootstocks. Re-pot in fresh soil. Prognosis is poor for this problem.

4) **Tuber Rot.** Caused (at least, partly) by a number of fungal organisms.

Remedy: remove the rootstock from the container, cut out diseased tissue and re-pot. No really effective treatment is yet available.

Editor's note:

For further discussion of Tuber/Crown Rot and other water lily diseases, see: **Waterlilies** by Philip Swindells in the June 1990 **Water Gardening (Questions & Answers) Supplement** published in *Aquarist & Pondkeeper*.

KOI

Unbelievable infection

For the last two seasons I have been treating my fish to clear them of their constant scratching and flicking. I quarantine all my fish for a month before putting them in my main pool of 3,500 gallons.

As soon as my problem started I tried three repeated baths of permanganate, treatment with Masoten and treatment with Sterazin P. None seemed to work.

Can you help me with any suggestions? Can I increase the dosage of Sterazin P, as it suggests on the small bottles? Can you also tell me where to obtain Dimilin for the treatment of parasites?

I find it difficult to believe that if your fish are suffering from a parasitic infection, that it is the same one which began two years ago.

You say that your fish are constantly scratching and flicking. A certain amount of flashing is quite normal behaviour for Koi and, once one fish begins, many others may well join in the activity. It is only when persistent, and quite aggressive, flicking occurs that you should become concerned about parasites.

Most parasites which would cause this action and are not visible to the eye, are usually treated by dosing the pond with formalin and malachite green. Your local Koi dealer should be able to supply you with the necessary strengths of formalin and malachite, but be sure to follow the recommendations on the bottles.

Two other reasons for flashing are possible. Firstly, after several treatments, a Koi's mucus may well be totally stripped from the fish, and any floating particles in the water will probably cause the fish to flick in order to remove them. A second reason for this flicking may well be a deterioration in the water quality of the pool.

In your particular case, you do not state how long a period was allowed between the various treatments that you have undertaken. If they have been one after another, then I would just make sure several large water changes are made and then leave the fish to build up their protective mucus layer again. I would also advise that the water be checked for ammonia and nitrite before any further treatments are used.

KOI

Continued from page 89

Your question on Sterazin, I feel, should be directed to Waterlife Research Industries, Bath Road, Longford, Nr West Drayton, Middlesex, UB7 0ED, as I believe that the two different sizes differ somewhat in strength.

Dimilin powder used for the sterilisation of Anchor Worms (*Lernaea*) is obtainable from Infiltration Ltd, Units 12 & 13, Millingford Industrial Estate, Bridge Street, Golborne, Nr Warrington, WA3 3QE, where supplies of formalin and malachite green are also available.



Parasites — even the most stubborn ones — are very unlikely to persist for two whole seasons.

Fishfeed

IT REMINDS
HIM OF
HOME



by PILBROW

MARINE

Greens v Plums

All of a sudden I have lost a fantastic growth of green algae. Instead, it has all turned to plum-coloured algae. The tank is fish-only; size: 44 x 14 x 22in (c 110 x 35 x 56cm) deep; it had one 3ft (90cm) Northlight and one 2ft (60cm) Northlight which did the job very well for about five to six months.

Then the algae started to change colour, so I renewed both tubes but it didn't make any difference. Now I am trying two Triton tubes; one 3ft, one 2ft. All that is happening is that I'm getting better growth of plum-coloured algae!

I use Seagreen and Seatrace every week, water changes every four weeks (15 gals — 67.5 litres). Filtration is reverse-flow with two powerheads, plus one external powerfilter. The water chemistry is correct in terms of pH, nitrite, etc.

I used to pride myself on the growth of green algae. I very much look forward to your reply.

There are three main groups of marine algae:

1 The green algae, all of which have a green respiratory and photosynthesising pigment (i.e. chlorophyll) in their tissues;

2 The brown algae which have a brown pigment;

3 The red algae which contain a red pigment.

As you walk down any rocky foreshore at a spring low tide, i.e. heading towards the sea, you will notice that the upper reaches of the shore which are covered only by shallow seawater at high tide are the zone where GREEN ALGAE predominate. This is because green algae need red and orange light to energise their food synthesising activities, and red and orange light can penetrate only through very shallow water.

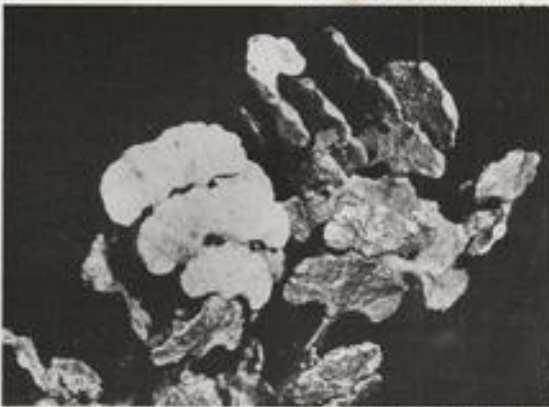
Further down the littoral zone (NB, littoral zone = that area of the seabed between the high tide and low tide lines), you will come upon yellow and brown seaweeds which need the yellow and green light components of white light which are able to penetrate quite a way deeper than red and orange lights.

Finally, right at the edge of the spring low tide zone, you will find the red algae growing. These red algae use the blue, indigo and violet components of white sunlight to photosynthesise their foods.

Light from the blue end of the spectrum can penetrate very deeply into the seawater, and so, these opportunistic red algae exploit the deeper reaches of the seabed where no other algae can grow and where they don't face any competition from other plants.

Now, the conditions at these 'blue depths' of the ocean are that the water is relatively cold, relatively low in dissolved oxygen and that only blue,

indigo and violet coloured light penetrates down there. If, therefore, you ensure that your water is slightly warmer, e.g. up to 82°C (28°C), permanently saturated with oxygen, i.e. use a microdiffuser, and if you increase the redness of your lighting (GRO-LUX is very good for this) and plant up the aquarium with some green macro-algae such as *Caulerpa prolifera*, you will soon find that the green algae then smother the red algae out of existence.



Green macro-algae, such as *Halimeda*, thrive only in shallow well-lit conditions.

PRODUCT ROUND-UP

BY DICK MILLS

ROSEWOOD PET PRODUCTS

A simple 1-2-3 range of AQUA-LIFE Pond Treatments from ROSEWOOD will not only get any pond off to a good start, but also maintain it in perfect order in the future. The POND CONDITIONER makes tapwater safe to use by removing chlorine compounds, heavy metals (these pop groups get everywhere!) and other poisons.

Should the pond follow the expected course and turn bright green before the plants get established, then POND ALGICIDE will control the algae and also eliminate Blanket Weed. In the unhappy event of the fish contracting some disease, or becoming attacked by parasites, then POND MEDICINE will help combat the most common disease found in pond fish. Each treatment comes in handy 250ml, easy-to-use dosing bottles. Details of Rosewood products from: ROSEWOOD PET PRODUCTS, 45 Coalport Road, Broseley, Shropshire (Tel: 0952 883408).

PORSOF

Every silver lining has its cloud, and we were sad to hear of the sudden passing of Patrick Ferrari, the inventor of the PORSOF FLOATING LILY GUARD. Since the launch of this innovative fish protection system last year, not only will many fish have eluded the attentions of cats and herons, but their pond will not have been fortified to resemble a flooded Colditz Castle either.

Each floating guard is about 20 x 10in (c 50 x 25cm) in area and features vacuum-formed polypropylene 'lily-pads'. The pads may be joined together with special clips and stainless steel rods and are easily cut to suit any contour your pond edging may follow.

Enough flexibility exists in the fixing to allow for slight variations in water levels about the season. The 'lily-pads' will assist algae in colonising the light

entering the water, and they may be easily removed for cleaning, should their green surface become soiled.

The virtue of these pads are their lightness; any weight (a leaping fish) on their surface causes instant submergence, but with almost equal instant resurfacing — this very unstable platform being the guard's deterrent factor — especially to something like an unsuspecting cat's paw! Having said that, the pads are stable enough to allow amphibious creatures, such as frogs, to use them as 'stepping stones' out of the pond, a valuable asset in formal, steep-sided pools. Additionally, small birds will use the pads as drinking stations.

Patrick Ferrari has left pond-keepers and their fishes a lasting beneficial legacy, for while natural lilies die down in winter, the floating lily guard ensures safety for your fish, and good looks for your pond, all year round.

Details from: PORSOF, 24-26 Station Road, Crayford, Kent DA1 3QA (Tel: 0322 225326).

AQUARIUM DESIGN & MANUFACTURING LTD

OK, so you're in the market for a piece of aquarium furniture but nothing appears to fit your exact requirements. How does the following selection grab you



Aquarium Designs' 48in Panel Bow, measures 51in high, 50in long and 18in high. It is available in six colours.

— fourteen models in six different colour finishes? That's what's on offer from AQUARIUM DESIGN.

Using high-density Austrian laminate boards, each cabinet is glued and dowelled, rather than just screwed and nailed, and a pre-inspection prior to leaving the factory ensures that the highest possible standards are maintained.

From free-standing 18in cubes, 26in hexagons and 30in octagons, to 39in and 50in bow-fronts, 33in corner, and a whole range of standard oblong tanks (38in, 50in, and 62in) there is something there for everyone. Finishes are mahogany, teak, black ash, grey ash, white ash and bleached ash. Various combinations of doors and shelves are also available. All hoods are supplied in matching finishes.

A full-colour brochure is available from: AQUARIUM DESIGN & MANUFACTURING LTD, Block 1, Unit 1, Huntershill Way, off Crohwill Road, Bishopbriggs, Glasgow G4 1RD (Tel: 041 762 1152).

BLAGDON

The next time you want to see a SUPERNOVA, try looking down into the pond instead of up into the sky, for that's the name of one of BLAGDON'S latest KFS Water Sculptors.

This terrestrial water constellation (complete with underwater lights) features four outer-angled mushroom jets with four inner jets surmounted by a central mushroom/multi-jet feature.

KFS is Germany's leading manufacturer of fountain technology and underwater lighting, and Blagdon offer a wide range of precision-built fountain jets — water bells, foam and volcano jets, swivel and pirouette jets, sequencers, single and multi-lightings sets, in whatever configuration of scale is required. To give an example of three popular lighting models: the UWR2040 is a heavy duty 120 watt/240v fountain/water floodlight; the UWR5000 is similar in design, but operates on a low voltage of 25 watts, as does the domelight

which is ideal for indoor fountains and the Henri Studio self-contained set-ups. It is even possible to have musical fountains!

Examples can be viewed at Blagdon Water Gardens, Bath Road, Upper Langford, Avon. Further information and catalogues available from: BLAGDON WATER GARDEN PRODUCTS LTD, Units 6 & 7, Commerce Way, Walrow Industrial Estate, Highbridge, Somerset TA9 4AG (Tel: 0278 781556; Fax: 0278 782079).



Blagdon's new Supernova — a new experience in fountain technology

GREENAWAY POND FILTERS

Further to the information about GREENAWAY FILTERS (see *A & P* May, 1990), new biological filter units with built-in UV sterilisers have now been added to the range. These new units retain the robust, high-quality construction and innovative design features (unique spraybar and generous foam/plastic media) that already contributed to the outstanding efficiency of Greenaway's original algae control system filters.

A UVAQ ultraviolet steriliser incorporated into the return side has the maximum 'ill-effect' on harmful micro-organisms without affecting any other pond life. The unit is powered by a single 13 amp plug wired directly to the UV, with the facility to take power for

other pond equipment (pump, lights, etc) directly from the UV unit.



Biological filtration and UV sterilisation are combined in Greenaway's latest filters.

Units are available in 1,700, 2,700 and 7,000 gallons capacity. The advanced design features of Greenaway filters are complemented by their ease of installation and comprehensive instructions are supplied with each unit.

Further details from: Dick Roper, GREENAWAY POND FILTERS, 6 Roman Way, Long Melford, Suffolk CO10 9LN (Tel: 0787 713551).

MENDIP CLEARWATER FILTERS

Providing a supply of aquarium-suitable water is apparently getting harder once you take trouble to analyse what is contained in our tap-supplied material.



Protection against waterborne 'nasties' from Mendip Clearwater.

MENDIP CLEARWATER FILTERS have introduced a range of ENCOOSYS WATER FILTERS especially with fishkeepers in mind, which remove a whole range of waterborne 'nasties' such as pesticides, nitrites, nitrates and herbicides, together with the taste of chlorine.

The undersink unit includes

a special tap and a 'mobile', both of which are easily plumbed into the main water supply. Additionally, there is a flask unit for use when running water is not available. The bacteriostatic sealed unit is protected by a one micron screen and contains filter media consisting of a highly effective combination of granular activated carbon impregnated with 1.5% silver. Units range in size from domestic to commercial applications.

Further details from: MENDIP CLEARWATER FILTERS, Hamsdown House, Maesbury, nr Wells, Somerset BA5 3HS (Tel: 0749 840498 and at 071 352 6811).

ROTAFIX RESINS

It's surprising how often a typical 'industrial' story appears which has fishy connections. Take this example, for instance. A Wiltshire concern was raising Tropical Shrimps (*Penaeus monodon*) but found that, owing to a high water table, there was a danger that fresh water would seep through the concrete tank wall and dilute the strength of the salt water or otherwise pollute it. A further problem was that the saltwater would corrode the concrete/steel structure. What to do?

Two ROTAFIX products supplied the answer on both counts. RENDACRETE solved the first problem, and AQUACHEM the second. AQUACHEM is a series of water miscible, two-pack, epoxy coatings; it conforms to BS6920 and will withstand repeated scrubbing and won't leach out any chemicals into the water. It can be applied by brush, roller or spray (either by professionals or by D-I-Y) and be used on brick, stone, steel, concrete or asphalt.

Further details from: ROTAFIX RESINS, Rotafix House, Avercave, Swansea SA9 1UX.

TECHNAQUATICS

"All you do is view" is the promise made by TECHNAQUATICS, the people behind the leasing of display aquaria and paludaria for business premises. However, that is not to say that you don't have a considerable say-so in what you want, inasmuch as what size the aquarium has to be, how it will blend in with existing decor, what species of fish (or what

type of display) you want, etc.

And that's only the start. Add to this a completely no-mess, no fuss installation to the highest professional standards, backed up with regular maintenance and servicing, free professional advice at any time and **guaranteed and insured** for complete peace of mind, what else is there to worry about? Yes, they've even thought about breakdowns while you're away too, with the introduction of their NEVANA, a unique multi-channel environmental control unit which virtually eliminates the risk of temperature extremes within the aquarium.

The NEVANA is a solid-state temperature monitoring and control centre designed to function fully with a main and a standby heater. The liquid crystal temperature display readout (fed from a remote sensor) is updated every 15 seconds, and a memory system allows highest and lowest temperatures to be stored for future reference as required; just press the MEMORY button to replay these.



Sophisticated aquarium control, the Nevana, from Technaquatics.

Although the readout is Celsius (Centigrade), conversion to Fahrenheit can be made by cutting a wire on the circuit board. Two alarms are incorporated: both the upper and lower limits of temperature can be entered as required, according to needs.

Like most modern solid-state heating controls, the heater is controlled proportionally and the pilot lamp shows exactly what is going on: a flashing light indicates temperature is at the pre-selected level; lamp 'ON' shows heat is being supplied (temperature below the set level); lamp 'OFF' shows temperature is above the set level. When the 'LO' alarm is activated, audible and visual signals are made and the standby heater is switched on. When the 'HI' alarm is activated, again both signals are triggered, but the electricity supply is disconnected to both

main and standby heaters.

Display and audible alarm are powered by battery, in event of power failure, with visual alarm being reinstated when power is restored. It may even be possible to extend the circuits so that the alarms can be heard or seen in the house from Nevana units in the fish house — but then you wouldn't be looking at the fish, would you(?), and they'd have to change their motto!

Full details of the Technaquatics range of services and the Nevana control unit from: TECHNAQUATICS LTD, 2 Orchard Close, Main Street, Hemmingborough, North Yorkshire YO8 7QF.

WEST ESSEX LABORATORY LIVEFOODS

A new pollutant-free livefood service available to (mainly) marine aquarists is announced by WEST ESSEX LABORATORY LIVEFOODS. The laboratory-grown foods are free from both parasites and pollutants, providing a source of protein and trace elements as yet unavailable to the marine aquarist, thus boosting the range of available livefoods considerably. The range of food includes:

Baby Clams — Thin-shelled and 'bite-sized' for all but the smallest fishes.

Baby Oysters — These have a much thicker shell and need cracking for the smaller marine fish (we hope that the legendary aphrodisiac properties of oysters prove to be true for breeding fishes!)

Phytoplankton — A mixture of mainly unicellular algae as found in the open sea and grazed upon by many fishes.

Zooplankton — Mixtures of microscopic animal life known collectively as Rotifers. Most suitable for feeding baby marine fish. It is hoped that its availability will facilitate the successful breeding of many more species.

Brine Shrimp Nauplii — Baby Brine Shrimp grown for two days to provide some 'meat' — an ideal second food to follow Rotifers in any feeding programme.

Further details from: S J Haswell, WEST ESSEX LABORATORY LIVEFOODS, Uphire Farm, Uphire, Essex (Tel: 0992 88677).

Diary dates

Letter from the Chairman

Once again, The British Koi-Keepers Society National Show is to be held at Billing Aquadrome, Northampton on 11 & 12 August. This, as in the past, is an Open Show, open to any Koi from any society, from anywhere in the world. The only cautionary note is that the Koi must be healthy (it's not fair to your Koi and it's certainly not fair on other people's Koi, when there is unhealthy stock around).

Water quality at shows has always been a major topic, so this year it's to be overseen and monitored by a professional body. The showground has been enlarged even more to cater for the deluge of dealers that insist that the National is the best show in the UK and the show to be seen at. Regrettably, some had to be turned away in the past, but we hope that this will not happen this year.

It's a special year for our Society: we are 20 years old. So, to mark this Anniversary year, there will be more trophies, more awards, special events going on throughout the weekend, clown shows for the children, chemistry and health talks for the older participants and bonsai demonstrations by specialists.

For those of you that want to make a weekend of it, special rates have been negotiated with Billing Aquadrome for caravans; two-berth to six-berth will be available, but only through this number — 0604 416316. For those who wish to make this weekend truly magical, the weekend package has to be the choice: 5-star hotel, evening dinner/dance, top TV cabaret, dancing into the night, breakfast, free parking, entry into the show (both days); all this and more for £42.50 per person. Bookings: 088365 3183.

So, to save wear and tear on your car, driving from dealer to dealer, why not catch them all at the same place and have a weekend, Japanese-style, with us? The British Koi-Keepers' Society, National Show, Billing Aquadrome, Northampton, August 11 & 12.

Sponsors for this show are

Hikari Fish Food, and it's with their agreement that for the first time, the National will be featuring special in-vat filtration. The medium to be used is Siporax; the air-driven filter units are by Hikari Fish Food.

Tony West,
B.K.K.S. Chairman,
Pilgrims Place Cottage,
The Ridge,
Woldingham,
Surrey, CR3 7AG.

Perth Aquarium Soc

The date of this year's Perth A.S. Open Show has been changed to 19 August. Please contact the Secretary, Thomas Young, 28 Craigie Road, Perth, Scotland, PH2 0BH, for further information.

Phoenix Aquarium Society Blackpool

The 6th Annual Open Show of the above society will be held on Sunday 5 August at Blackpool Boys Club, Laycock Gate, Blackpool. Benching: 11.30 am to 1 pm; Judging: 1.15pm prompt. Cash prizes to be won on the day. Further information may be obtained from the Show Secretary, P Hands, 5 Wheatley Close, Burnley, BB12 0JN. Tel 0282 29021, or the Club Secretary, Mrs G Redman, 18 Althorp Close, Blackpool. Tel 0253 752187.

BKKS (SE Section)

Following the overwhelming support received last year (when the number of Koi entered was second only to the National Show) the organisers of this year's BKKS (South Eastern Section) show plan to make 1990 even better. Dates: Bank Holiday Sunday and Monday, 26-27 August.

This year, large marquees will again be erected to house Koi, dealers who will have a wide variety of dried goods and Koi both on display and for sale. In addition, there will be various arts and crafts, bonsai and many other attractions.

The show itself will be 'English Style' (Koi not mixed) and will be judged by BKKS judges. For those people interested in entering their Koi, benching will be on Saturday 25 August between 10 am and 5 pm, and on Sunday 26 August

from 9 am until 12.30 pm. Judging starts at 2 pm. Presentations will take place on Monday 27 August at 3 pm, followed by de-benching at 4 pm. No charge will be made for entering Koi. Entry to show: £1.50 adults, children free.

The show will be held at Ravenswood School, Oakley Road, (A233) Bromley, Kent. Plenty of free car parking and refreshments are available.

Further information from: Doug Holder (Show Chairman) 081 460 5256 (evenings).



International Herpetological Soc

The International Herpetological Society will be holding a Reptile Fair on Sunday 16 September at Alumwell Centre, Primley Avenue, Walsall, West Midlands. Doors open: 10 am — 4 pm. As well as numerous trade stands, there will also be a show of amphibians and reptiles put on by members of the society. Full details available from A J Mobbs (Secretary), 65 Broadston Avenue, Walsall, West Midlands, WS3 1JA.

C.A.G.B. (Northern Area Group)

This year's Northern Area Group Catfish Open Show will be held at the Mill, Pier Complex, Wigan, Lancashire, on Sunday 2 September. There will also be a Grand Auction, run by Derek Harrop, a catfish advice and information stand, and photographic and 'habitat tank' competitions. The Best in Show winner will be awarded the A & P Gold Pin, thus qualifying for the Champion of Champions competition to be held at B.A.F. '90. Benching: 11.30 am — 1.30 pm (20p per entry); Public viewing: 1.30 pm; Admission: 50p (adults), 20p (children). Further details: S. Anderson (Show Secretary) — 0257 481867 or B Walsh (Show Organiser) — 0254 776567.

Walthamstow & District Aquarists Society

The 1990 W.D.A.S. Open Show will be held at Pathfinders Lodge, Lecha Road, London, E17, on Sunday 2 September. For full details and schedules, contact Roy Parnell, 52 Rensburg Road, Walthamstow, London, E17. Tel 081 521 3383.

Ilford Aquarist's and Pondkeepers' Society

The Annual Exhibition of Fish organised by the above society will be held on 27 October at St. Johns Church Hall, High Street, Wanstead. Please note the change of venue (exhibition previously held at Ilford Town Hall). Doors open from 11 am approximately. For further details contact R E Downer, 5 Suffolk Drive, Laindon West, Basildon, Essex, SS15 6PL.

Darlington Fishkeepers Klub

The D.F.K. 1990 Open Show will be held on Sunday 2 September at Eastbourne School, Darlington. Ring 0325 487581 for further details

NEWS FROM THE SOCIETIES

Rochdale Aquarist Society

The Rochdale Aquarist Society was formed in April 1990 to fill the gap that has existed (in terms of a club) in the area since the 1960's.

Meetings are held twice a month on Monday evenings at the Entwistle Arms Public House in Rochdale. There is already a full programme of lectures and videos planned for 1990-91 (the first meeting was held on 2 July). The society has also become an affiliated member of the Federation of Northern Aquarium Societies (F.N.A.S.) — organisers of the British Aquarist Festival.

For full details of membership and society activities, contact Mrs J M Wild (Secretary), 11 Everest Street, Rochdale, OL11 2DZ. Tel 0706 58242.



Traditional fishing methods are better suited for the exploitation of African lakes.

GREAT LAKES — BUT FOR HOW LONG?

Dr Chris Andrews recently attended an International Symposium in Burundi in Central Africa which was concerned with the environmental problems facing Africa's Great Lakes. This article highlights some of the current problems and points out the economic, scientific and aesthetic value of these 'living laboratories'.

(Photographs by the author)

In November 1989 the International Limnological Society organised a symposium in Burundi which, as a result of generous support from Tetra, the Royal Society and the British Council, I was fortunate enough to attend and participate in. Burundi is a tiny Central African country situated at the northern end of Lake Tanganyika. Although the symposium was originally intended to consider just the problems facing Lake Tanganyika, the subject matter was expanded to deal with other African lakes, in particular Lakes Malawi and Victoria.

An important point to bear in mind whenever one is discussing these lakes is their size. Lakes Malawi and Tanganyika, which lie in Africa's Western Rift Valley, are essentially freshwater inland 'seas', complete with their own pelagic community, including jellyfish. Lake Victoria is a much shallower lake — although still very large.

Lakes Malawi and Tanganyika are more or less thermally stratified the whole time, with only a small temperature difference between the surface and lower layers, and

with the deeper water areas permanently de-oxygenated. Within these lakes life is generally restricted to the top 100 to 200 metres, with the nutrient-rich deeper water out of bounds due to a lack of oxygen.

The shallower Lake Victoria, is stratified on a more temporary basis — like many temperate lakes — with a seasonal overturn and consequent mixing of the upper and lower water layers.

The riverine input and output from these lakes is relatively small, giving the lakes very long water retention times amounting to (perhaps) several hundred years. Most of the input into the lakes comes from rainfall and most of the output is via evaporation. This means that the lakes are more or less closed systems, which has important implications with regard to their management and to pollution control (see below).

All these lakes are very old. Although current thinking indicates that Lake Malawi is around 1 million years old, Lake Tanganyika, perhaps, 2 million years old, and Lake Victoria three quarters of a million years old, some recent research suggests that Lake

Tanganyika, and parts of Lake Malawi, may be at least 20 million years old! These lakes are also relatively stable environments, something that has had a number of effects on their resident faunas.

UNIQUE FAUNAS

The faunas present in these African lakes reflect their past and present drainage systems. Therefore, Lake Victoria has affinities with the River Nile, Lake Tanganyika with the River Zaire system, and Lake Malawi with the Zambesi system. However, very rapid and explosive adaptive radiation has occurred within each lake, so that each has its own unique fauna which exhibits a high degree of endemism.

The fish faunas of all the lakes are dominated by the cichlid family, providing supreme examples of adaptive radiation and specification which is far more impressive than the often-quoted thirteen species of Darwin's finches from the Galapagos Islands. The vast majority of the cichlids in the three lakes are endemic to the lake in



Silt washed into lakes, causes local problems.

question and occur nowhere else in the world.

A high degree of endemism is also exhibited by other non-cichlid species and by other animal groups too. For example, over half of the recorded molluscs, and most of the crustaceans, in Lake Tanganyika are endemic to that lake.

As a result, these 'seas' are huge natural reservoirs of biological diversity. The complexity of these faunas is indicated by the fact that, within a 20 x 20 metre quadrat in Lake Tanganyika, over 7,000 fish (mainly cichlids) from 40 species have been recorded. In comparison, the whole of Europe has only 200 freshwater fish species — and these are from 29 different families.

These often closely related and morphologically very similar species of cichlid are able to co-exist by exploiting different food resources. Therefore, certain species may feed on algae and/or plants, while others feed on various bottom-dwelling invertebrates, such as snails, crabs etc. Plankton, fish and fish fry may be eaten by other species, and certain cichlids may rely upon the scales of other fish or, even, fish ecto-parasites as a source of nutrition. There are species of African lake cichlids which feed on the eyes of other fish, and certain species eat fish eggs. At least one species will half-swallow the head of a mouth-brooding female cichlid of a different species, causing her to release some of her eggs or young, which are then consumed by the aggressor.

As well as exploiting different food resources, factors such as habitat preference, including substrate type, water depth and water movement, are all important in allowing these species to co-exist within the same environment.

IMPORTANCE OF THE LAKES

Environments like Lake Malawi, Tanganyika and Victoria are important to man in a number of different ways. To begin with, they are important as a source of drinking water for humans and livestock which live around their shores. Towns often abstract water and use it for their municipal supply with only rudimentary treatment, and domestic and, even, industrial sewage, is discharged into the lakes.

Bearing in mind their size, and the fact that each lake may be bordered by several different countries, boats are a major means of transport and are especially important for trade between neighbouring countries. Of particular significance is the fact that oil and natural gas reserves have been found

beneath both Lake Victoria and Lake Tanganyika, both these reserves being potentially very valuable to the local countries. Nigeria is now one of the major oil producers in the world, and exploitation of the reserves of oil and gas in this part of East Africa is certain to begin before too long.

The spectacular scenery and fascinating wildlife which live in and around the shores of these lakes mean that they have a huge potential as a tourist attraction, particularly for water-based holidays. This potential is, as yet, not realised and, of course, should only be developed in a sensitive fashion that preserves the very features which tourists wish to see. Fish are also exported from the lakes for the ornamental fish trade and a number of species are also bred for this purpose at lakeside locations.

Finally, all three lakes are of immense importance for the populations of the lake-shore countries as sources of relatively inexpensive protein, with each lake producing between 50,000 and 400,000 tons of fish each year. The combined catches from Lakes Malawi, Tanganyika and Victoria already account for over one quarter of the catches recorded from all of Africa's inland freshwater fisheries.

The catches are made up of a range of species, and current information suggests that, in certain lakes, there is considerable potential for increasing the catches to exploit an even greater estimated potential yield. However, some species in certain areas may be showing signs of being overfished, especially with regard to the use of large-scale,

non-selective mechanised fishing methods, as opposed to the more selective traditional methods.

It is clear, therefore, that the lakes and their faunas are of huge direct value to the riparian countries, and cash values can be ascribed to many of the above-mentioned items. However, like rainforests, tropical coral reefs and most other natural habitats and the animals and plants they contain, these lakes have an 'intrinsic natural value' for all of mankind, highlighted by their aesthetic appeal and their unique faunal assemblages as living scientific laboratories.

Unfortunately, it is less easy to ascribe a definite financial value to this, but then, who knows, perhaps genetic material from an African Great Lake cichlid could revolutionise fish farming, or perhaps a mollusc-eating cichlid could help control snail-transmitted human diseases, at some time in the future.

THREATS

Exploitation of the lakes, as described above, brings with it a number of threats, principally pollution, overfishing and alien introductions.

Pollution

Lake Tanganyika provides an excellent example of the potential harm which might occur following an oil spillage. We have already seen that Lake Tanganyika is a huge freshwater environment with a very slow water turnover time, which makes it, effectively, a closed aquatic system. It is a very deep lake, and any pollutants which go into the deep anoxic (oxygen-depleted) layer may stay there, or may surface at some time in the future.

The Rift lakes, although large, should not be looked upon as a pollution sink into which various pollutants can be discharged with scant regard to the future. Since Lake Tanganyika is a tropical lake, it has quite low oxygen levels to begin with (even in its surface layers), making it very susceptible to

AFRICAN GREAT LAKES (FISH FAUNA)				
	Cichlids		Other Fish	
	No species	% endemic	No species	% endemic
Lake Malawi	~500	99	45	63
Lake Tanganyika	~170	99	115	45
Lake Victoria	~300	99	38	42

NOTE: An 'endemic species' is one that occurs in a particular habitat/place and nowhere else.

AFRICAN GREAT LAKES (VITAL STATISTICS)				
	Area Km ²	Vol Km ³	Depth	
			Mean	Max
Lake Malawi	30,800	8,400	426	758
Lake Tanganyika	33,000	18,800	570	1470
Lake Victoria	68,000	2,700	20	79
For comparison				
Lake Windermere (UK)	15	0.3	21	64
Wales	20,766	—	—	—

organic pollution and resultant de-oxygenation. The very diverse aquatic fauna is not adapted for change, and many of the animals which live in the lake have quite limited distributions. The pelagic community, in particular, has a very simple food chain which would be very easy to disrupt.

Within Lake Tanganyika the most likely sources of pollution are from:

- * input from the surrounding watershed
- * rainfall
- * sources within the lake itself

Lake Tanganyika has a catchment area of 250,000 km² and a huge shoreline, involving the countries of Burundi, Tanzania, Zambia and Zaire. As a result, the control of potentially polluting discharges has its problems. The continued use of DDT and other pesticides in the area is of concern, as is, for example, the installation of industrial plants on the lake shore, such as the proposed paper mill on the shores of Lake Malawi, which would provide its effluent with only very primitive treatment before discharging into the lake.

African rain is changing and is now quite heavily polluted — perhaps almost as polluted as rainfall in the northern hemisphere. As a result, rainfall may bring with it, not only well-recognised pollutants, but also nutrients such as nitrogen. These African lakes are poorly buffered to resist the chemical changes which they may induce. Indeed, there are already signs of eutrophication (over-enrichment) in some African lakes. As was noted above, rainfall is a major input into all of the African Great Lakes.

Oil exploration has also taken place, and oil production will occur in the not-too-distant future, so pollution incidents are almost certain to follow. It has been suggested that even a moderate oil spillage in Lake Tanganyika would have serious consequences: the water in certain areas would be unfit for drinking and washing, shoreline pollution could affect tourism and other shore-based (as well as water-based) activities, and, of course, it would affect the fish and fisheries. Estimates suggest that three years after such a pollution incident, 20% of the oil would remain deposited on the shoreline as tar, 45% would be present in the water as biodegradable products and 5% would remain in the bottom sediments.

It appears that most oil spills occur as a result of transport problems, and oil barges would almost certainly be used to transport oil up and down the lake. However, in addition to the headline-grabbing effects of major pollution incidents, minor recurring spills can also have a chronic effect, degrading the environment in a much less obvious fashion.

Overfishing

Lake Malawi provides an example of the effects of over-fishing on an aquatic community. Man has fished Lake Malawi for a considerable time, but it was only the introduction of large-scale mechanised fishing techniques in the late 1960's, and the needs of an ever-growing population, which have resulted in problems.

Data on the catch-per-unit-effort suggest that, between 1968-1970, there was a linear increase in the catch with effort. However, despite increasing effort, the catch then began to fall through to 1974; subsequently, by reducing effort, catches did improve, perhaps aided by migration into that area of the lake by fish from elsewhere.

The fishery initially consisted of 160 species of fish and, at that time, 80% of the catch was cichlids. Overfishing not only reduced the catch-per-unit-effort (as a result of little recruitment of young fish into the adult population), but also appeared to eliminate one in five species from the catches during 1971-1974.

Recent experiences in these African lakes suggest that large-scale mechanised fishing is incompatible with these diverse communities. Species mixes do change as a result of over-fishing, and it is not known if they will be able to revert to their former status once fishing is practised on a more controlled basis.

Alien fish

Many fish introductions have taken place in African waters in the last fifty years or so. Not all have been as disastrous as the introduction of Nile Perch (*Lates niloticus*) into Lake Victoria.

Against advice from fishery scientists, Nile Perch were introduced into Lake Victoria around 1957. They may have been introduced to provide sport for the local anglers, bearing in mind that Nile Perch grow to around 2 metres (over 6ft) in length and may weigh up to 200kg (440lb).

Initially, there were no obvious problems. Then the Nile Perch population seemed to expand in the late 1970's and early 1980's, with disastrous effects on the endemic haplochromine cichlids. Catches which were once dominated by these cichlids became dominated by the predatory Nile Perch, and it has been suggested that at least dozens of species of cichlids are now extinct, as they have completely disappeared from some areas. Overfishing may have been involved too, but whatever the cause(s), it seems as if there has been a sudden and enormous loss to the endemic cichlid fauna of Lake Victoria, which is unrivalled in terms of comparable vertebrate extinction rates elsewhere in the world. A real ecological disaster...! (See: *Balancing the Scales in Lake Victoria* — A & P, January 1990).

Over the last fifty years or so, other changes have also been observed in the Lake Victoria fishery. Once the local people accepted the haplochromine cichlids as a food source (they had exploited other introduced cichlids for some time), there was an initial resistance to exploit the Nile Perch. Now, however, Nile Perch is a major fishery in Lake Victoria making up 60-70% of catches from the lake, within an overall four-fold increase in the total weight of fish caught. This has led some people to look favourably on the introduction of Nile Perch into Lake Victoria, but the question which remains to be answered is whether these catches can be maintained in the long term or not, and if its

population is stable.

Development of the Nile Perch fishery has brought with it other problems too. The Nile Perch is a rather oily fish which cannot be sun-dried and must, therefore, be smoke-dried over charcoal fires. As a result, deforestation of the hills around Lake Victoria has increased to provide wood for these fires. (See: *Lake Victoria Cichlids Face Extinction* — A & P, July 1986).

FUTURE HOPES AND FEARS

There is, of course, a great deal of African, as well as world-wide, interest in conserving and improving the management of these lakes. Nonetheless, priorities do vary. Lakes like Lake Malawi, Lake Tanganyika and Lake Victoria are remarkable resources, providing food for the local people and, perhaps, revenue from oil, gas and tourism. The difficulty will be their controlled exploitation in a sustainable fashion, permitting the maintenance of their aesthetic and scientific value.

The problems are easy to identify, but less easy to solve. Urgent action is required to conserve the lakes, but it is important that the measures are instigated by the riparian countries, who will have to act in a cohesive fashion. However, with the human population in many African countries set to double in the next thirty years or so, some very hard decisions will have to be made.

On a more positive note, it is interesting to observe the success of the recently-established Lake Malawi National Park. This is now a World Heritage site which was set up to protect the Mbuna rock cichlids and their habitat. It has been extremely successful in a fairly small way, appealing to bird watchers, scuba divers and other wildlife-orientated tourists.

However, one additional problem is that as such a national park becomes more popular, its clientele begin to demand more in the way of accommodation and on-site facilities. If such developments are allowed to occur in an unrestrained fashion, they may then destroy the very environment they were set up to preserve. Ecological-based tourism must be developed in an environmentally friendly fashion, and what are now needed are a number of these reserves in Lake Malawi, as well as other lakes throughout Africa.

FURTHER READING

- Ecological Studies in Tropical Fish Communities* by R H Lowe-McConnell. Cambridge University Press (1987).
The Natural History of Lakes by M J Burgis and P Morris. Cambridge University Press (1987).
Plenty more fish in the lake? by C Tudge. *New Scientist*, 9 December 1989.
Balancing the scales in Lake Victoria, by K Harrison et al., *Aquarist & Pondkeeper*, January 1990.
Lake Victoria Cichlids Face Extinction by John Dawes, *Aquarist & Pondkeeper*, July 1986, p22.



Danny Regev strips a ripe brood Koi female of eggs. A female this size can yield in excess of 100,000 eggs.

learn that Tewin's proprietor, Martin Symonds, had forged very close links with Adrian Barnes, owner of Pisces Ltd. Aquaculture, the only independent ornamental fish breeder and farmer currently operating in Israel.

As a result of the agreement, Tewin now handles all the fish produced by Pisces, distributing them to the aquatic trade, both in the UK and throughout Europe.

At the time of my visit, I had also been impressed by the thoroughly professional approach taken by both parties. This included importation into the UK of large stocks of fish during the early autumn, followed by quarantine, prophylactic (preventive) treatment and subsequent overwintering in Tewin's ponds, thus ensuring hardened, disease-free stocks at the beginning of the coldwater season.

What intrigued me more than anything else, though, was the story behind it all. Let's face it, it's not everyday that you learn of a UK fish farm joining forces with an independently owned and operated company based about an hour from Tel Aviv, and a large progressive Kibbutz located some two hours' drive to the north by the banks of the River Jordan, right on the Israeli/Jordanian border, surrounded by mines and

THE ISRAELI CONNECTION

A & P editor John Dawes reports on a unique, ambitious and highly successful operation set up between an English fish farm, an independent Israeli Koi and goldfish breeder, and an enterprising Kibbutz on the Israeli/Jordanian border.
(Photographs by the author)

Picture the following scene: A large, almost deserted hall at an international airport. The time is about 3 am. Along one whole length of the hall there is a row of checking-in counters — all of them closed ... except for one. A few yards in front, two bleary-eyed would-be passengers are individually being given a gentle grilling by separate teams of security personnel. This goes on for nearly one hour.

The questions — all of them searching and expertly devised — keep coming in thick and fast. Every once in a while, one of the interviewers swaps groups and asks further questions, checking and cross-checking the responses given by the two interviewees.

Finally, the all-clear is given and they are asked to proceed to the check-in counter. ... only to be informed that it will not be possible for them to leave on the flight in question because that would necessitate an alteration to the tickets that they (the check-in staff) are not empowered to carry out. And all this, after earlier assurances had been given that the alterations would be possible!

Security is tight — very tight — at Ben

Gurion Airport in Tel Aviv — and so it should be, of course. The interviews may not be everyone's idea of a picnic, but, at least, they fill you (once they are over and you are allowed to check in!) with a tremendous feeling of reassurance that you are probably safer from terrorist attack on an El Al flight than on any other aeroplane anywhere else in the world.

The same goes for the cargo carried by El Al freighters like the one we had so desperately been trying to get on. Had we managed to do so, then this last lap of our journey would have been just as highly successful as the hectic activities of the previous five days had been.

BACKGROUND

It had all started several months earlier. I had visited Tewin Mill Fish Farm near Welwyn Garden City to do a write-up on the latest additions to the fast-expanding farm (see *Out & About* in the June 1990 issue of *Aquarist & Pondkeeper*). I was struck at the time by the excellent quality of their Israeli Koi and goldfish and was most interested to

electronic fences, and with round-the-clock protection from the Israeli army to boot!

This, I had to see. ... and so it was that I



The tiny fry are kept and fed indoors until it's deemed safe for them to be transferred to the outdoor rearing ponds.

ended up spending five of the most interesting days I have so far experienced in my travels, in the company of some of the most dedicated, enthusiastic and impeccably hospitable people I have ever come across in the aquatic industry.

THE TEAM

There are three main partners in this remarkable co-operative venture:

1. Pisces Ltd, Aquaculture;
2. Kfar Ruppin;
3. Tewin Mill Fish Farm.

Pisces Ltd. Aquaculture

Based at Moshav (village) Bet Halevi, near the seaside town of Netanya (as far east on the Mediterranean as you can go), Pisces is owned by Adrian Barnes and his wife Ori. They employ a small staff — Yotam, Peter, Michaela and Shi. In addition, they receive wholehearted, unselfish assistance from a number of friends and when required — assistance that is freely offered and received in that uniquely Israeli spirit of comradeship that most of us have, sadly, long forgotten can exist between people.

At least one truckload carrying over 150,000 assorted Koi, Shubunkins, Comets and Sarasas arrives at Bet Halevi most mornings. The fish are promptly unloaded into the waiting ponds where they are inspected, sorted and left to spend the next few days feeding and settling down after their two-hour journey from Kfar Ruppin.

About 48 hours before they are due to be shipped, they are sorted into the required numbers, inspected again and floated in coolers where the temperature of the water is very gradually lowered to 10°C. This has several beneficial effects, such as bringing about a significant slowing down of the fishes' metabolism and, consequently, the level of stress that they are likely to experience during transit. Slower metabolic rates also mean fewer waste products in the water, with all the obvious advantages that this brings.

On shipment day, the fish are duly transferred into large double polythene bags containing a carefully measured volume of Acriflavine-treated water (to help prevent any outbreak of disease during transportation). The bags are then filled with oxygen, sealed and packed in double-layered cardboard boxes, appropriately marked with the customer's details, taped up and loaded to await transfer to Tel Aviv Airport.

Once at the airport, and assuming that all the seemingly interminable mounds of paperwork are in order and the security checks have been carried out, it's into the airport's own chiller for the final few hours before loading onto freighters ready for departure to the various destinations.

Several hundred thousand fish are handled by Pisces each week and every single shipment receives the same meticulous attention to detail that characterises the truly professional operator.

One thing that is immediately noticeable

by its almost total absence at Pisces is broodstock. Adrian and Ori do keep some top-quality Koi which are sometimes used for breeding purposes, but the vast majority of Koi, Shubunkin, Comet and Sarasa broodstock is kept permanently under the watchful eye of Danny Regev, another key member of the team based at Kfar Ruppin.



Ouriel Koonra (wearing the oil-skins), Danny Regev and Martin Symonds with a netful of young Koi harvested from just one corner of an outdoor rearing pond (this one contained over one million fish!)

Kfar Ruppin

Danny Regev, together with Ouriel Koonra, runs the hatchery at his Kibbutz, Kfar Ruppin, located in the Bet Shean valley along the banks of the legendary — but disappointingly tiny — River Jordan that runs from the Sea of Galilee (also known as the Kinneret or Lake Tiberias) southwards to the equally legendary Dead Sea.

In an unprecedented arrangement, Kfar Ruppin — a state-backed communal village — has entered into an agreement with two totally commercial companies (Pisces and Tewin) whereby they (the Kibbutz) breed, rear and harvest ornamental fish from broodstock, and with facilities, provided by the other two partners. While, at first sight, the alliance seems to be a most unlikely one, it is, in effect, highly successful. Basically, there are three reasons for this.

Firstly, Danny and Ouriel are expert fish breeders and producers, but they would be the first to admit that they are not experts when it comes to dealing with international



Unsorted, robust, colourful... and disease-free Koi from Kfar Ruppin.

markets. Pisces and Tewin, on the other hand, have precisely the expertise required in this department.

Secondly, there is the question of space that such a large-scale operation demands, and in this respect, Kfar Ruppin is ideally equipped. In fact, one of the ponds I was shown held well over one million small Koi!

Another, located outside the mined fence — but well within sight of one of the ever-watchful army lookouts — contained more than 15,000 adult Comets (this, and next year's broodstock), while yet another large pond held several million small Shubunkins, most of which will be ready for sale anytime now. And these were just three of goodness knows how many ponds, all holding fish that Pisces and Tewin would be selling in due course.

Thirdly, and probably most importantly of all, there is the question of mutual trust and respect. Both were evident in abundance in everything I saw. What I also found particularly pleasing as well, was that all four men clearly like each other and genuinely consider themselves to be part of a highly effective team.

Add all these ingredients together and you've got the makings of both a successful and permanent-looking partnership that augurs well for all concerned, including hobbyists worldwide.

Within the hatchery itself, there was a buzz of excellently co-ordinated activity during my visit, as female after female, and male after male, prime brood Koi were swiftly and effectively stripped of their eggs and sperm — the next batch of Kfar Ruppin/Pisces/Tewin fish in the making.

Following fertilisation, the eggs were placed in a 'rocker' with a urea/salt mixture that 'precipitates' the 'glue' which the eggs possess and which would cause them to stick together. This 'glue' is essential in natural spawnings among natural vegetation but, in the strictly controlled environment of a hatchery, it could lead to insurmountable problems.

After 'de-gluing' — which takes about an hour — the eggs are transferred to a hatcher where a constant supply of clean water and air keep them moving freely until they hatch a few days later.

During incubation, and after hatching, samples are taken regularly and examined under a microscope by the third member of the Kfar Ruppim team, Tami Kimmelman, to ensure that everything is proceeding as it should.

Following hatching and consumption of the yolk sac, the tiny fry are fed indoors for a short time until it is felt that they are sufficiently advanced to survive in the outside ponds. From then on, it's a question of constant monitoring and a great deal of T.L.C. (tender loving care) over the next few months until the young fish are ready for harvesting.

Not all fish will be harvested in one go, of course. Some will be kept to grow on for sale at a larger size later on, while others will go to form the basis of the next generation of broodstock.

Harvesting is followed, almost immediately, by transport to Pisces at Bet Halevi, where the reception/conditioning/packing programme which I described earlier is set in motion, with the fish eventually being shipped either to Tewin Mill or one or other of the Pisces/Tewin customers in other countries.

Tewin Mill Fish Farm

The flight from Tel Aviv to Heathrow takes some five hours (barring delays). Once the paperwork (not quite as mountainous as at the Israeli end, but still considerable) has been sorted out, it's on to the van and up to

Tewin — approximately 50 minutes' drive away.

Arrival at Tewin is followed by re-cooling, acclimatisation (usually over a two-day period) and eventual release into the holding vats and ponds, where the fish are checked and re-checked prior to being put on sale.

Should the shipment be an end-of-season one, then the fish will over-winter in the ponds, hardening off and being prepared for the first surge of sales the following spring. During the coldwater season, the fish will undergo quarantine (the period varying according to condition of the fish) before being offered for sale either through Tewin's own retail outlet, or through the trade.

CLOSING REMARKS

My original idea in going to Israel was to



Yotam (nearer the camera) and Peter sort out young Koi at Pisces prior to cooling.

follow a shipment all the way from the Kibbutz to Tewin, hopefully seeing the whole operation, even prior to the harvesting of the fish.

'Owing to circumstances beyond my control(!)' — as they say — I was unable to get on the same freighter as the shipment, as I outlined in my opening paragraphs. However, I console myself in the knowledge that, in some ways, the flight part of the journey is the least interesting in terms of 'things going on' and, having witnessed the receipt of fish by Tewin on a previous occasion, I have, at least, seen this link in the chain as well, and can vouch for its thoroughness and attention to detail.

Looking at the rest of the operation, I found it truly awe-inspiring, and well worth every interminable second of my Ben Gurion Airport 'interview'. How a Kibbutz in the Bet Shean valley, a breeder and shipper in Netanya, and an importer/breeder/wholesaler/retailer in Tewin can combine so effectively... and produce healthy, robust fish at the end of it all, almost defies description — were it not for the inescapable fact that they actually do it!

My most sincere thanks go to all parties concerned, not only for allowing me to see their project at such close quarters, but also for allowing me to ask so many awkward questions, for being so willing to answer them... and for pointing out the strategically-placed foot mines that 'adorned' the perimeter fence around the Kfar Ruppim ponds!

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News

A & P LENDS SUPPORT TO AQUARAMA '91

Academic Associates Pte Ltd, organisers of Aquarama '91 (scheduled to take place at the World Trade Centre in Singapore on 27-30 June 1991) have invited *A & P* to join other leading organisations such as Ornamental Fish International, the Primary Production Department (Singapore), and the Ministry of National Development, Singapore, as an official supporter of the exhibition/conference.

No other aquatic publication has received the honour of being invited to support such a

prestigious event. We are therefore pleased to accept and look forward to bringing news of Aquarama to our readers on a regular basis.

Our editor, **John Dawes**, has also been invited to return to this international trade/consumer aquatic show (the largest in the world) as judge and will present a comprehensive report in *A & P* as soon as possible after June 1991.

For further information on Aquarama '91, contact **John Dawes** or the organisers direct: **Miss Irene Goh**, Academic Associates Pte Ltd, Block 808, French Road, #03-185 Kitchener Complex, Singapore 0820, Republic of Singapore.

KINGFISHERIES — FIRST UK 'TUNZE DEDICATED DEALER'

Interzoo, the largest pet trade fair in Europe, is staged in Nurnberg, West Germany, every two years.

The 1990 event (held in May) recorded the largest number of visitors — 13,779 — with 5,180 coming from outside Germany. Of the 458 exhibitors, 87 were concerned with aquatics. The UK was excellently represented with 47 stands.

Among the many overseas visitors was **Stan Kemp** of **Kingfisheries Ltd**, who have recently acquired the first 'Dedicated Tunze Dealership' in the UK. In the accompanying photograph, Stan is seen

shaking hands with **Norbert Tunze** (creator of the system that carries his name) in official recognition of the Dealership.

Also in shot, **Andrew Dollery** (left) of **Classic Cabinets** who had a stand at Interzoo and with whom **Kingfisheries** joined forces, to great effect, at this year's Ideal Home Exhibition (see *News, A & P*, June '90), and **Chris Rawlings** of **Aquamagic** who are the sole UK distributors for Tunze systems.

For further details of Tunze systems and dealerships, contact **Chris Rawlings**, **Aquamagic Ltd**, Marine House, Market Street, Watford, Herts, WD1 7AN. Tel 0923 39637; Fax: 0923 30460; Telex: 826933 BALRAWL G.



Kingfisheries — first UK 'Tunze' dedicated dealer.



URSULA THE EEL SLIPS PAST THE COMPETITION

A Common Eel (*Anguilla anguilla*) took the fishkeeping world by storm at the F.B.A.S. British Open Show held at the NEC, Birmingham on 2 and 3 June and went home with the biggest-ever cup to be presented to a fishkeeping winner.

Sponsored by manufacturers, **Interpet Ltd**, the cup stands a staggering 3ft high, which measures up well to **Ursula** who is, herself, almost 3ft in length. This impressive eel had already won the Fish of the Year at the Yorkshire Aquarist Festival earlier this year (reported in *A & P*).

Ursula, owned by **Robin Day** and **Marion Wright** of Doncas-

ter, was judged to be the British Open Champion from a field of hundreds. Competition was tough, with many exotic and tropical fish from all over the country in the running. At the end of the day, however, it was this Common Eel that gained the highest marks against F.B.A.S. standards and took the honours.

The cup was presented by **Joe Nethersell**, Chairman of the Federation of British Aquarist Society (F.B.A.S.) and **Mike Clarke**, Sales Promotion Manager of Interpet.

Robin and **Marion** are members of the Select Aquarist Society and have kept fish for 21 years, although this is only their second year in major competitions.

NEW SOLE DISTRIBUTOR FOR MINIREEF

Following lengthy discussions, both in Holland and the UK, **Pedigree Wholesale Ltd** have been appointed sole distributors of the highly-rated **Minireef Aquarium Systems** for the UK.

The first deliveries were

taken into stock in a purpose-built unit within one of the company's warehouses in June, with a selection of H29, H39 and H33 systems, plus H50 cabinets in six-colour combination, becoming available for delivery as from that date.

For further information, contact **Derek Slater** or **Adrian Hind** on 0602 816521; Fax: 0602 4555612.

NOTE: Items for this page should be sent to the editor six to eight weeks prior to publication.

Crossword

Across

1. Aquatic sandwich filler
6. Tarka the - - - - -
8. Always weeping
10. Thank you very much
11. Used in clarinets
12. Bird-type watchdogs
14. Fishing weights
16. Flower that swings in the trees
19. Your ego
20. Scum on the surface
21. Another word for fur
23. Opposite of down
24. Flowing water
26. The water jewel beetle
27. Peas come in it!
28. Watery emission

Down

1. Aquatic watch plant
2. Small streams
3. The plant's foundation
4. A river's root
5. Croaking floating plant
7. A deep trench
8. A gardener's nightmare
9. General name for pond foliage
13. Typha or bulrush
14. A plant's egg
15. Opposite of off
17. Clean that tank's glass!
18. Bobbing water bird
20. A mature tadpole
22. The Sahara perhaps?
24. A plant's blood!
25. Its eggs make fish food



AQUATIC TIMES CROSSWORD

Did you spot our 'deliberate' error in July's Crossword? We were 'just testing', of course. And if you believe that, you'll believe anything!

The real truth is that somehow, some ill-disciplined gremlin got in when we least expected it — and when we had already checked our scripts before going to press. The result was that one clue went 'walkies' and another got moved.

No wonder we didn't get any correct entries! Please accept our most sincere apologies for driving you mad trying to complete our impossible challenge.



To redress matters, therefore, we are re-running the same Crossword — hopefully, with every clue in this time round . . . and in the right place. The prize remains the same: a superb GRASSLIN RNDOMATIC Automatic Fish Feeder to get you and (far more importantly) your fish over those difficult periods when you are away from home. Selling at £49.83 the Grasslin Rondomatic is a highly desirable addition to every aquarist's armoury of accessories, allowing 28 separate feeds to be programmed to occur at pre-determined times.

To enter into the draw, please complete the Crossword and send it to us to reach us by 31 August at the very latest. The first correct entry drawn on 2 September will win the prize.

Send your completed entry, along with your FULL name and address in BLOCK CAPITALS to:

Aquarist & Pondkeeper,
Grasslin Rondomatic Crossword (August),
9 Tuffon Street,
Ashford,
Kent, TN23 1QN

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OUT AND ABOUT

Aquaria and Watergardens '90

Dr David Pool — Tetra Information Centre
(Photographs by the author)

Make a note in your diary — the Aquaria and Watergardens '91 exhibition will take place at the National Exhibition Centre on the weekend of 15 and 16 June 1991. Judging by the success of this year's event and the proposed improvements for 1991, it promises to be an event not to be missed.

The fact that the venue has already been booked and organisation is underway for next year's exhibition says much for the event in 1990. Aquaria and Watergardens '90 was held on 2 and 3 June and proved to be very popular, with official (N.E.C.) figures of 12,428 people attending over the weekend. This figure included 800 members of the trade. Despite its large size, the exhibition hall appeared crowded throughout both days, suggesting that those who attended found items of interest and stayed for most of the day.

The main attraction of any large aquatic show are the trade stands, and those attending had 56 to browse around. Most stands had products for sale and reported brisk business. In fact, several local dealers had to replenish their stocks before the exhibition re-opened on Sunday.

Several companies and societies were present on an



The only stand selling fish at the show.

information-only basis. This included the Tetra Information Centre and 'Aquarian' Advisory Service, who were both inundated with enquiries throughout the weekend. The F.B.A.S. also had their 'Beginners Team' in attendance, giving practical demonstrations on how to set up an aquarium and avoid those early pitfalls. Further information on a wide range of aquatic topics was also on hand through a well attended series of lectures.

In order to allow Mums and Dads to enjoy the exhibition, crèche facilities were available. Entertainment for the children was also provided in the form of Ferdie-Dee the clown and his 'Future-Rama' production. Judging by the laughter, the show was appreciated by young and not-so-young alike.

Aquaria and Watergardens '90 was the first aquatics show to be held at the NEC, and, not surprisingly, there were a few minor teething problems. The most important was undoubtedly the low numbers of fish and other livestock, either on display or for sale. In fact, the only fish for sale at the exhibition were on the Northern Discus and Koi stand which, obviously, attracted a crowd throughout the weekend. The lack of fish at the show was due, in part, to unfortunate circumstances, with one dealer having to withdraw at the last minute owing to difficulties in obtaining a large shipment of fish. The advertised amphibian and reptile displays were also not present owing to a last-minute withdrawal. Reassuringly, arrangements are already in hand to ensure that such problems do not recur next year.

The exhibition itself included both trade-only and public areas. The general feeling among those exhibiting in the trade-only pavilion was that it had not been a success owing

to the low numbers of trade customers attending the show. However, all commented on the hectic business conducted on the public sections of their stands. As always, there were exceptions, and several exhibitors had obtained important new orders from trade customers.

The exhibition also featured the F.B.A.S. Open Show which attracted an entry of 447 fish and 10 furnished aquaria. Pride of place at the show went to Miss M Wright and Mr R Day with their eel (*Anguilla anguilla*)

which won the Interpet-sponsored 'British Open Championship'. The winners were presented with the giant F.B.A.S. Open trophy which stands nearly 3 feet high and 18 inches wide.

Aquaria and Watergardens '90 was, overall, a great success, and given the planned improvements, the 1991 event should be even better. Congratulations for all of their hard work should go to the organisers — Concept Conference and Exhibitions Ltd. and to the F.B.A.S. for running the Open Show.



This impressive water feature welcomed visitors to Aquaria & Watergardens.

Major Trophy Winners

Interpet-sponsored

British Open Championship

1st Miss M Wright/Mr D

Day — *Anguilla anguilla*

—(Select A.S.)

2nd Mr. D. Saysell — *Channa*

argus — (J.E.D)

3rd Mr R Lemmon — *Cichlasoma*

nicaraguense — (Strood

A.S.)

Interpet-sponsored F.B.A.S.

Championship Class C —

Characins

1st Mr A Waller — *Gymnocorymbus*

socoloffi — (Romford

A.S.)

2nd Mr P Yeomans — *Nanaethiops*

amitaemans —

(Leicester A.S.)

3rd Mr M Smith — *Anostomus*

ternstrozi

Interpet-sponsored Best

in Show

1st Mr A Kelford — *Barbus*

fraseri — (Strood A.S.)

Tableau Competition

1st Strood A.S. — Thomas

the Tank Engine

2nd Scorpion A.S. — Green-

house Effect

3rd Darwen A.S. — Medieval

Castle.

Highest Pointed Exhibitor

Mr J T Mayle — Chelmsley

Seudy Group

Highest Pointed Society

Romford A.S.

Coldwater jottings

Stephen J. Smith



HOSE THAT!

The apparent trend over recent years for "hotter than average" British summers appears to be continuing — this year being no exception. The consequent shortages of water supply in many parts of the country pose more than a few problems of bare lawns: but what can the pondkeeper do in the event of a hosepipe ban?

My personal opinion has always been that my responsibility to my aquatic animals has priority over any such circumstance, but a couple of enquiries to the water companies were well worth the effort.

Quite simply, check with

your local water company if you are a pondkeeper and are worried about the effects upon your fish of a hosepipe ban in your area. According to Thames Water, while such a ban means restrictions on the use of hosepipes for gardening or car washing, for example, the use of a hosepipe for filling your pond is perfectly in order. Conversely, Severn Trent incorporates the use of hosepipes for filling ponds within their restrictions.

"Responsibility and commonsense are the key words," commented a spokesman for Severn Trent. "If possible, try to conserve water by collecting rainwater in bowls or by using buckets to carry water from the tap."

And, returning to that bald lawn, why not recycle your dirty pond water by sprinkling it onto your lawn. "Such expediency would be highly commended," remarked a spokesman for Thames Water. And quite right, too. The nutrients, such as nitrates, in 'used' pond water are ideal for plants and the same water is being used for a different purpose, thus conserving supplies.

So, why aren't our river waters — polluted as they are with nitrates — pumped back onto the land where such nutrients will be far more beneficial than when they reach their marine destination...?



Overcrowding on this scale can only be maintained for any length of time if the water is well-oxygenated — something that is difficult to achieve during hot, muggy weather.



Extensive use of submerged oxygenating aquatics such as 'Crispa' (*Lagarrosiphon major*) — can, in fact, lead to oxygen depletion at night.

HOT AND BOTHERED

Naturally, over the hot weather of recent months, I have received several enquiries regarding the health of fish under such conditions. Many Goldfish enthusiasts are of the opinion that such 'tropical' conditions are unhealthy for the fish, while others believe that the warm weather is a boon to growing fry.

By far the biggest problem associated with warm weather is lack of dissolved oxygen in the water. I have repeated this many times, and I feel it is appropriate to do so this month. Water at higher temperatures does not contain as much dissolved oxygen as cooler water, and the resultant effect is that fish can often be seen gasping at the surface of the pond; this occurs especially during the early hours of the morning.

A further problem arises from the proliferation of algae, often even in apparently well-filtered ponds. Ironically, this can lead to problems associated with too much oxygen in the pond, created by photosynthesis, the process by which plants absorb carbon dioxide and emit oxygen during daylight hours. (This process stops during darkness, robbing the water of fish-life sustaining oxygen.)

The following check-list may provide some assistance to both yourself and your fish, during prolonged hot and 'muggy' weather:

- **DO NOT OVERCROWD.** Reduce your fish population to one adult fish per square

foot of surface area.

- **PROVIDE SHADE.** The use of water lilies is an excellent — and attractive — means of providing shade to the pond: resulting in less algae as well as sanctuary for the fish. Alternatively, a useful, though less attractive, expedient is to float a number of polystyrene ceiling tiles on the pond.
- **AVOID EXCESSIVE USE OF 'OXYGENATING' PLANTS.** Such misnomers can actually create worse conditions than their name suggests.
- **UNDERTAKE REGULAR PARTIAL WATER CHANGES.** I remove approximately 50% of the total water volume every couple of days during hot weather. This not only helps to flush out excess algae, but also refreshes the fish with cooler, oxygenated water.
- **USE A FOUNTAIN OR WATERFALL.** This will help, to a small degree, in the absorption of oxygen by the water. However, I have heard of some slow-moving waterfalls which, in the recent 'tropical' climate, have been responsible for actually warming the water. I would be delighted to hear from readers of *Coldwater Jottings* about some of the ways in which they have overcome — or otherwise — some of the problems of the recent hot weather. Please address your comments to me, c/o The Editor, *Aquarist & Pondkeeper*, 9 Tufton Street, Ashford, Kent, TN23 1QN.

Understanding Fish

VERSATILE FINS

Dr David Pool, Head of the Tetra Information Service, continues his occasional series with a look at fins: what they are and what they do.



Many species, like this Panther Bass, can carry out directional changes by altering the orientation of their pectoral fins.

The fins of fishes show immense variation in shape, size and function. In most cases this variation has gradually evolved over many millions of years, enabling fish to be successful in their particular environments. Man has also had some effect on the fins of certain fish species and, by selective breeding, has produced fish with greatly enlarged fins (eg Siamese Fighting Fish and Guppies) or with fins missing (eg Lionhead and Ranchu varieties of goldfish).

However, with very few exceptions, all fish have the same basic finnage, with each fin performing the same function, be it on a tetra or a goldfish. In the following paragraphs I will look in more detail at what a fin is, and how a fish uses each of its fins.

WHAT IS A FIN?

Fins are comprised of the fin membrane, supporting fin rays and associated musculature. The rays are of two types: the hard, or spinous, rays, and soft, or branched, rays. The branched rays are used primarily to support the fin membrane and are so-called because they often branch out towards the outer edge of the fin. Spinous rays also provide support, but in addition, are used for protection, being strong and (often) sharp.

In the perches and basses, the anterior dorsal fin has only spinous rays and, when erect, forms a very effective means of protection. The Stickleback has taken this form of

protection a stage further and the spines do not have any associated finnage.

In many other fish only the anterior rays of each fin are spinous. This provides a good means of protection — few aquarists who keep *Corydoras* will not have observed the locking of the spines on the dorsal and pectoral fins into an erect position when the fish are caught in a net. Such behaviour makes the *Corydoras* more than a mouthful for most predators. These anterior spines also provide strength and protection for the fins when they catch on plants or debris as the fish swims.

The fin rays are linked by joints to the fin ray supports which are located in the body of the fish. Small muscles attached to the fin rays and supports enable the fins to be extended, contracted or, for example in the seahorses, to move with a propeller-like action.

TYPES OF FINS

The numbers of fins possessed by a particular species of fish, together with the number of spinous and soft rays in each fin, is relatively constant and enables identification of that fish.

Fins can be divided into those which are paired and those which are unpaired. The paired fins include the pectoral and pelvic fins, whereas the unpaired fins include the caudal (= tail), dorsal and anal fins.

Caudal fin or tail

In most fish the tail is the main organ for propulsion and is used when a fast or large movement is required (eg capturing prey or moving across the aquarium). This propulsion is provided by the lateral body muscles in the rear part of the body, which cause the tail to move from side to side (like the sculling oar of a gondolier).

The shape and size of the tail gives some indication of how fast a particular fish can swim. Hatchetfish, orfe and mackerel, for example, all have very forked tails and are capable of very fast swimming. Discus and anemone fish, at the other extreme, have rounded tails and can only swim relatively slowly.

In some fish species, particularly those which require sudden acceleration, the dorsal and anal fin are positioned close to the tail. In this way they move from side to side with the tail, thus effectively increasing its size, and therefore its efficiency. The Pike (*Esox lucius*) and Pike-top Livebearer (*Belontiopsis belontiensis*) are ideal examples, with the rapid acceleration being used to capture their prey.



Lumpsuckers have specially modified pelvic fins that allow them to attach themselves to any surface.

There are obviously exceptions to this general rule. Fan-tailed goldfish, for example, have a very forked tail, but are unable to swim fast. In this case, the forked tail has been selectively bred for over countless generations by man. The wild form of the goldfish has a fairly blunt tail and, consequently, is a relatively slow swimmer.

The tail is also used as a rudder to change direction, in much the same way as we would use a rudder in the boat. So, for example, if the fish wants to turn to the right when swimming forwards, it bends the tail to the right. Directional changes using the tail are only possible when the fish is moving, and tend to be major changes.

Dorsal and anal fin

The main function of these fins in most

swim quickly and avoid a predator, the resistance may be critical. To avoid this, a fish that is fleeing will often fold its fins close to its body, since speed is more important than stability. When this occurs the fish may roll onto its side as it swims. As soon as it is safe the fish extends its fins and regains its normal position in the water. This behaviour can often be seen with Koi in a large pond, or with cichlids and other territorial species in an aquarium.

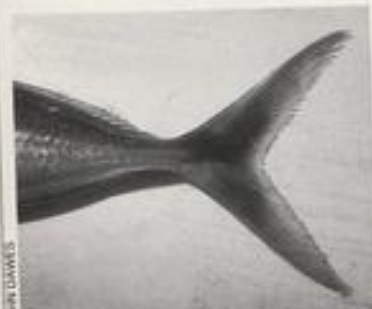
The dorsal and anal fin are also used as a means of propulsion in, for example the Knifefish (*Notopterus* species) and eels. These species have greatly elongated dorsal and anal fins, which are undulated in order to propel the fish forwards. Seahorses, pipefishes and pufferfishes also use their dorsal fin for propulsion, in this case with a propeller-like action.



The Gurnard can 'feel/smell' for food by using specially modified pectoral fin rays.

fish is to provide stability, and prevent the fish from rocking from side to side as it swims. As such, they have the same function as the keel of a yacht.

When these fins are erect, they do, however, cause a certain amount of resistance which will slow the fish down. Generally, this is no problem, but if the fish is trying to



The caudal fin of the Horse Mackerel has the stiff leading edge and forked features of a fast-swimming fish.

Pectoral fins

The pectoral fins are primarily used for fine movements, directional changes and braking. Movement is achieved by the fish using the pectoral fins as paddles. In this way a fish can undertake the very fine movements needed, for example, in obtaining food, courtship and manoeuvring through densely planted aquaria. Most bony fish use the pectoral fins in this way, although it is particularly obvious in Siamese Fighting Fish (*Betta splendens*), Discus (*Symphysodon* species) and Angelfish (*Pterophyllum scalare*).

Directional changes are achieved by turning the right or left fin so that it restricts water flow over the body, while turning the opposite pectoral fin so there is minimal resistance. This action can be seen very clearly in the accompanying slide of a Panther Bass (*Chromileptes altivelis*). This action is similar to the way in which a canoeist or tobogganist would turn, and allows very precise directional changes to be made.

When slowing the fish down, both fins are turned to create maximum resistance to the

water flow. This is very effective and will stop the fish within a short distance.

The pectoral fins are also used for vertical movements, ie swimming up or down in the water. Upward movement is achieved when the fish is moving forwards by turning the pectoral fins so that the front edge of the fin is higher than the back edge. When the fish wants to swim downwards the front, or leading, edge of the fin is lower than the back. Submarines use an identical method to adjust their position in the water.

Pelvic fins

The pelvic fins complement the pectoral fins when the fish changes directions (vertically or horizontally) or brakes, and are used in exactly the same way.

SPECIALISED USES

With such a vast number of different fish species living in a wide range of environments, it is perhaps not surprising that certain fish have fins which are different to the 'normal' pattern, and have very specialised functions.

Flyingfish and Hattchettfish

The marine Flyingfish (*Cypselurus* and *Exocoetus* species) and freshwater Hattchettfish (*Gasteropelecus* and *Carnegiella* species) have very enlarged pectoral and, in some cases, pelvic fins, which enable them to glide or fly above the water surface.

To fly, the fish swim at high speed (using their very forked tail), and turn the pectoral and pelvic fins slightly to force the fish upwards and through the water surface. Once airborne, the pectoral (and pelvic) fins are fully extended, enabling the fish to glide for considerable distances.

Flyingfish, for example, will remain airborne for up to 12 seconds and cover 100-150 metres (330-500ft). During their flight, the Flyingfish will gain further speed by dipping the tail into the water and moving it quickly from side to side.

Hattchettfish use the same method to become airborne, but, once in the air, they will actually flap their large pectoral fins to gain extra distance. Hattchettfish, with their proportionately smaller pectoral fins, do not cover the same distances as the Flyingfish, but can still travel for 3-4 metres (10-13ft) above the water. This flying behaviour has evolved into an effective means of avoiding predators, which lose sight of their prey once it becomes airborne.

Suction organs

A number of fish which live in fast-flowing or turbulent water have developed structures which enable them to attach to the substrate and so maintain their position without expending much energy. In some of these fish species the fins have been modified to form suction organs.

Gobies, for example, use their pelvic fins to form a 'sucker' which enables them to cling quite firmly to rocks, so preventing

them from being washed about by the waves in their sea shore environment. The Shark Suckers (*Remora remora*) have evolved a more sophisticated attachment device from the first dorsal fin which enables them to cling to sharks and other large marine fish and mammals.

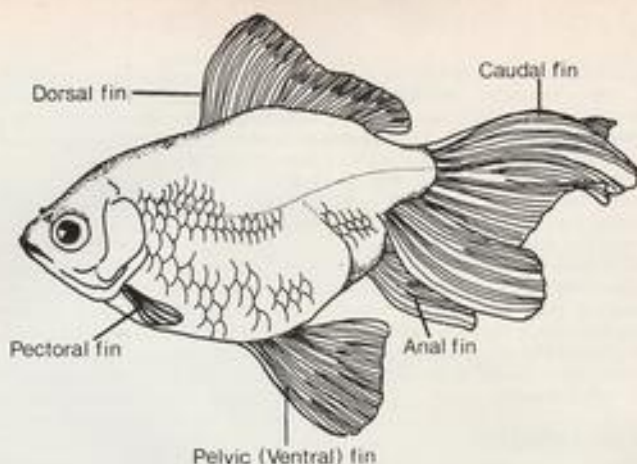
Copulatory organs

The male livebearing fishes of the family Poeciliidae, have a specially developed anal fin, called a gonopodium, which allows the male to fertilise the female. This fin is very specialised and has a groove running along its length, which allows the spermatozeugmata (packets of sperm) to flow. There are also hooks and claws on the ends of some of the fin rays in some species (for example, the Guppy and the Swordtail) which allow the gonopodium to remain in the correct position on the female for internal fertilisation to occur.

Sharks and rays also use their fins to aid copulation, although, in this case, it is the pelvic fins which have a specialised form.

Protection

The use of spinous fin rays as a means of protection has already been mentioned in this article. Some fish take this protection a stage further and have poison glands associated with some of the spinous rays. These poison glands are located in the skin and, when the spine penetrates the skin of an attacker, the poison flows along furrows in



Despite man-made modifications, even most fancy Goldfish varieties still carry all the 'basic' fins found in the wild-type.

the spine and into the wound.

There are several hundred species of fish which can produce toxins which are released along the spinous rays. These include species such as the Greater Weever Fish (*Trachinus draco*) which is often found of the European coast; these fish pass poisons along the spines of their first dorsal fin. These poisons can cause severe pain for several hours if one inadvertently steps on a Weever when paddling in the sea. The Scorpionfish, Lionfish and Stonefish can also release toxins, and are commonly kept by aquarists.

CLOSING REMARKS

There are numerous other examples of the specialised uses for fins, but, hopefully, the above examples give some idea of the adaptability of these structures.

The use of the fins as described in this article is something which any fishkeeper can observe in their fish, be they marine or freshwater, tropical or coldwater. By understanding just how fish are able to move as they do, one will get even more enjoyment out of our hobby.



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coloured specimens.

One of the most important considerations

is the size of the tank. Its capacity should be

not less than 50 litres (11 gals). If the tank is

a community aquarium then, of course, the

size of the total population must be taken

into account.

Almost as important is the planting of the

aquarium and its situation. At least 70% of the

of eggs in the fourth month of their lives. It is

the female that first shows interest in spar-

ning. Her coloration becomes more intense,

her urogenital papilla becomes slightly more

prominent, and she attracts the male to her.

As soon as a pair forms, the partners seek out

a suitable spawning site together.

Most commonly, they choose a smooth

stone of the same colour as the eggs. After

thorough cleaning of the substrate, the first

grey-green eggs are laid, and soon after

fertilised by the male. This process is

repeated, and for the duration of the spawn-

ing, the partner not actually laying or ferti-

lising, defends the eggs against any potential

intruders.

The parents guard the site assiduously and

attack anything suspicious that approaches.

In my experience, 90% of spawnings occur in

the evening after the light has been switched

on. The embryos develop best in water with a

hardness of up to 10 dGH and up to 3KH. At

a water temperature of 27°C (81°F) the

female may produce 500 eggs, but I have

spawned 4-6 month bands of times and in a

single spawning.

In the literature, it is often stated that a

somewhat

age, their interest in spawning diminishes

best suited for breeding. With increasing

these fish are at their most productive and

(1.6-2in). During their fifth to eighth month,

the end of this month, measure 4-5cm

seem to grow before your very eyes, and, at

the beginning of the fourth month, they

age, their growth rate becomes slower, but at

second month. After they have reached this

The fry grow very quickly until their

male keeps watch.

As a rule, the female marshalls the fry and the

under the direction of one of the parents. As

food. They swim in a shoal and are always

after a further 4-6 hours, can take dust-like

fertilisation the fry are free-swimming and,

in a pre-dug pit in the sand. 128 hours after

and carry them to a more sheltered location

They use their mouths to extract the larvae

embryos completely from the egg-shells,

emerges. Then the parents help free the

First, the egg-shell is ruptured and the tail

embryos hatch after 52 hours.

Favourite foods are Caddisfly larvae and a

mosquito larvae, together with spinach and a

good-quality flake.

Breeding

These fish become sexually mature very

quickly and, if well fed, females become full

of eggs in the fourth month of their lives. It is

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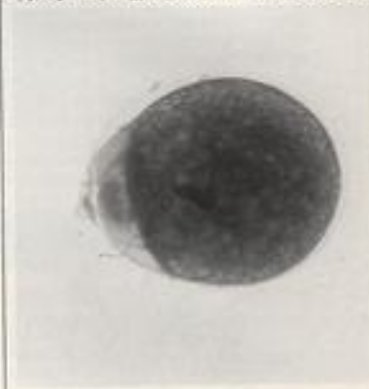
mosquito larvae, together with spinach and a

good-quality flake.

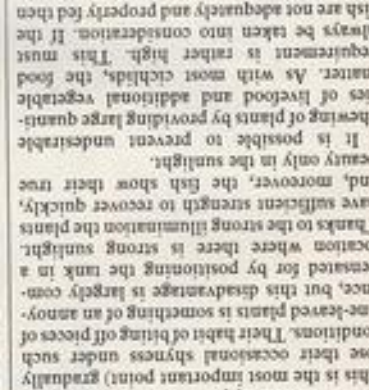
30 hours after hatching, the 'ear-stones', or
otoliths, are visible just above (and behind)



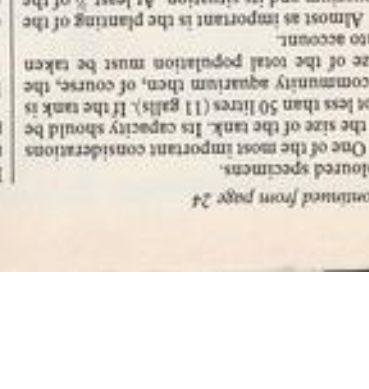
stage the embryo consists of just four cells.



At 33 hours the head of the embryo becomes
clearly visible. Most of the egg is still occu-



Some three days after hatching, the fry
become free-swimming.



Under extreme alkaline conditions 'dropsy' of
the heart cavity can develop, resulting in

accumulated fluid and the death of the fry.